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YSICS

PHY

QUESTIONS

EL-MOASSER

By A Group Of Supervisors

3rd SEC. 2026

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PHYSICS

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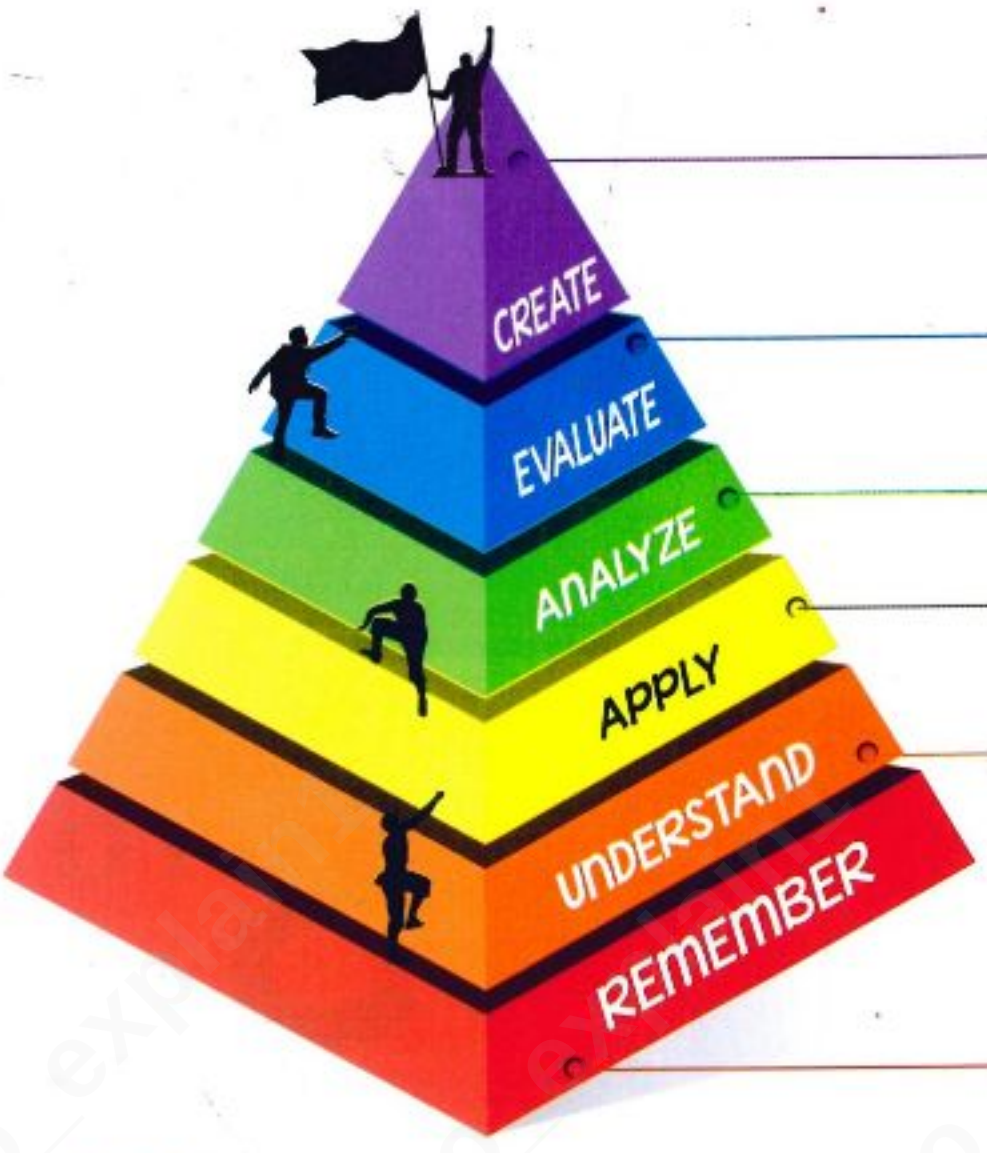

Produce new original work
Design - Construct - Formulate

Justify a stand or decision
Conclude - Decide - Correct the mistakes

Make connections among ideas
Prove - Deduce - Classify - Analyze

Use information in new situations
Solve - Find - Complete - Calculate

Explain ideas or concepts in your own words
Compare - Explain - Give examples

Recall facts and basic concepts
State - Define - List

Higher Order Thinking Skills

Lower Order Thinking Skills

Note :

The questions within each exercise are classified according to the levels of Bloom's pyramid and are referred to as follows:

● Understand ○ Apply Higher Order Thinking Skills

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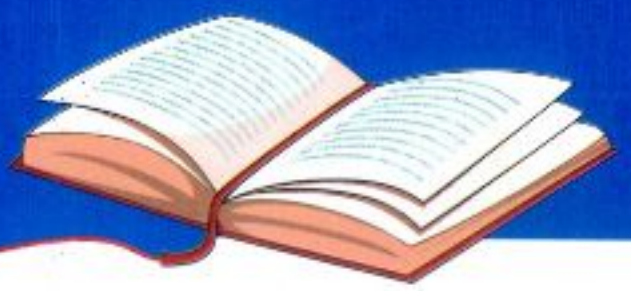
Now



Interactive test on each lesson by scanning a QR Code.

- After finishing each test you can evaluate yourself by viewing a detailed report of the correct answers.

New

- Exercise on Each **Lesson** from the Questions of the Previous Exams.
- Test on Each Chapter of Unit **1**.
- Test on Each Two Chapters of Unit **2**.
- To reach **the First Session Exam 2026**, scan the **QR code** at the end of the book.

Note: The book questions signed by * are answered in detail.

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Lesson Four	Kirchhoff's Laws.

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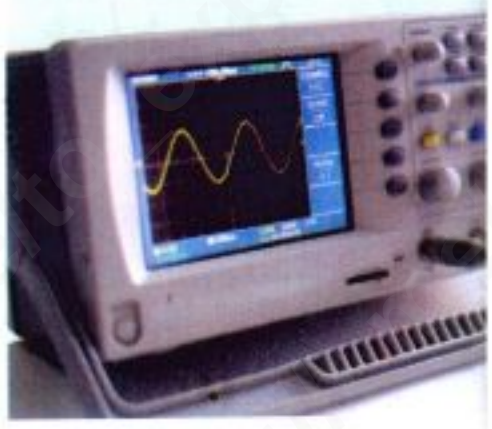

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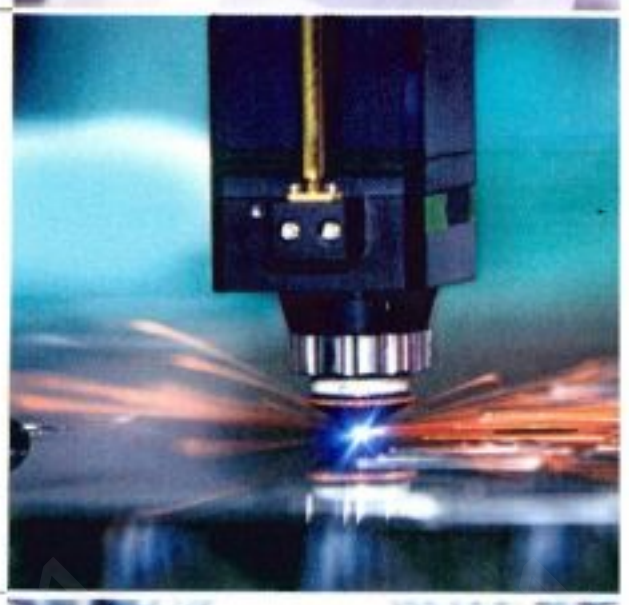

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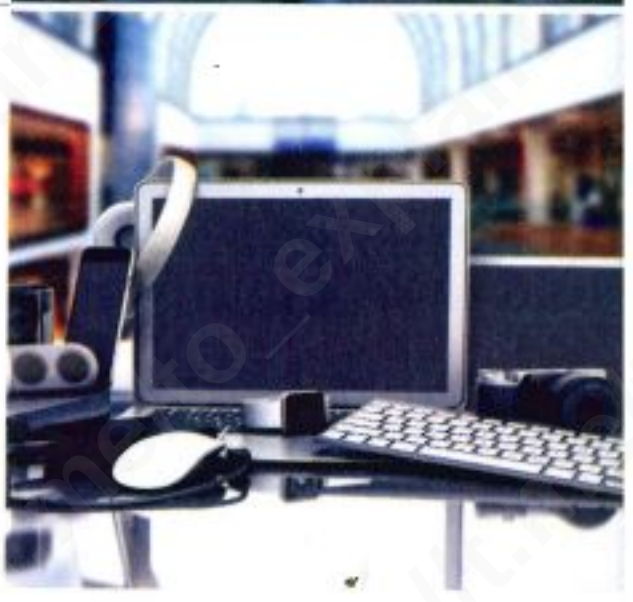

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Unit 1

Dynamic Electricity and Electromagnetism

Chapter One — Electrical Current and Ohm's Law.

Chapter Two — Magnetic Effects of the Electric Current and Measuring Instruments.

Chapter Three — Electromagnetic Induction.

Chapter Four — Alternating Current Circuits.

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Chapter One

Electrical Current and Ohm's Law

Lesson One	Electrical Current and Ohm's Law.
Lesson Two	Resistors Connection.
Lesson Three	Ohm's Law for the Closed Circuit.
Lesson Four	Kirchhoff's Laws.

- Questions on each lesson from the Previous Years Exams.
- Test on Chapter 1

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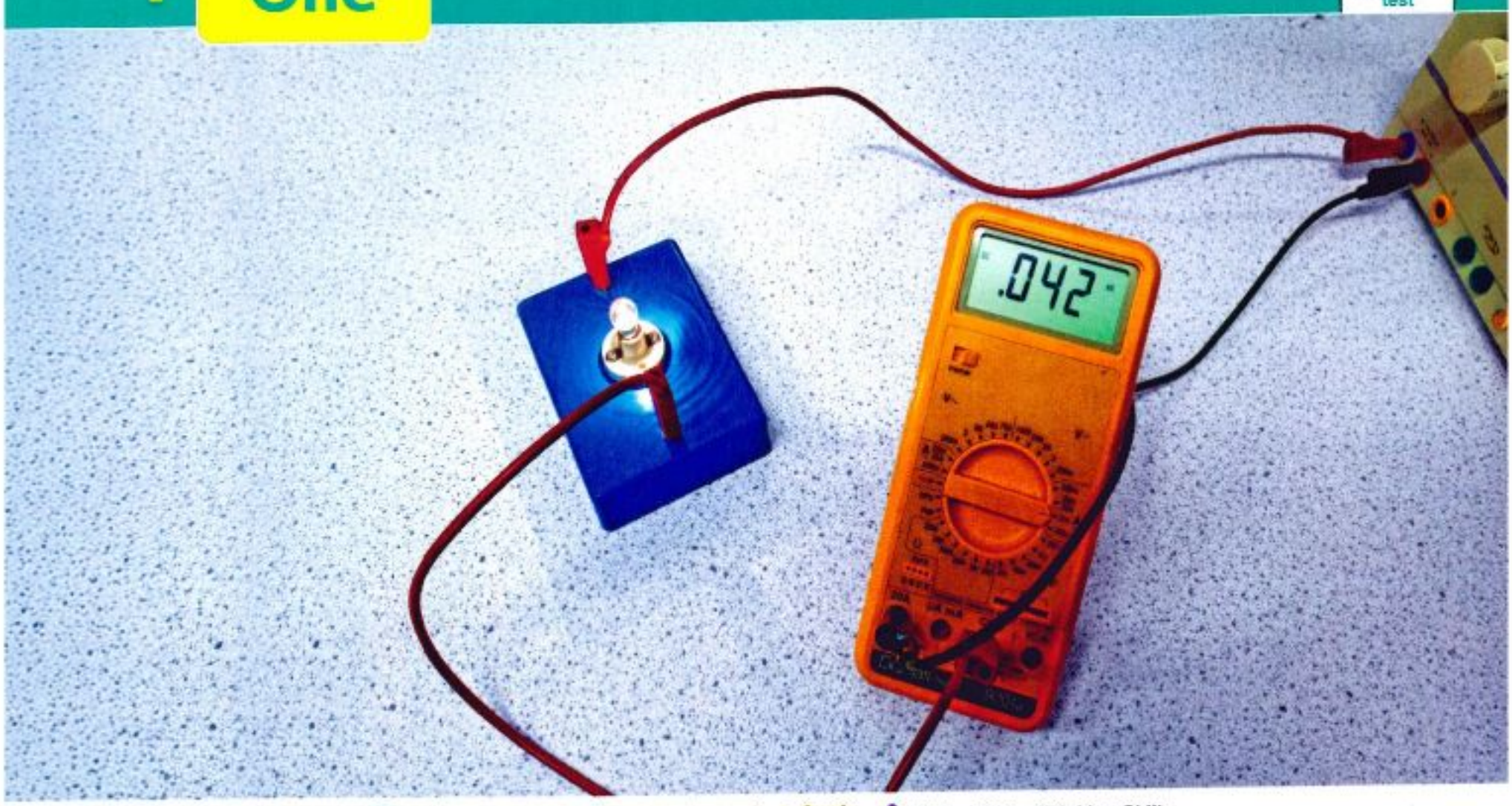
Chapter 1

Questions on Lesson One

Electrical Current and Ohm's Law

Interactive test



The questions signed by ✳ are answered in detail. ● Understand ○ Apply ● Higher Order Thinking Skills

Important guidelines

Electric current intensity (I)

=

$\frac{Q}{t}$ | $\frac{V}{R}$ | $\frac{Ne}{t}$

- To determine the number of the passing electrons through a cross-section of a conductor (N): $N = \frac{Q}{e}$ (electron)

Electric potential difference (V)

=

$\frac{W}{Q}$ | IR | $\frac{W}{Ne}$

- To determine the resistivity (ρ_e) and the conductivity (σ):

$\rho_e = \frac{RA}{\ell}$ ($\Omega.m$) $\quad \therefore \sigma = \frac{1}{\rho_e} = \frac{\ell}{RA}$ ($\Omega^{-1}.m^{-1}$)

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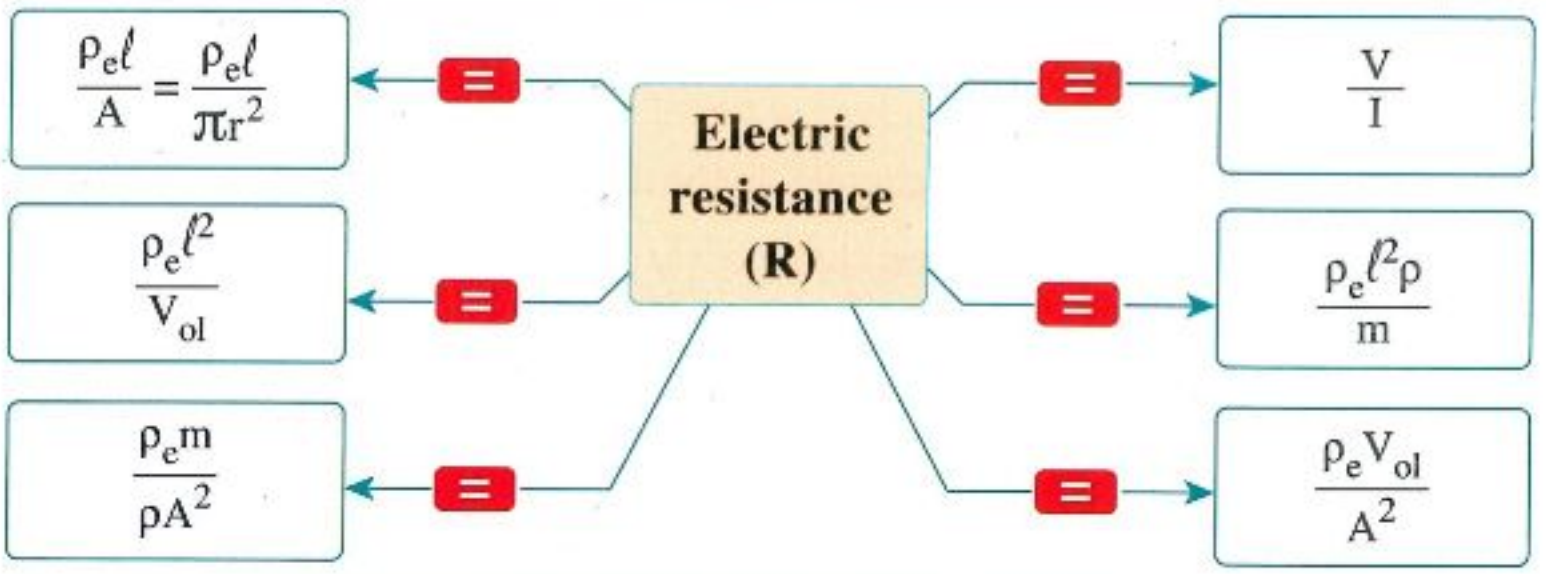
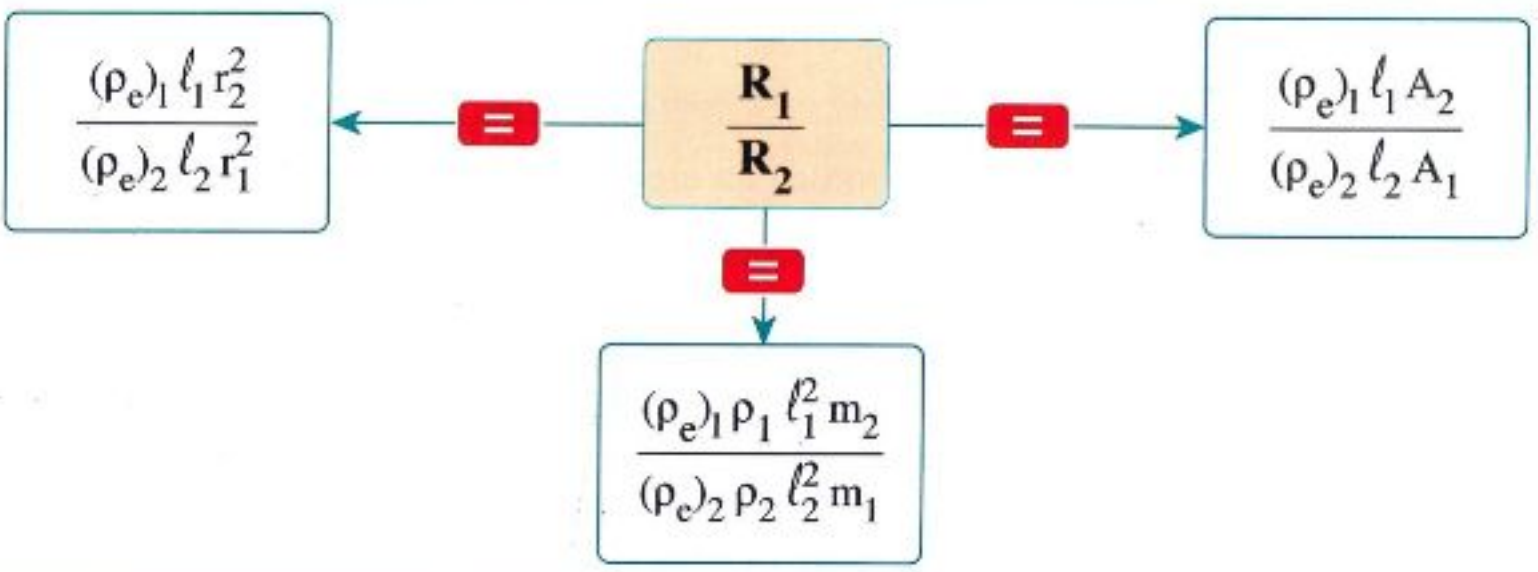
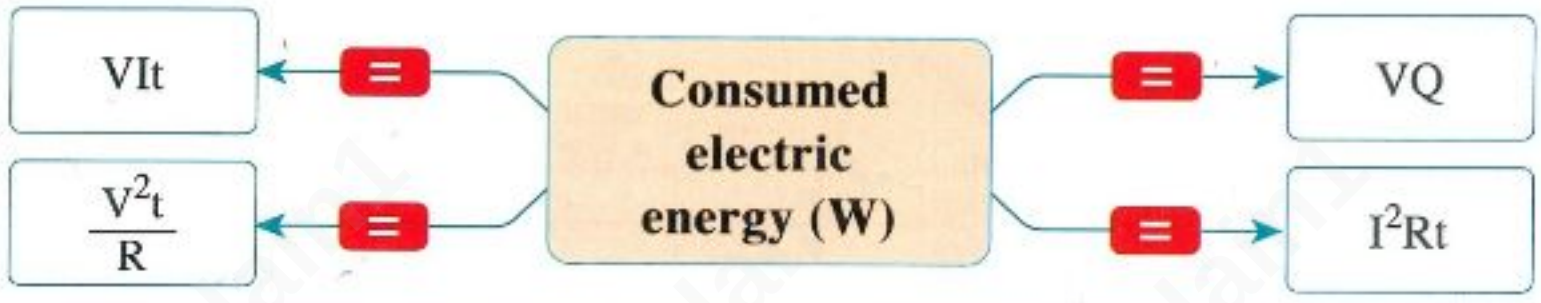
- To determine the length of a wire that is coiled to form a circular coil of number of turns N and radius r_{coil}: $\ell_{wire} = 2\pi r_{coil} N$

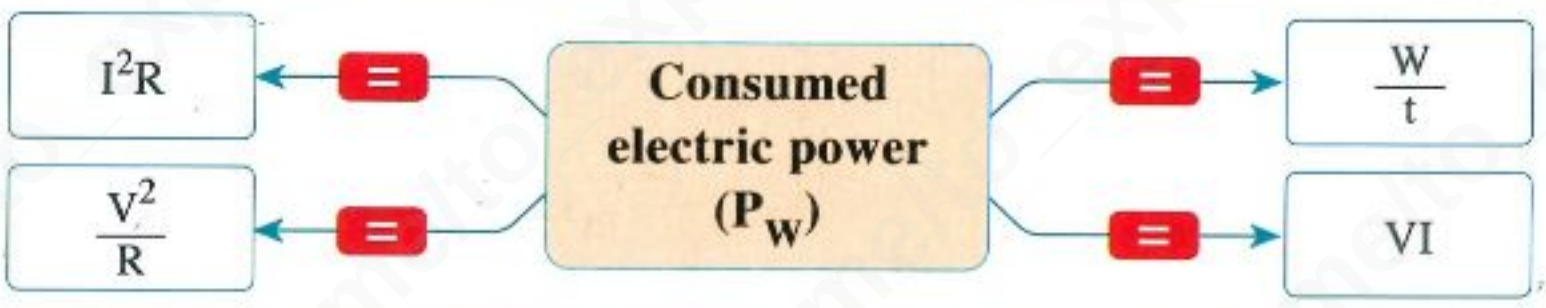




- If the wire is reshaped so that its length increases and its cross-sectional area decreases, so:

$$\frac{R_1}{R_2} = \frac{\ell_1 A_2}{\ell_2 A_1} = \frac{\ell_1^2}{\ell_2^2} = \frac{A_2^2}{A_1^2} = \frac{r_2^4}{r_1^4}$$





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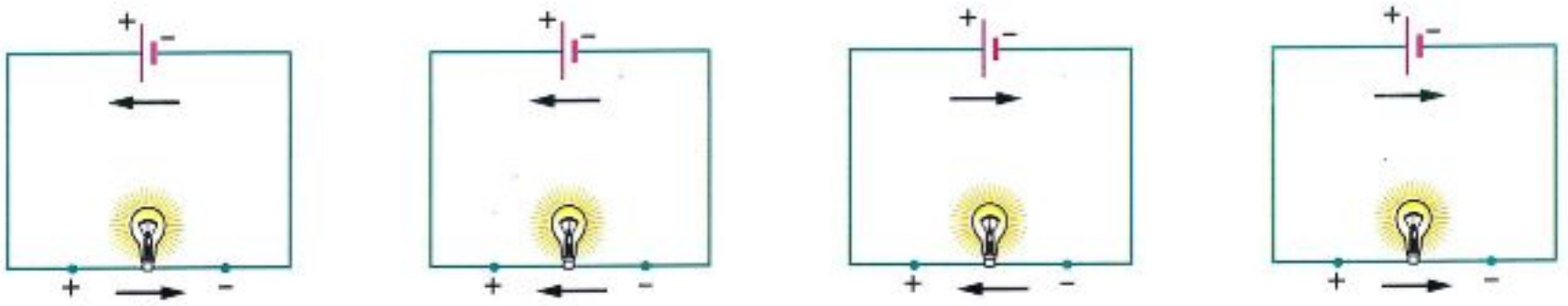
First Multiple choice questions

Use the following constant when needed: $e = 1.6 \times 10^{-19}$ C

Electric current intensity

1 In which of the following electric circuits do the directions of arrows correctly represent the conventional direction of electric current?



(a) (b) (c) (d)

2 The opposite figure represents a section of an electric circuit through which a direct electric current (I) is passing, so which of the two ammeters shows a higher reading?

(a) Ammeter A_1 (b) Ammeter A_2

(c) Both ammeters show the same reading. (d) The answer is indeterminable.

3 If the electric current through a conductor equals 2 A, it means that:

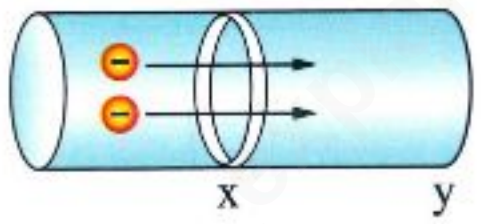
(i) the quantity of electric charge that passes through a cross-section of the conductor in 10 s is ..... .

(a) 0.2 C (b) 8 C (c) 12 C (d) 20 C

(ii) the time taken by an electric charge of 4 mC to pass through a cross-section of the conductor is ..... .

(a) 2 ms (b) 4 ms (c) 6 ms (d) 8 ms

4 In the opposite figure, a negative electric charge of 2 μC passes through cross-section x of a conductor in 4 ms, then the intensity and direction of the conventional current are ..... , ...



(a) 8 mA, from x to y (b) 8 mA, from y to x

(c) 0.5 mA, from x to y (d) 0.5 mA, from y to x

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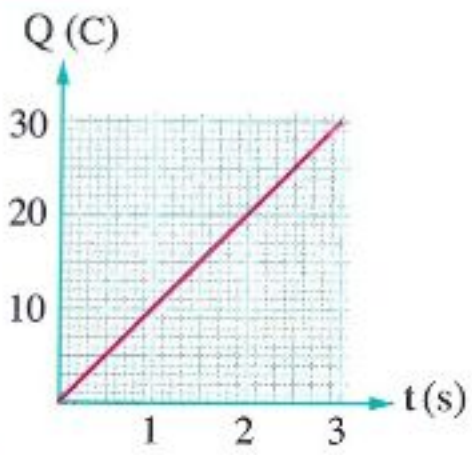
5 If the flow rate of electrons in wire x is 10^{20} electrons/s and its flow rate in wire y is 2×10^{20} electrons/s, then the ratio between the current intensities in the two wires $\left(\frac{I_x}{I_y}\right)$ equals ..... .

(a) $\frac{1}{1}$ (b) $\frac{2}{1}$ (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

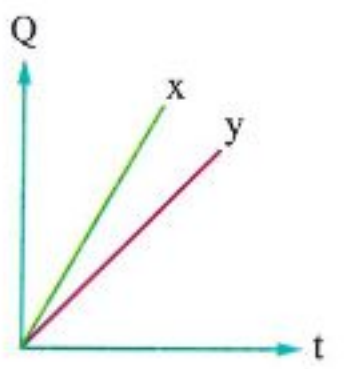
6 The opposite graph represents the relation between the quantity of charge (Q) that flows through a cross-section of a conductor in a DC (direct current) circuit and the time (t), so the intensity of the current is ..... .



(a) 2 A (b) 10 A

(c) 50 A (d) 250 A

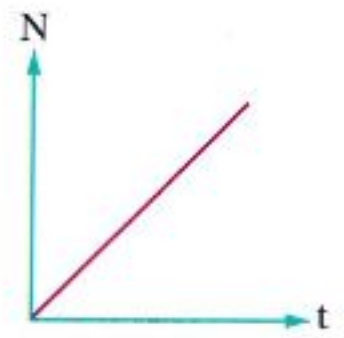
7 The opposite graph represents the relation between the electric charge (Q) passing through cross-sections of two conductors x and y and time (t), so the ratio between the electric current intensities in the two conductors $\left(\frac{I_x}{I_y}\right)$ is ..... .

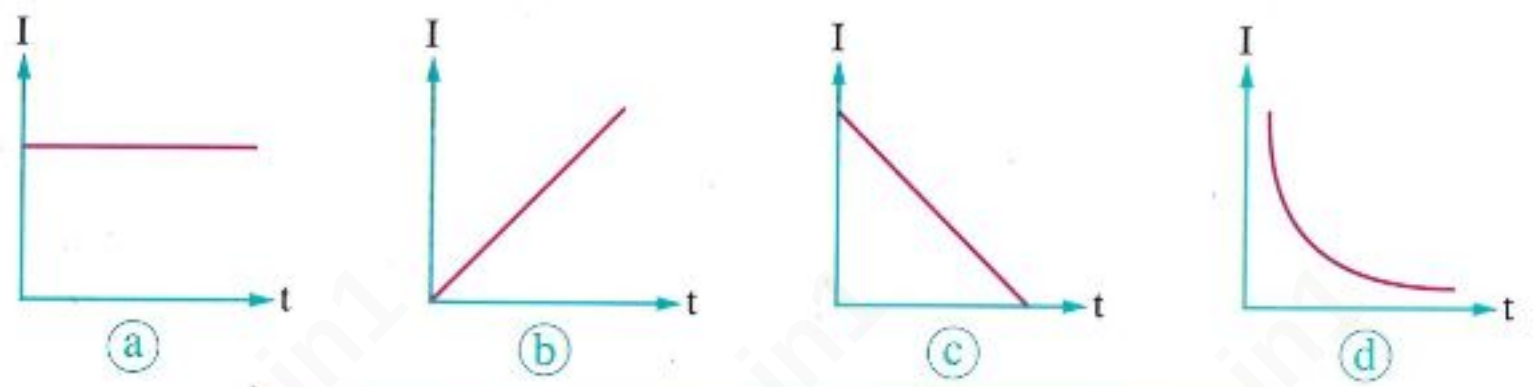


(a) greater than one (b) less than one

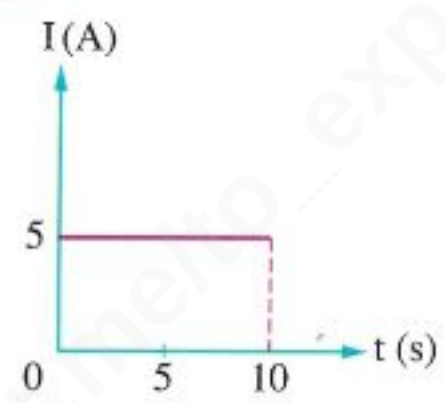
(c) equal to one (d) indeterminable

8 The opposite graph represents the relation between the number of electrons (N) that pass through a certain cross-section of a conductor in an electric circuit and the time (t), so the graph that represents the relation between the current intensity (I) through this conductor and the time (t) is ..... .





9 The opposite graph represents the relation between the electric current intensity (I) passing in a conductor and its flow time (t), then the electric charge that passes through a cross-section of that conductor in 10 s equals ..... .



(a) 5 C (b) 10 C

(c) 15 C (d) 50 C

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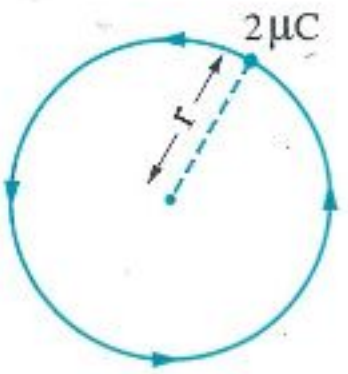
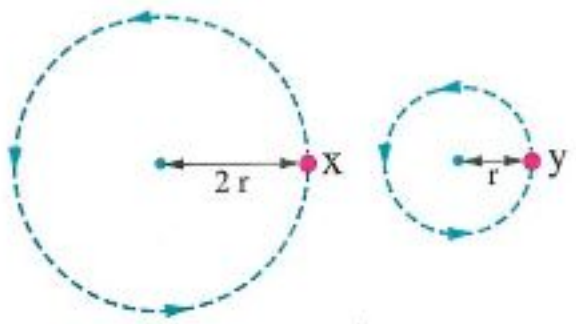
10 The opposite figure represents a charge of 2 μC rotating with a frequency of 1000 Hz in a circular path, then the current that arises due to the rotation of the charge equals ..... .



(a) 5 mA (b) 2 mA

(c) 500 A (d) 2000 A

11 In the opposite figures, two bodies x and y are carrying electric charges of quantities Q and 2Q respectively, while rotating in two different circular paths, so the ratio between the current intensities due to the rotations of these charges $\left(\frac{I_x}{I_y}\right)$ if both charges rotate with:



(i) the same frequency equals ..... .

(a) $\frac{1}{1}$ (b) $\frac{1}{2}$ (c) $\frac{2}{1}$ (d) $\frac{1}{4}$

(ii) the same linear speed equals ..... .

(a) $\frac{1}{1}$ (b) $\frac{1}{2}$ (c) $\frac{2}{1}$ (d) $\frac{1}{4}$

12 Based on Bohr's model for the hydrogen atom, the electron moves in a circular path of radius 0.53 Å with a speed of 2.2×10^6 m/s, then the current intensity due to the motion of the electron equals ..... .

(a) 3.141 mA (b) 6.282 mA (c) 1.166 mA (d) 1.057 mA

Electric potential difference

13 The battery in an electric circuit is the source of ..... .

(a) positive charges (b) negative charges

(c) electric conductivity (d) electric energy

14 A metal conductor has its terminals connected to a DC source forming a closed electric circuit, so which of the following statements correctly describes the motion of electrons inside and outside the source?

(a) They vibrate in their positions without moving to new positions.

(b) They move inside the source towards the terminal of higher potential.

(c) They move outside the source towards the terminal of lower potential.

(d) They move outside the source towards the terminal of higher potential.

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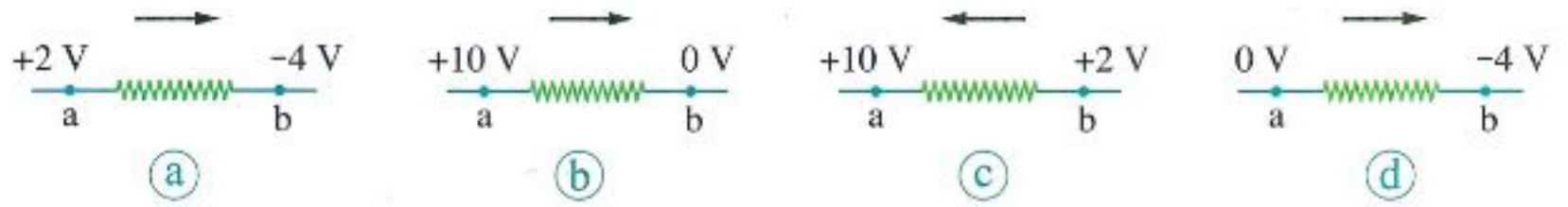
15 In which of the following cases the arrow represents the direction of free electrons through the resistance between the two points a and b?



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16 In the opposite figure, the work done to move a charge of 4 C between the two points x and y is ..... .

(a) 20 J (b) 40 J (c) 60 J (d) 80 J

---

17 The potential difference between two points when a work of 30 J is required to transfer an electric charge of 10 C between them equals ..... .

(a) 0.3 V (b) 3 V (c) 30 V (d) 300 V

---

18 ✱ If the work done to transfer a quantity of electric charge of 5 C between two points in a conductor is 100 J and this quantity passes through a cross-section of the conductor during 1 s, then:

(i) The potential difference between the two points equals ..... .

(a) 0.05 V (b) 5 V (c) 10 V (d) 20 V

(ii) The electric current intensity through the conductor equals ..... .

(a) 2.5 A (b) 5 A (c) 7 A (d) 12 A

(iii) The number of electrons that pass between the two points through 2 s equals ..... .

(a) 4.22×10^{18} electrons (b) 1.56×10^{19} electrons

(c) 6.25×10^{19} electrons (d) 1.25×10^{19} electrons

---

19 Coulomb is the quantity of electric charge that ..... .

(a) when passes through a cross-section of a conductor in 5 s, it means that the intensity of the current passing in the conductor is 50 A

(b) when passes through a cross-section of a conductor in 50 s, it means that the intensity of the current passing in the conductor is 0.5 A

(c) needs a work done of 5 J to be transferred between two points of potential difference 0.5 V

(d) needs a work done of 0.05 J to be transferred between two points of potential difference 0.05 V

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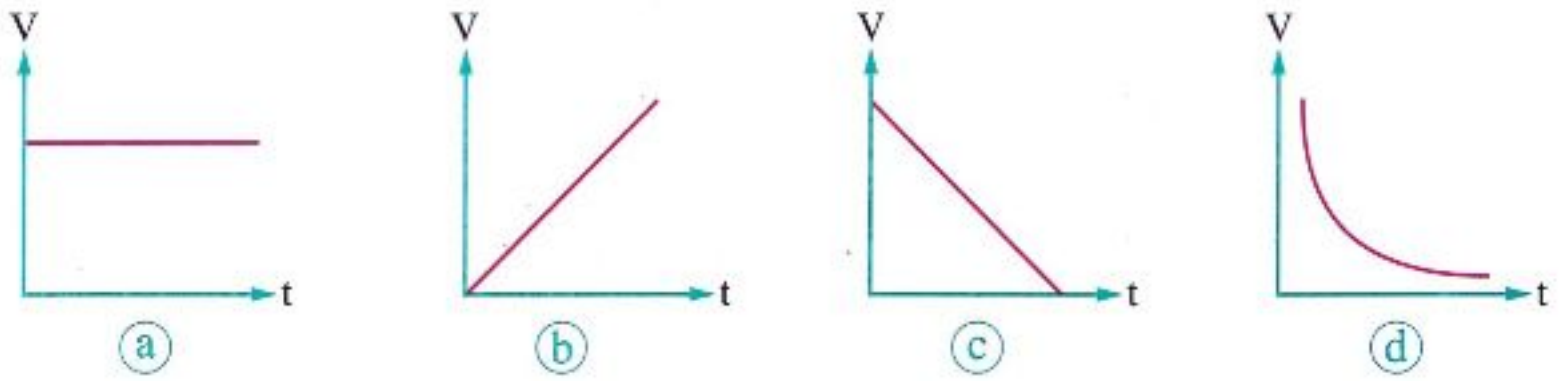
20 If the work done to transfer 10^{20} electrons between the terminals of conductor A is 10 J and the work done to transfer 4×10^{20} electrons between the terminals of conductor B is 20 J, then the ratio between the voltages across the two conductors $(\frac{V_A}{V_B})$ equals ..... .

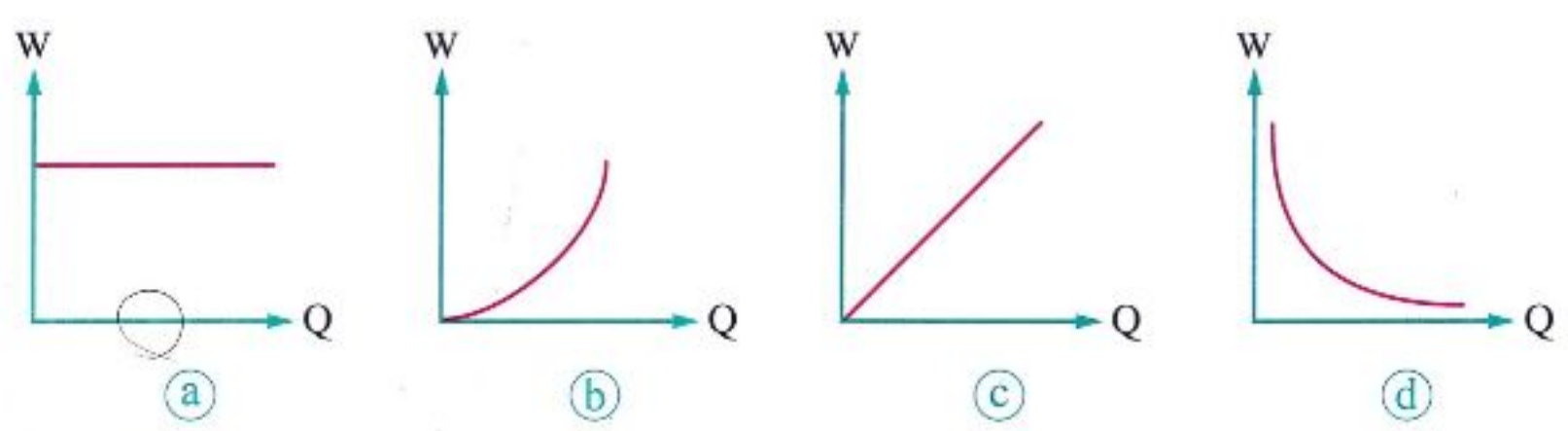
(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{1}{4}$ (d) $\frac{4}{1}$

21 Which of the following graphs represents the relation between the potential difference (V) across the terminals of a conductor that carries a direct current (DC) and the time (t)?



(a) (b) (c) (d)

22 Which of the following graphs represents the relation between the work done (W) and the transferred electric charge (Q) between two points between which the potential difference is constant?



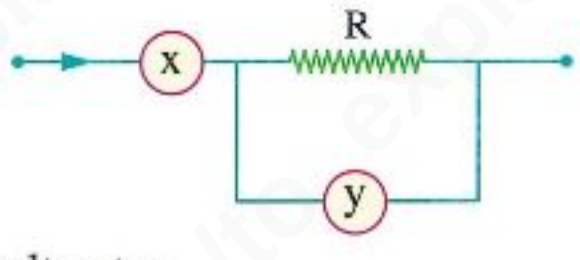
(a) (b) (c) (d)

Ohm's law

23 In which of the following cases the intensity of the current in the resistor is higher?

(a) (b) (c) (d)

24 The opposite diagram represents a part of an electric circuit, so if devices x and y are connected correctly, then:



(i) The two devices are ....., ... respectively.

(a) ammeter, ammeter (b) ammeter, voltmeter

(c) voltmeter, ammeter (d) voltmeter, voltmeter

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(ii) The measuring units for the measured quantities by device x and device y are ..... , ... respectively.

(a) coulomb/second, volt (b) coulomb/second, ampere

(c) joule/coulomb, volt (d) joule/coulomb, ampere

25 A potential difference of 12 V is applied between the terminals of a conductor to move 6.25×10^{18} electrons through a cross-section of this conductor during two seconds, then the resistance of the conductor is ..... .

(a) 24 Ω (b) 12 Ω (c) 6 Ω (d) 3.84 Ω

26 The opposite figures (1) and (2) show two parts of two electrical circuits carrying currents I_1 and I_2 respectively, so the ratio between current intensities $\left(\frac{I_1}{I_2}\right)$ is equal to ..... .

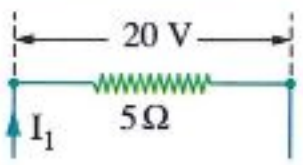


Figure (1)

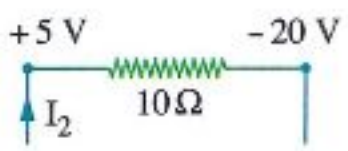


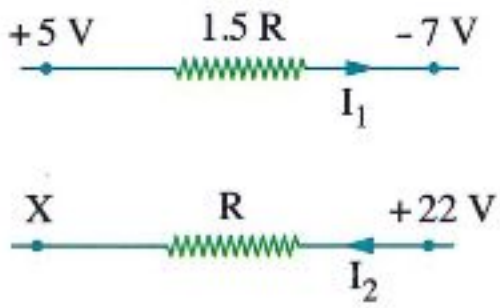
Figure (2)

(a) $\frac{4}{1}$ (b) $\frac{1}{4}$ (c) $\frac{8}{5}$ (d) $\frac{5}{8}$

27 A conductor of resistance 10 Ω carries an electric current of intensity 0.5 A. If an electric current of intensity 1 A passes through the same conductor at constant temperature, then its resistance equals ..... .

(a) 2.5 Ω (b) 5 Ω (c) 10 Ω (d) 20 Ω

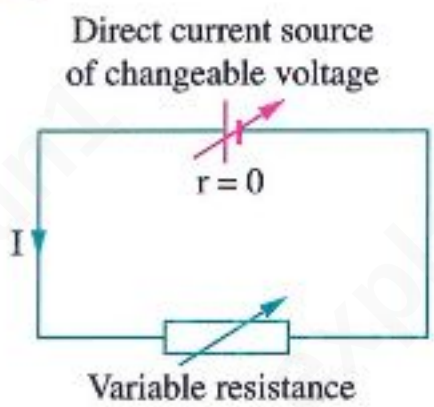
28 In the opposite figure two conductors, each carries an electric current, so if the ratio between the electric current intensities $\left(\frac{I_1}{I_2}\right)$ equals $\frac{1}{3}$, the potential of point X is ..... .



(a) 2 V (b) 24 V

(c) – 2 V (d) – 24 V

29 The opposite figure illustrates an electric circuit carrying an electric current of intensity I. One change can be made to the circuit as follows:



(I) Increasing the electromotive force of the battery to the double.

(II) Decreasing the electromotive force of the battery to its half.

(III) Increasing the variable resistance to the double.

(IV) Decreasing the variable resistance to its half.

So, which of these changes will lead to increasing the electric current intensity to 2I?

(a) (I) or (II). (b) (II) or (III). (c) (III) or (IV). (d) (I) or (IV).

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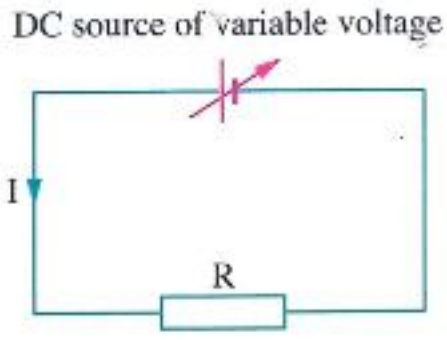
30 In the opposite electric circuit, when the voltage of the source increases, the physical quantity whose value **doesn't** change is ..... .



(a) the rate of passing electrons in the circuit

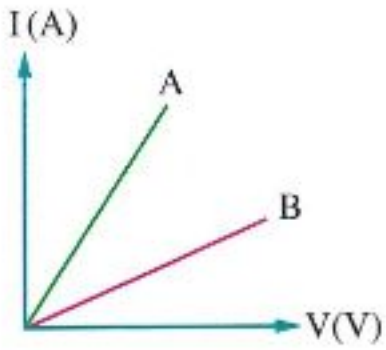
(b) the work done by the source per second

(c) the current intensity (I) passing in the circuit

(d) the value of resistance (R)

---

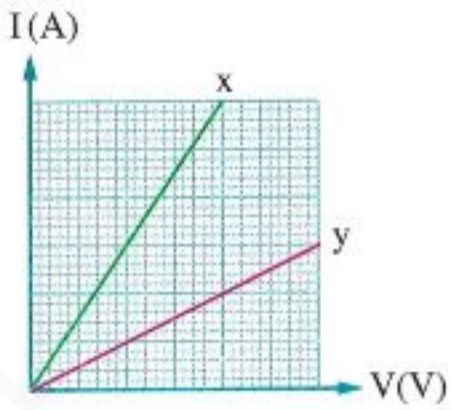
31 The opposite graph represents the relation between the current intensity through each of two wires A and B and the potential difference across each of them, then which of the two wires has a higher resistance? And why?



	The wire of the higher resistance	The reason is that the slope of the line represents
(a)	A	the resistance of the wire
(b)	A	the reciprocal of the resistance of the wire
(c)	B	the resistance of the wire
(d)	B	the reciprocal of the resistance of the wire

---

32 The opposite graph represents the relation between the current intensity (I) passing in two conductors x, y and the potential difference (V) across each of them, then the ratio between the resistances of the two conductors $\left(\frac{R_x}{R_y}\right)$ equals ..... .



(a) $\frac{1}{2}$ (b) $\frac{3}{4}$

(c) $\frac{7}{4}$ (d) $\frac{1}{3}$

---

33 Graph (1) represents the relation between the work done (W) to move an electric charge through a conductor that carries an electric current and the amount of that charge (Q) and graph (2) represents the relation between the amount of electric charge (Q) passing through a specific cross-section of the same conductor and time (t),

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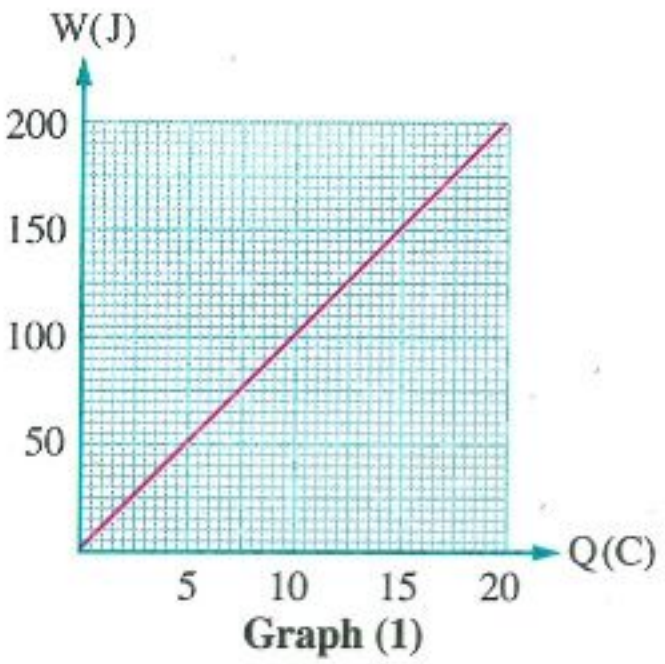
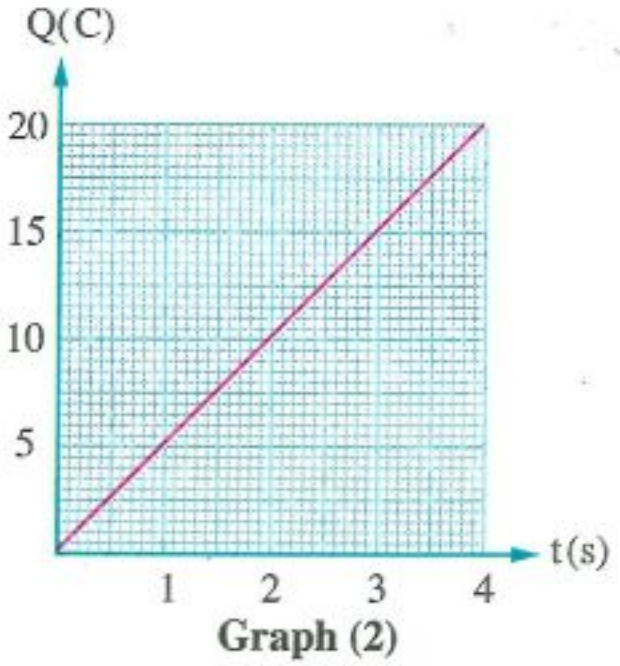


Graph (1)



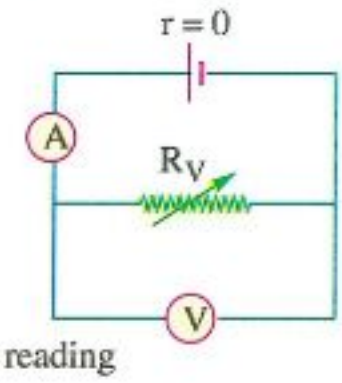
Graph (2)

So, the electrical resistance of the conductor equals ..... .

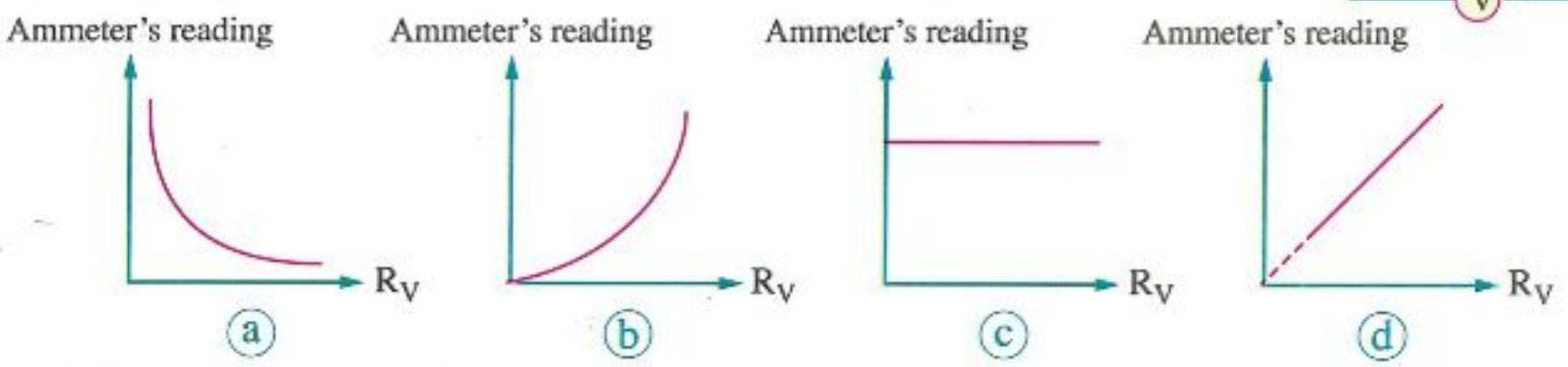
(a) 0.5 Ω (b) 2 Ω (c) 5 Ω (d) 15 Ω

---

34 In the opposite circuit:

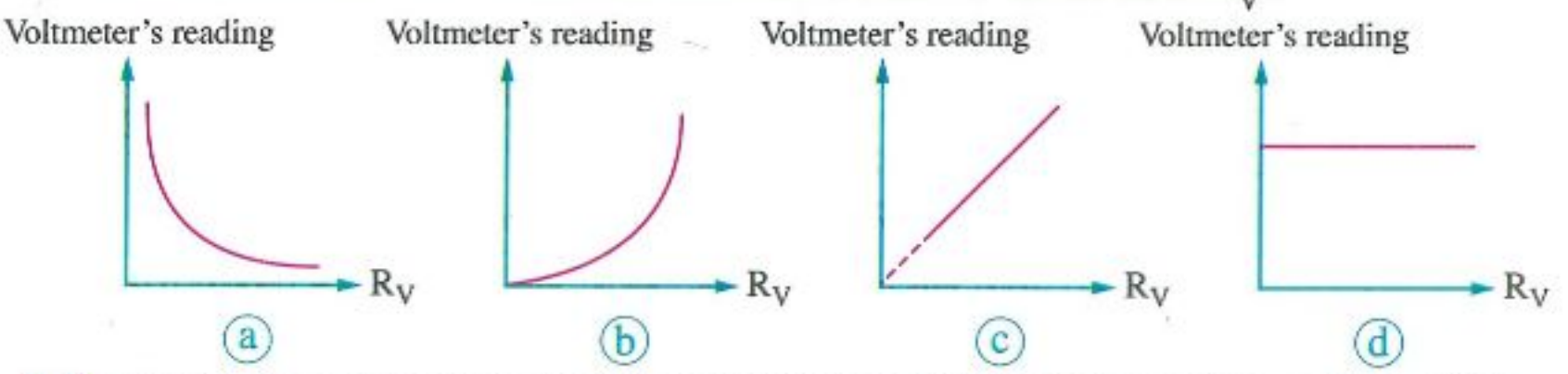


(i) Which of the following graphs represents the relation between the reading of the ammeter and the value of the resistance which is taken from R_V?



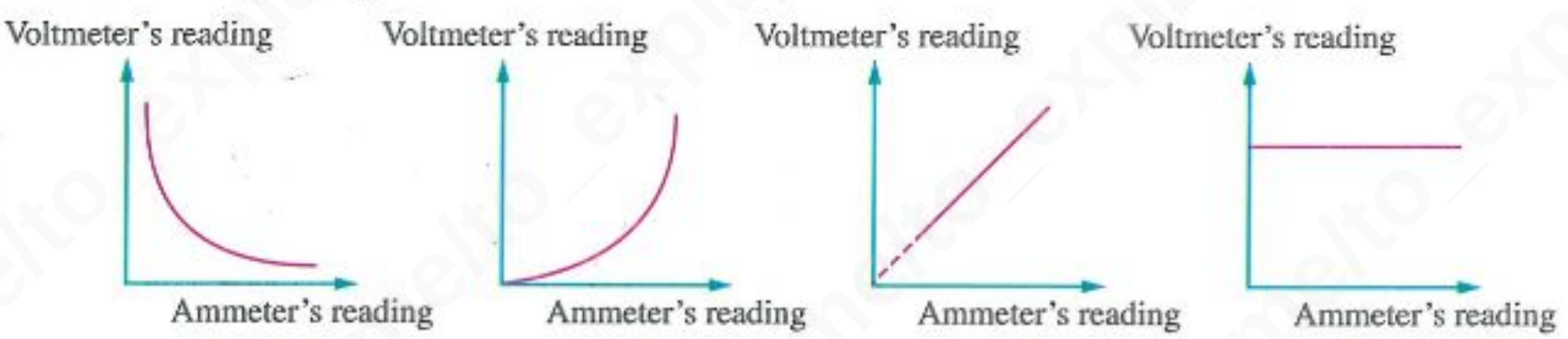
(a) (b) (c) (d)

(ii) Which of the following graphs represents the relation between the reading of the voltmeter and the value of the resistance which is taken from R_V?



(a) (b) (c) (d)

(iii) Which of the following graphs represents the relation between the reading of the ammeter and that of the voltmeter when the value of the resistance which is taken from R_V changes?



(a) (b) (c) (d)

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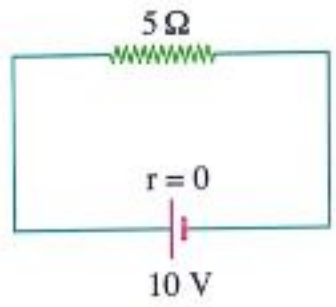
Electric power and electric energy

35 Which of the following units **isn't** equivalent to watt?

(a) J/s (b) A.V (c) $A^2.\Omega$ (d) $\Omega^2.V$

36 In the opposite circuit:



(i) The consumed power in the circuit is ..... .

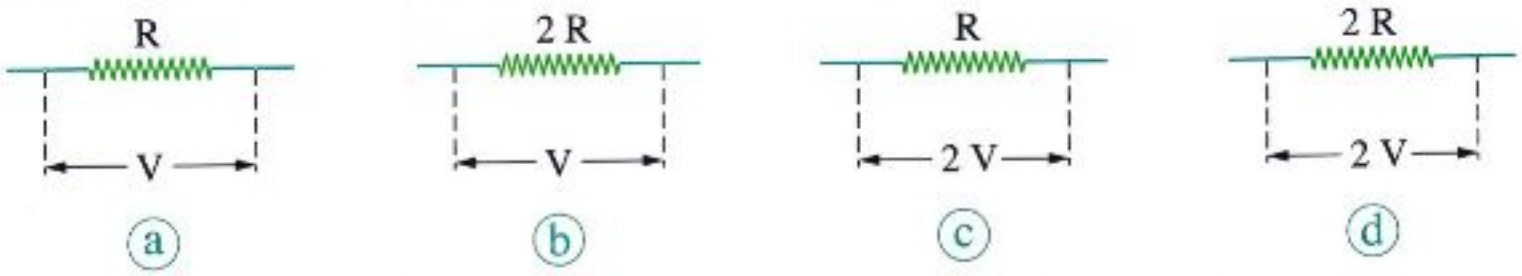
(a) 10 W (b) 20 W

(c) 50 W (d) 100 W

(ii) The consumed energy in the circuit within 20 s is ..... .

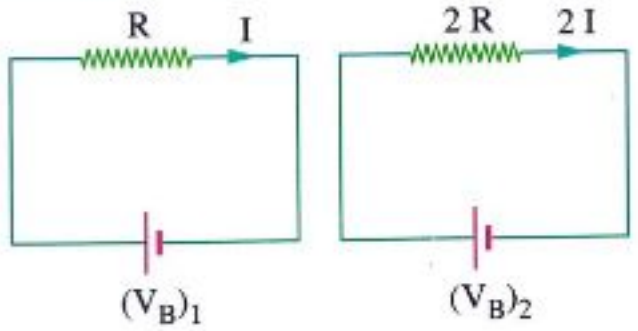
(a) 100 J (b) 200 J (c) 400 J (d) 1000 J

37 In which of the following figures the consumed power in the resistor is greater?



(a) (b) (c) (d)

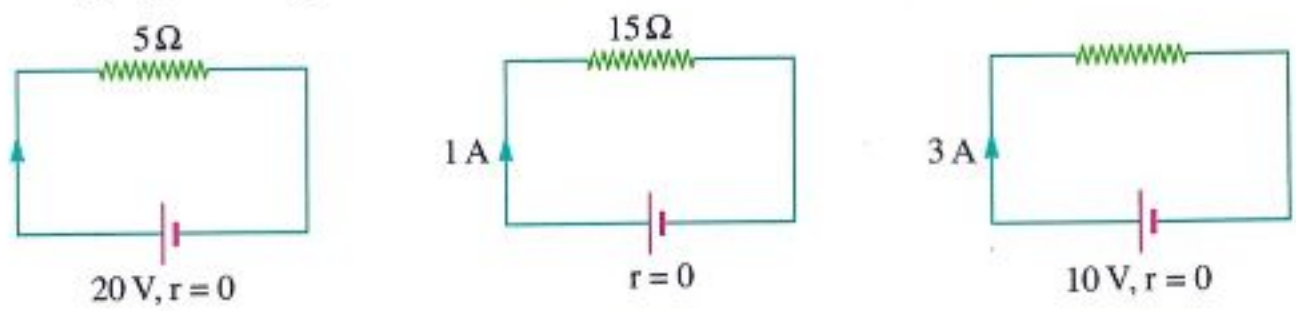
38 In the opposite two circuits, the ratio between the consumed power in the two circuits $\left(\frac{(P_w)_2}{(P_w)_1}\right)$ is ..... .



(a) $\frac{2}{1}$ (b) $\frac{4}{1}$

(c) $\frac{8}{1}$ (d) $\frac{16}{1}$

39 The following figures represent three electric circuits x, y and z.



Circuit (x) Circuit (y) Circuit (z)

So, the correct order of these three circuits according to the consumed power from the source is .....

(a) x < y < z (b) z < y < x (c) x < z < y (d) y < z < x

40 An electric fan is labelled (220 V – 100 W) and an electric heater is labelled (220 V – 1000 W), then the resistance of the heater is ..... that of the fan.

(a) equal to (b) less than

(c) larger than (d) indeterminable with respect to

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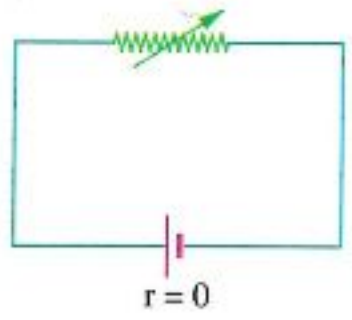
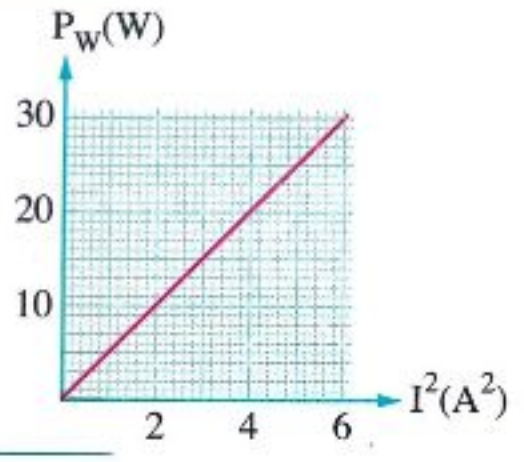
41 In the opposite electrical circuit, when the value of the variable resistance is doubled, the rate of electrical energy consumption in the circuit ..... .



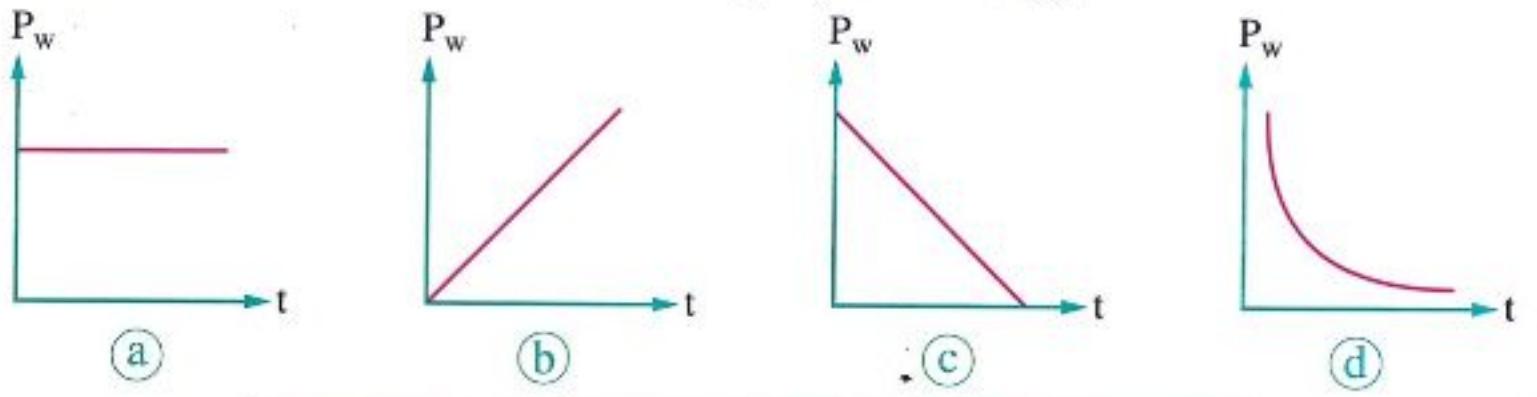
(a) increases to double
(b) decreases to its half
(c) decreases to its quarter
(d) remains constant

42 The opposite graph represents the relation between the consumed power in a conductor and the square of the intensity of the electric current that passes through it, so the resistance of the conductor equals ..... .

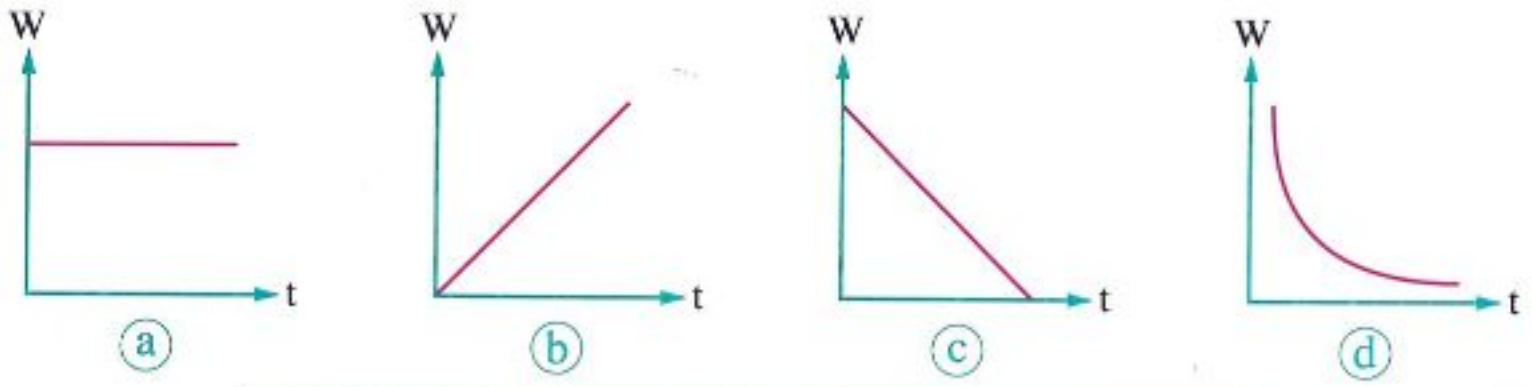


(a) 2 Ω
(b) 5 Ω
(c) 50 Ω
(d) 0.5 Ω

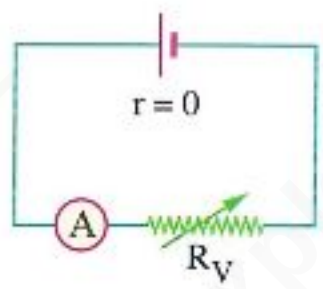
43 Which of the following graphs represents the relation between the consumed power (P_w) in a conductor that carries a direct current (DC) and time (t)?

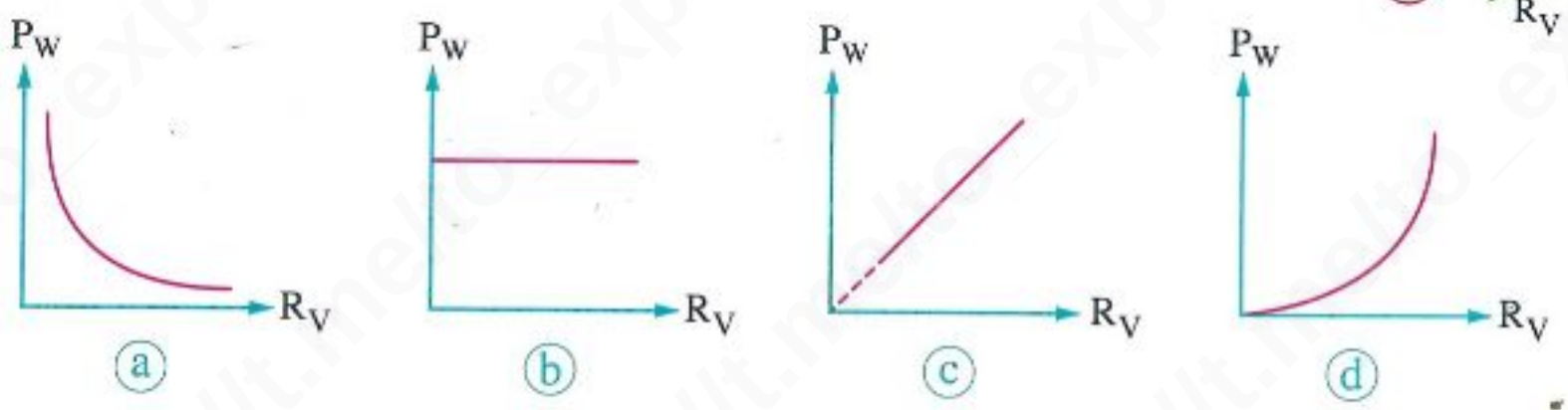


44 Which of the following graphs represents the relation between the consumed energy (W) in a conductor that carries a direct current (DC) and time (t)?



45 The opposite figure represents an electric circuit, which of the following graphs represents the relation between the consumed power through resistance R_V and its value?





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The electric resistance

46 A metal wire of length 20 m and cross-sectional area 0.5 cm^2 has a material resistivity of 10^{-7} Ω.m, so the electrical resistance of the wire equals ..... .

(a) 0.02 Ω (b) 0.04 Ω (c) 0.06 Ω (d) 0.08 Ω

---

47 A wire of iron which is 3.14 m long and has a radius of 0.5 mm is connected between the terminals of a 5 V battery. If the resistivity of the iron is 10^{-7} Ω.m, so the passing electric current intensity in the wire equals ..... . (Knowing that: $\pi = 3.14$)

(a) 6.2 A (b) 8.2 A (c) 9.6 A (d) 12.5 A

---

48 ✱ A wire of length 200 m has a resistivity of 3.14×10^{-7} Ω.m, if the wire allows the flow of 2×10^{19} electrons per second when it is connected to a source of 64 V, the radius of the wire equals ..... . (Knowing that: $\pi = 3.14$)

(a) 10^{-1} m (b) 10^{-2} m (c) 10^{-3} m (d) 10^{-4} m

---

49 If the length of a copper wire is doubled and its cross-sectional area is decreased to its half, then its resistance ..... .

(a) doubles (b) decreases to its half

(c) quadruples (d) decreases to its quarter

---

50 When the length of a conductor has doubled and its cross-sectional area has decreased to half its original value, then the resistivity of its material ..... .

(a) is quadrupled (b) is tripled

(c) gets halved (d) remains unchanged

---

51 Three identical wires x, y, and z, each is connected between a potential difference (V), while being kept at temperatures 3t, 2t, and t respectively for an interval of time. In which of these wires:

(i) electrons are colliding with the wire atoms at a higher rate?

(a) x (b) y

(c) z (d) is equal in the three wires

(ii) a higher current is flowing?

(a) x (b) y

(c) z (d) is equal in the three wires

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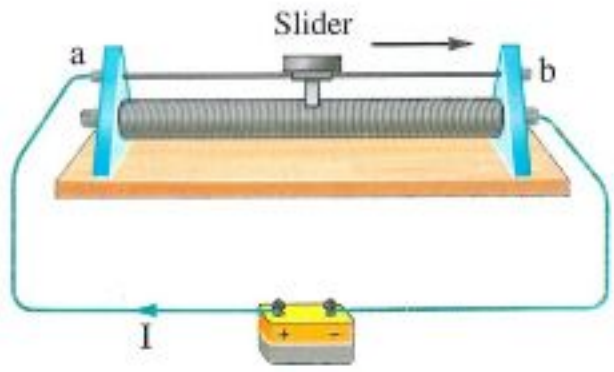
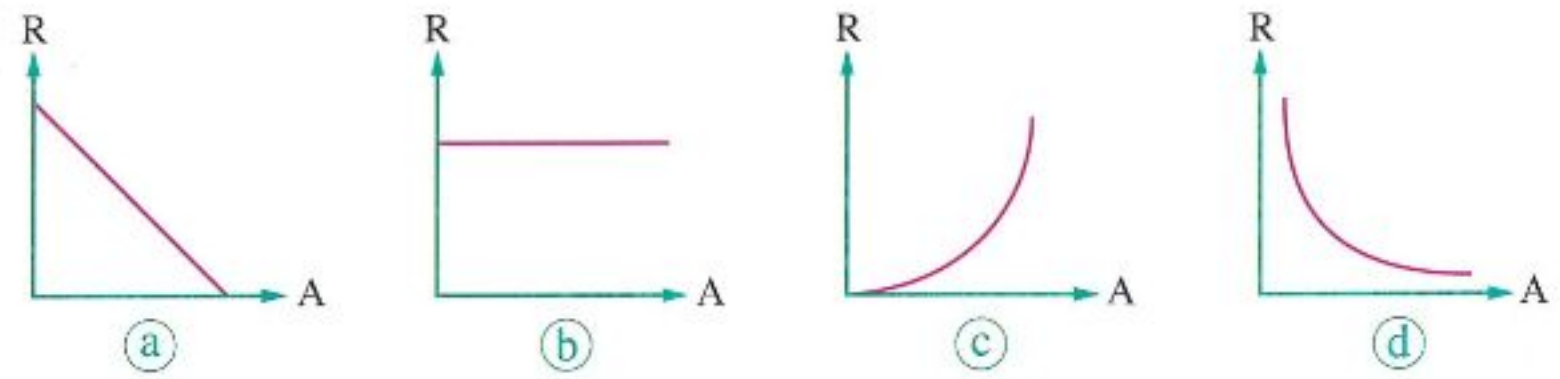
52 In the following electric circuit, when the position of the rheostat slider is changed from its position towards position b, which of the following choices represents what happens in the circuit?

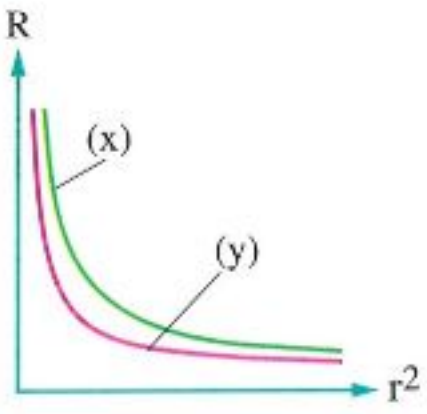
	The length of the rheostat wire that carries an electric current	The intensity of the current that passes in the circuit
(a)	Increases	Increases
(b)	Increases	Decreases
(c)	Decreases	Increases
(d)	Decreases	Decreases



53 Which of the following graphs represents the relation of resistance (R) for several copper wires that have the same length versus the cross-sectional area (A) of each?



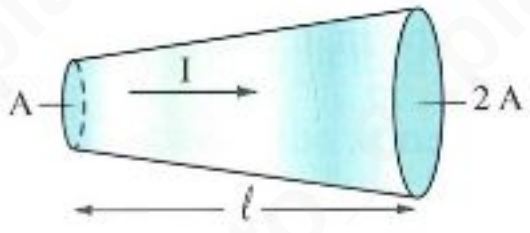
54 A group of wires, all of the same length, are made of either metal (x) or metal (y). The opposite graph represents the relationship between electrical resistance (R) and the square of the cross-sectional radius (r^2) for each wire at the same temperature. Which of the following relationships is correct when comparing the conductivity (σ) of both metals?



(a) $\sigma_x > \sigma_y$ (b) $\sigma_x < \sigma_y$

(c) $\sigma_x = \sigma_y$ (d) The answer can't be determined.

55 The opposite diagram shows a conductor whose resistivity is ρ_e. If the cross-sectional areas of its two terminals are different, the value of its resistance is ..... .



(a) equal to $\frac{\rho_e \ell}{A}$ (b) greater than $\frac{\rho_e \ell}{A}$ (c) less than $\frac{\rho_e \ell}{A}$ (d) equal to $\frac{\rho_e \ell}{2A}$

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56 The resistivity of copper = 1.8×10^{-8} Ω.m, which means that ..... .

(a) the resistance of a copper wire that is 1 m long and has a 1 m diameter equals 1.8×10^{-8} Ω

(b) the resistance of a copper wire that is 1 m long and has a 1 m^2 cross-sectional area equals 1.8×10^{-8} Ω

(c) the resistance of a unit length of copper equals 1.8×10^{-8} Ω/m

(d) the resistance of a unit volume of copper equals 1.8×10^{-8} Ω/m^3

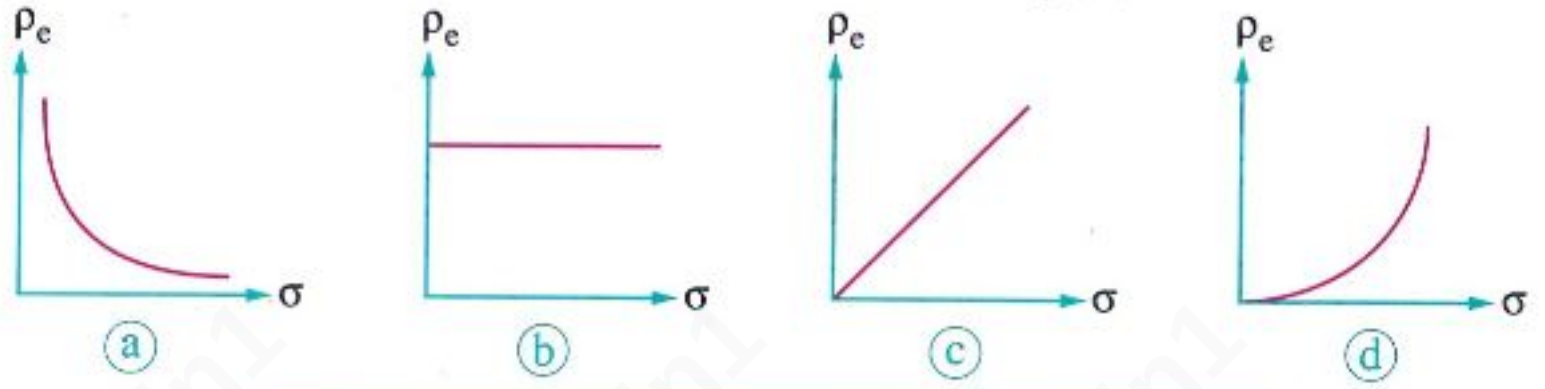
57 If the resistivity of copper is 1.8×10^{-8} Ω.m, then which of the following wires represents a copper wire of a cross-sectional area 10 mm^2?

	Its length	Its resistance
(a)	10 m	1.8×10^{-8} Ω
(b)	10 m	0.018 Ω
(c)	1 m	1.8×10^{-4} Ω
(d)	1 m	1.8 Ω

58 ✱ Two wires are of the same length and the same resistance but one of them is made of copper and the other is made of iron, so the ratio between their radii $\left(\frac{r_{Fe}}{r_{Cu}}\right)$ equals ..... .

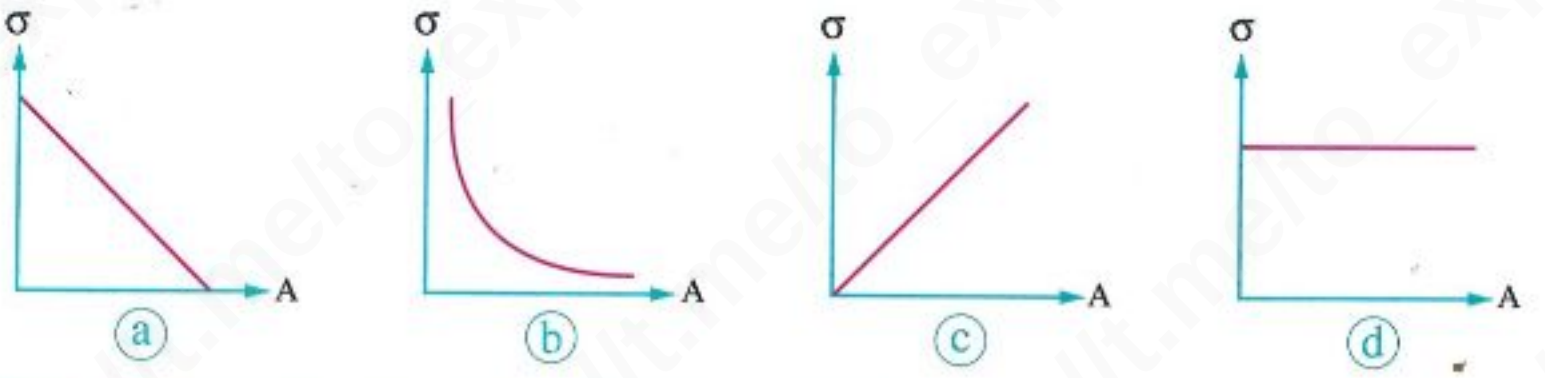
(a) $\frac{(\rho_e)_{Fe}}{(\rho_e)_{Cu}}$ (b) $\frac{(\rho_e)_{Fe}}{\sqrt{(\rho_e)_{Cu}}}$ (c) $\frac{\sqrt{(\rho_e)_{Fe}}}{(\rho_e)_{Cu}}$ (d) $\frac{\sqrt{(\rho_e)_{Fe}}}{\sqrt{(\rho_e)_{Cu}}}$

59 Which of the following graphs represents the variation of resistivity (ρ_e) for a group of wires of different materials versus the electric conductivity (σ) for each of them?



(a) (b) (c) (d)

60 Which of the following figures represents the relation between the conductivity (σ) of the material of a conductor and its cross-sectional area (A)?



(a) (b) (c) (d)

https://t.me/to_explain1

61 ✱ A wire is 106.3 cm long whose cross-sectional area is 1 mm^2 and its resistance is 1 Ω, so:

(i) The resistivity of the wire's material equals ..... .

ⓐ 9.41×10^{-7} Ω.m ⓑ 8.53×10^{-7} Ω.m ⓒ 5.71×10^{-6} Ω.m ⓓ 6.25×10^{-6} Ω.m

(ii) The conductivity of the wire's material equals ..... .

ⓐ $1.89 \times 10^{6}\ \Omega^{-1}.m^{-1}$ ⓑ $2.35 \times 10^{9}\ \Omega^{-1}.m^{-1}$

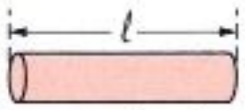
ⓒ $7.35 \times 10^{8}\ \Omega^{-1}.m^{-1}$ ⓓ $1.06 \times 10^{6}\ \Omega^{-1}.m^{-1}$

---

62 ✱ The following figures represent four metallic conductors made of different materials that have the same cross-sectional area. Below each figure, the conductivity of the material of each conductor is written. Which of these conductors has the largest electrical resistance?

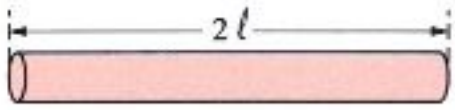
The conductivity of the conductor material = σ

ⓐ



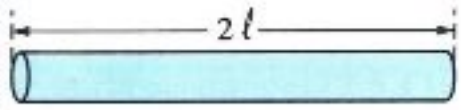
The conductivity of the conductor material = 2 σ

ⓑ



The conductivity of the conductor material = 2 σ

ⓒ



The conductivity of the conductor material = $\frac{\sigma}{2}$

ⓓ

---

63 ✱ A power station is connected to a factory 2.5 km away by two wires. If the potential difference between the terminals of the two wires at the station is 240 V and that between the other terminals of the two wires at the factory is 220 V and the factory is using a current of 80 A, so: (Knowing that: π = 3.14)

(i) The resistance of one meter of the wire equals ..... .

ⓐ $5 \times 10^{-5}\ \Omega/m$ ⓑ $6 \times 10^{-5}\ \Omega/m$ ⓒ $12 \times 10^{-5}\ \Omega/m$ ⓓ $1 \times 10^{-4}\ \Omega/m$

(ii) The radius of the wire if the resistivity of its material is 1.57×10^{-8} Ω.m equals ..... .

ⓐ 0.004 m ⓑ 0.007 m ⓒ 0.01 m ⓓ 0.05 m

---

64 If you have four wires of the same material but different in both length and thickness, each of them is connected separately with the same battery and ammeter, then the ammeter reading becomes the highest in the case of the ..... wire.

ⓐ longest and thickest ⓑ longest and thinnest

ⓒ shortest and thickest ⓓ shortest and thinnest

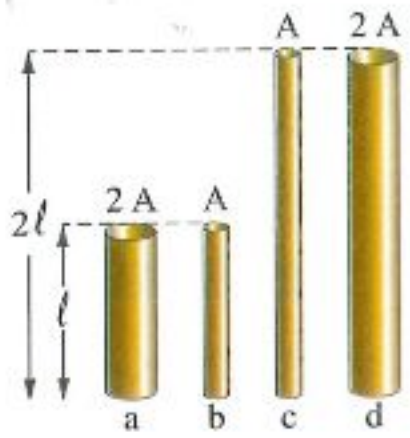
---

65 A metal wire of uniform cross-section has a length ℓ. When the potential difference between the ends of the wire is V, an electric current of intensity I flows through it. If a part (X) of the wire is cut off, and the remaining part is connected between the same potential difference (V) so that the current flowing through it becomes $\frac{4}{3}$ I. Then, the length of the part that was cut (X) equals ..... .

ⓐ $\frac{1}{4}\ell$ ⓑ $\frac{1}{3}\ell$ ⓒ $\frac{1}{2}\ell$ ⓓ $\frac{2}{3}\ell$

https://t.me/to_explain1

66 The opposite figure represents the lengths and cross-sectional areas of four wires which are made of the same material. So, at the same temperature if each of them is connected between the same electric potential difference, the correct order of the wires according to the passing electric current intensity in each of them is .....

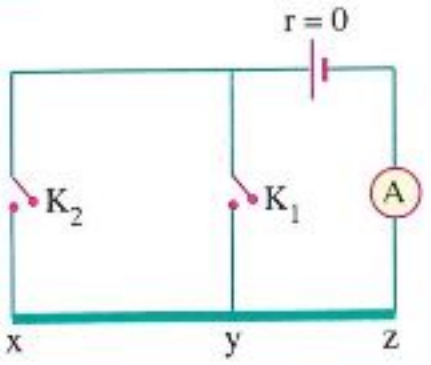


(a) c > b = d > a (b) a > b = d > c (c) b > a = c > d (d) d > a = c > b

67 ✱ The following table shows the specifications and temperatures of four conductors x, y, z and k of uniform cross-sections made of the same metal. Which of these conductors has the highest electrical resistance?

	Conductor	Conductor length (m)	Conductor cross-sectional area (mm^2)	Conductor Temperature (°C)
(a)	x	2	4	20°
(b)	y	2	4	50°
(c)	z	4	2	20°
(d)	k	4	2	50°

68 A wire xyz of uniform cross-section and electrical resistance (R) is connected in an electrical circuit as shown in the opposite figure. When only switch (K_1) is closed, the ammeter reading is 4 A. And when only switch (K_2) is closed, the ammeter reading is 1 A. so the ratio between the lengths of the two parts of the wire $\left(\frac{\ell_{xy}}{\ell_{yz}}\right)$ is equal to ..... .



(a) 2 (b) 3 (c) 4 (d) 5

69 If three copper wires z, y and x have lengths of 1 m, 4 m and 2 m respectively while having the same cross-sectional area, therefore the resistance of the three wires respectively are .....

(a) 1 : 4 : 2 (b) 4 : 1 : 2 (c) 2 : 4 : 1 (d) 2 : 1 : 4

70 ✱ Two wires (x) and (y) are made of the same metal and with the same length. The radii of their cross-sections are r_x and r_y. Each of the wires is wound into a circular coil with radii r_1 and r_2, respectively. The ratio between the electrical resistances of the wires of the two coils $\left(\frac{R_x}{R_y}\right)$ is equal to ..... .

(a) $\frac{r_y}{r_x}$ (b) $\frac{r_1}{r_2}$ (c) $(\frac{r_y}{r_x})^2$ (d) $(\frac{r_1}{r_2})^2$

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71 ✱ Two wires are of the same material, the length of the second wire equals double the length of the first wire and its diameter equals the radius of first wire, so the ratio between the resistance of the second wire and that of the first wire equals ..... .

(a) $\frac{1}{8}$ (b) $\frac{8}{1}$ (c) $\frac{1}{2}$ (d) 2

72 A conductor of regular cross-section whose length is 20 m has a resistance of 108 Ω, so if another conductor of the same material has a length of 5 m while its cross-sectional area is three times as large as that of the first conductor, then the resistance of the second conductor equals ..... .

(a) 81 Ω (b) 27 Ω (c) 9 Ω (d) 6 Ω

73 ✱ A metallic rod in the shape of a cylinder of cross-sectional area 2 cm^2 and resistance 22.5 Ω is drawn uniformly until its cross-sectional area became 1.5 cm^2, so its resistance will be ..... .

(a) 37 Ω (b) 40 Ω (c) 52 Ω (d) 56 Ω

74 ✱ If a metallic wire was drawn regularly until its length has increased to the double, then its resistance gets ..... compared to its original value.

(a) doubled (b) halved (c) quadrupled (d) quartered

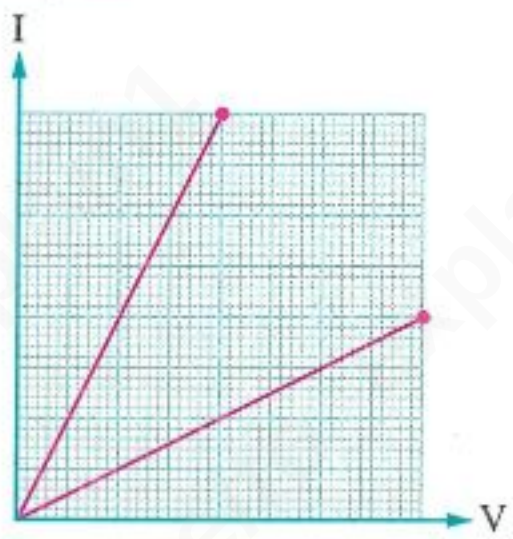
75 A metal wire is stretched uniformly such that its radius decreases by 20%, so the electrical resistance of the wire will approximately increase by ..... .

(a) 44% (b) 56% (c) 144% (d) 244%

76 A cylindrical metallic conductor with a cross-sectional diameter d and an electrical resistance R was uniformly stretched till it became a cylindrical conductor with a cross-sectional diameter $\frac{d}{x}$, so the electrical resistance of the conductor becomes ..... .

(a) x^2R (b) x^4R (c) $\frac{R}{x^2}$ (d) $\frac{R}{x^4}$

77 ✱ A wire of uniform cross-section was uniformly drawn, and the relation between the current intensity (I) through it and the potential difference (V) across its ends before and after it has been drawn is represented as in the opposite graph. Then, the wire was drawn such that ..... .



(a) its length increased to double

(b) its length increased to nine times

(c) its cross-sectional area decreased to one-third

(d) its cross-sectional area decreased to one-ninth

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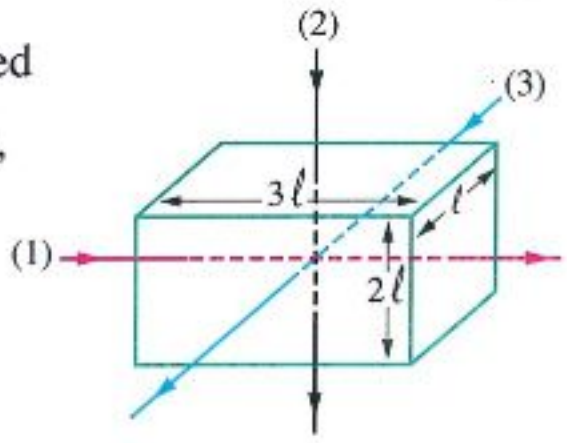
78 ✱ The opposite figure shows a conducting solid cuboid where each two opposite faces of the cuboid can be connected between the terminals of an electric source and the paths (1), (2) and (3) are the probable pathways of electric currents through the conductor, in which of these paths the electric current faces the highest resistance?

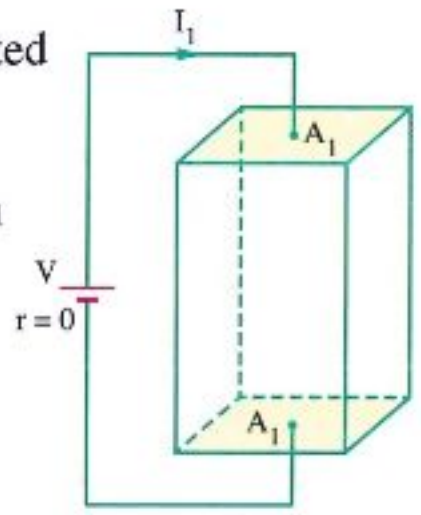


ⓐ Path (1) ⓑ Path (2)

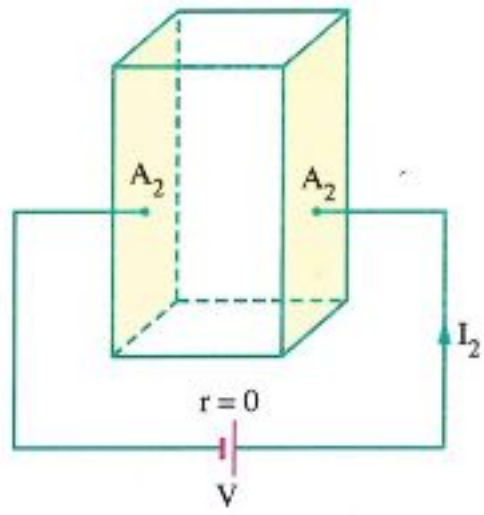
ⓒ Path (3) ⓓ All paths have the same resistance.

---

79 ✱ An electrical conductor in the shape of a solid rectangular cuboid is connected in two different ways to a battery of negligible internal resistance, as shown in circuits (1) and (2). Then, the ratio between the current intensities in the two circuits $\left(\frac{I_1}{I_2}\right)$ is equal to ..... .



Circuit (1)



Circuit (2)

ⓐ $\frac{A_1}{A_2}$ ⓑ $\left(\frac{A_1}{A_2}\right)^2$

ⓒ $\frac{A_2}{A_1}$ ⓓ $\left(\frac{A_2}{A_1}\right)^2$

---

80 ✱ A metal wire of volume 2×10^{-4} m^3 and cross-sectional area 4×10^{-5} m^2 has a resistance of 1.25 Ω, so its conductivity equals ..... .

ⓐ $10^3\ \Omega^{-1}.m^{-1}$ ⓑ $10^5\ \Omega^{-1}.m^{-1}$

ⓒ $10^7\ \Omega^{-1}.m^{-1}$ ⓓ $10^8\ \Omega^{-1}.m^{-1}$

---

81 A metallic cube has a side length ℓ, when it is connected to an electric circuit at two opposite faces, its electrical resistance equals R, so the electrical conductivity (σ) of this metal can be determined using the relation; .....

ⓐ $\sigma = R\ell$ ⓑ $\sigma = \frac{\pi}{2R\ell}$ ⓒ $\sigma = \frac{1}{2R\ell}$ ⓓ $\sigma = \frac{1}{R\ell}$

---

82 ✱ Two wires are made of copper, the length of the first wire is 10 m and its mass is 0.1 kg, while length and mass of the second wire are 40 m and 0.2 kg, respectively, so the ratio between their resistances $\left(\frac{R_1}{R_2}\right)$ equals ..... .

ⓐ $\frac{1}{4}$ ⓑ $\frac{1}{5}$ ⓒ $\frac{1}{7}$ ⓓ $\frac{1}{8}$

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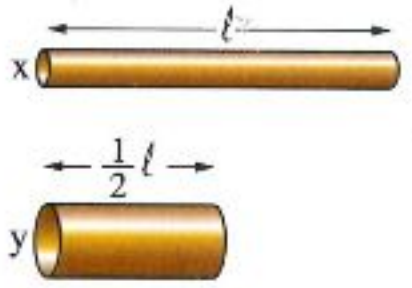
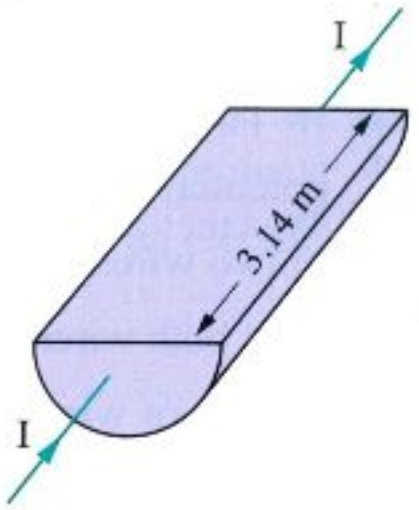
83 ✱ The opposite figure shows two wires x and y of the same material. If the mass of wire x is 5 g and the mass of wire y is 10 g, then ratio between the resistances of the two wires $\left(\frac{R_x}{R_y}\right)$ equals ..... .



(a) $\frac{2}{1}$ (b) $\frac{4}{1}$ (c) $\frac{8}{1}$ (d) $\frac{16}{1}$

84 ✱ In the opposite figure, a conductor that has a length of 3.14 m and its cross-section is in the shape of a semi-circle with a diameter of 2 mm carries an electric current. If you know that the resistivity of the conductor material is 10^{-6} Ω.m, then its electrical resistance equals ..... . (Given that: $\pi = 3.14$)

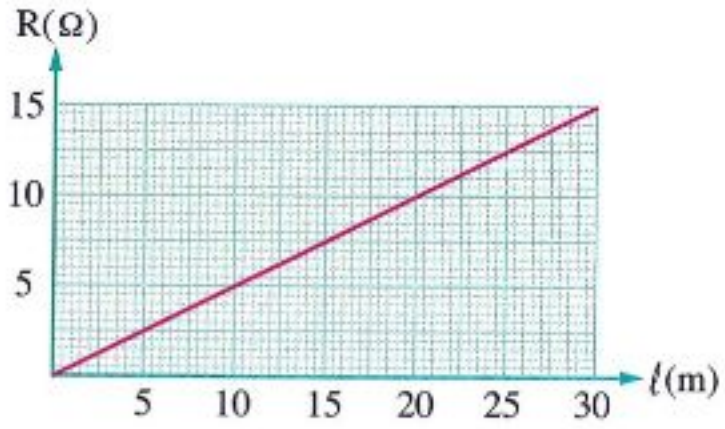


(a) 0.25 Ω (b) 0.5 Ω
(c) 1 Ω (d) 2 Ω

85 A hollow cylinder made of a metal with resistivity 2×10^{-8} Ω.m has a length of 1 m and inner and outer radii of 1 mm and 2 mm respectively, as shown in the opposite figure, so the electrical resistance between the ends of the cylinder is equal to ..... .

(a) 1.6×10^{-3} Ω (b) 2.1×10^{-3} Ω (c) 4.8×10^{-3} Ω (d) 8×10^{-3} Ω

86 ✱ The opposite graph represents the relation between the resistance (R) of a wire and its length (ℓ). If the cross-sectional area of the wire is 0.1 cm^2, so:



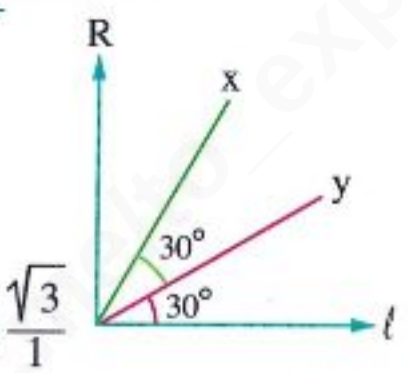
(i) The resistivity of the wire's material (ρ_e) equals ..... .

(a) 3×10^{-7} Ω.m (b) 5×10^{-6} Ω.m
(c) 4×10^{-5} Ω.m (d) 9×10^{-8} Ω.m

(ii) The resistance of a 25 m long section of this wire equals ..... .

(a) 9.25 Ω (b) 11.3 Ω (c) 12.5 Ω (d) 15.9 Ω

87 The opposite graph represents the variation of resistance (R) with length (ℓ) for two copper wires (x) and (y), so the ratio between the cross-sectional areas of the two wires $\left(\frac{A_x}{A_y}\right)$ is ..... .



(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{3}{1}$ (d) $\frac{\sqrt{3}}{1}$

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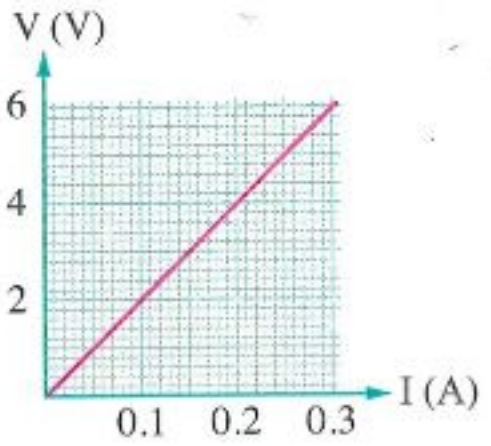
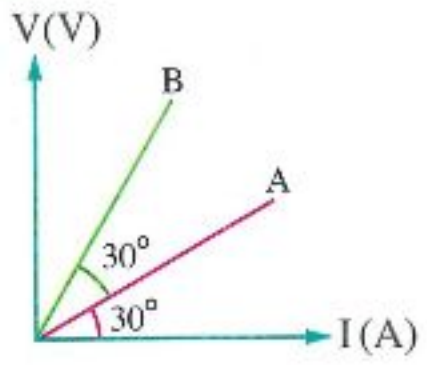
88 ✱ The opposite graph represents the variation of the potential difference (V) across a wire of length 5 m and cross-sectional area 0.1 mm^2 versus the current intensity (I) through the wire, so the conductivity of the wire's material equals ..... .



(a) $4.1 \times 10^6\ \Omega^{-1}.m^{-1}$ (b) $3.2 \times 10^5\ \Omega^{-1}.m^{-1}$

(c) $2.5 \times 10^6\ \Omega^{-1}.m^{-1}$ (d) $1.6 \times 10^5\ \Omega^{-1}.m^{-1}$

89 ✱ The opposite graph shows the variation of the electric potential difference (V) with the electric current intensity (I) in two wires of the same material, so:



(i) If both wires have the same length and the cross-sectional area of wire B is $3 \times 10^{-6}\ m^2$, the cross-sectional area of wire A equals ..... .

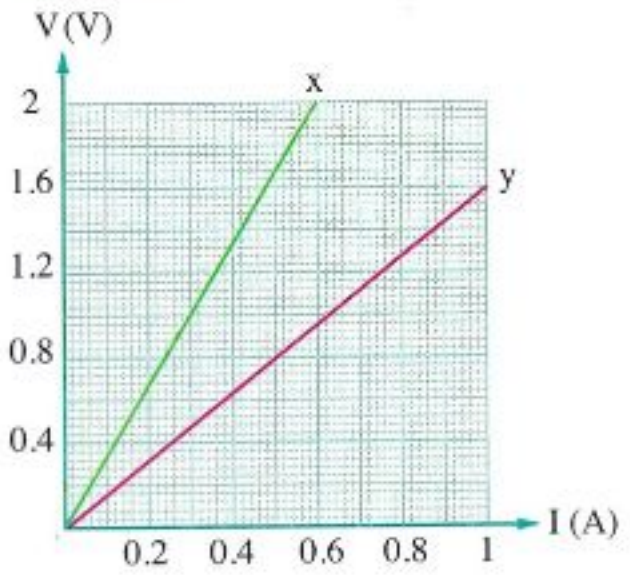
(a) $10^{-6}\ m^2$ (b) $9 \times 10^{-6}\ m^2$ (c) $3 \times 10^{-6}\ m^2$ (d) $12 \times 10^{-8}\ m^2$

(ii) If both wires have the same cross-sectional area and the length of wire B is 3 m, the length of wire A equals ..... .

(a) 1 m (b) 2 m (c) 3 m (d) 9 m

90 ✱ The opposite graph represents the variation of the potential difference (V) across two wires (x and y) that have the same length with the current intensity (I) in both of them at constant temperature.

If the ratio between the cross-sectional areas of the two wires $\left(\frac{A_x}{A_y}\right)$ equals $\frac{12}{25}$, so the ratio between the resistivities of their materials $\left(\frac{(\rho_e)_x}{(\rho_e)_y}\right)$ equals ..... .



(a) $\frac{2}{1}$ (b) $\frac{1}{1}$ (c) $\frac{1}{4}$ (d) $\frac{1}{7}$

91 The opposite table shows different values of lengths, cross-sectional areas and resistivities for wires that are made of different materials:

	Wire length ℓ (m)	Cross-sectional area A (cm^2)	Resistivity $\rho_e \times 10^{-4}$ (Ω.m)
(1)	10	0.1	0.05
(2)	5	0.5	0.25
(3)	5	0.1	0.5
(4)	0.5	0.5	0.005

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(i) Which of these wires carries a current of intensity 2 A when the potential difference between its terminal equals 10 V?

(a) Wire (1) (b) Wire (2) (c) Wire (3) (d) Wire (4)

(ii) Which of these wires gives larger amount of heat than the other wires when the same current intensity passes through them for the same time interval?

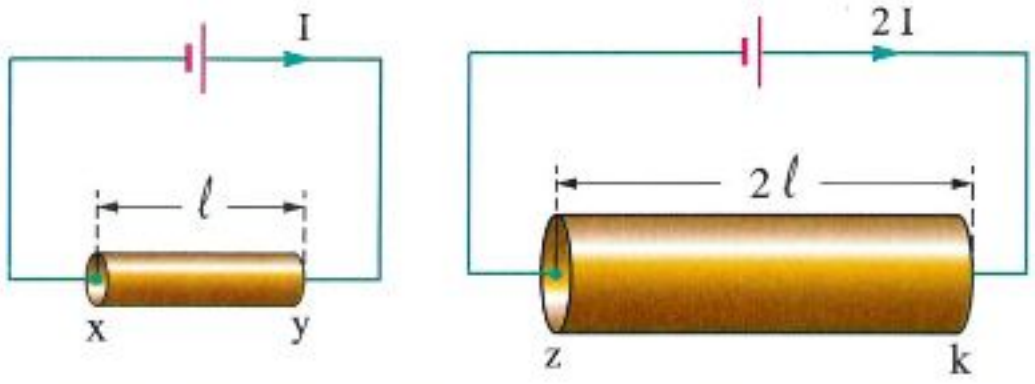
(a) Wire (1) (b) Wire (2) (c) Wire (3) (d) Wire (4)

(iii) Which of these wires gives less thermal power than the other wires when each of them is connected between the same potential difference?

(a) Wire (1) (b) Wire (2) (c) Wire (3) (d) Wire (4)

---

92 Each of conductors xy and zk has a uniform cross-section and both of them are made of the same metal with lengths ℓ and 2ℓ respectively. Each is connected in an electrical circuit as shown in the following two figures,



If the electrical powers consumed in the two conductors are equal, the ratio between the cross-sectional areas of the conductors $\left(\frac{A_{xy}}{A_{zk}}\right)$ equals ..... .

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) $\frac{1}{6}$ (d) $\frac{1}{8}$

---

93 A wire of resistance R consumes an electric power P_w when the potential difference between its terminals is V, if the wire is drawn uniformly so that its length gets doubled while keeping the potential difference between its terminals V, it will consume an electric power of ..... .

(a) $2\,P_w$ (b) $4\,P_w$ (c) $\frac{P_w}{2}$ (d) $\frac{P_w}{4}$

---

94 * A wire of length 2 m has a cross-sectional area of 4×10^{-6} m^2, when the potential difference between its terminals was 20 V, the consumed power through it was 10 W, so:

(i) The resistivity of the wire's material equals ..... .

(a) 2×10^{-7} Ω.m (b) 10^{-5} Ω.m

(c) 8×10^{-5} Ω.m (d) 4×10^{-6} Ω.m

(ii) The number of electrons that pass through a cross-section of the wire in one minute equals ..... . (Where: $e = 1.6 \times 10^{-19}$ C)

(a) 9.741×10^{17} electrons (b) 6.435×10^{18} electrons

(c) 2.314×10^{19} electrons (d) 1.875×10^{20} electrons

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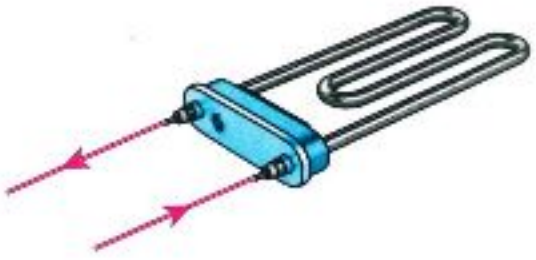
Second Essay questions

Electric current intensity

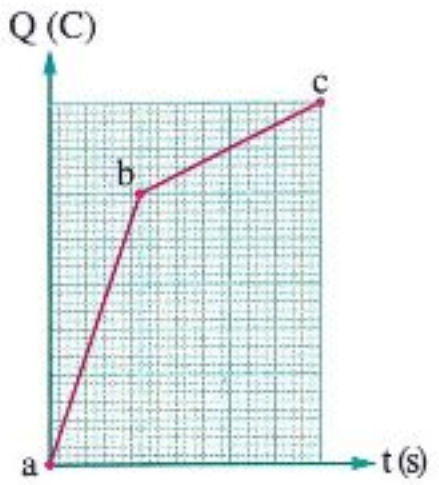
1. **Explain why** some materials conduct the electric current while others are electrically insulators.

2. A current of intensity 3.2 mA passes through a wire, **calculate** the rate of electrons flow across a section of the wire.

3. The opposite figure shows a wire of a heater through which a direct electric current is passing. **Explain why** the intensity of the electric current at the ends of the wire is the same, although electric energy is consumed through it.

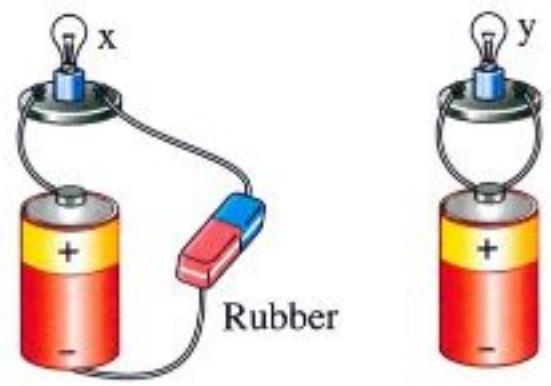


4. The opposite graph represents the relation between the quantity of electric charges (Q) passing across a certain section of a conductor and time (t), **deduce the relation between** intensities of the current passing in the conductor during the intervals ab, bc respectively.



Electric potential difference

5. **Explain:** None of the two lamps x and y is lit up, even though each of them is connected to a dry cell as shown in the opposite figure.



6. In the opposite figure, if the work done to transfer 10^{20} free electrons from point y to point x is 80 J, **calculate** the electric potential at point y.

Ohm's law

7. The potential difference between the terminals of a battery is 9 V when it is connected to an electric lamp whose filament resistance is 1.6 Ω, **calculate** the number of electrons passing per minute across a section of the filament.

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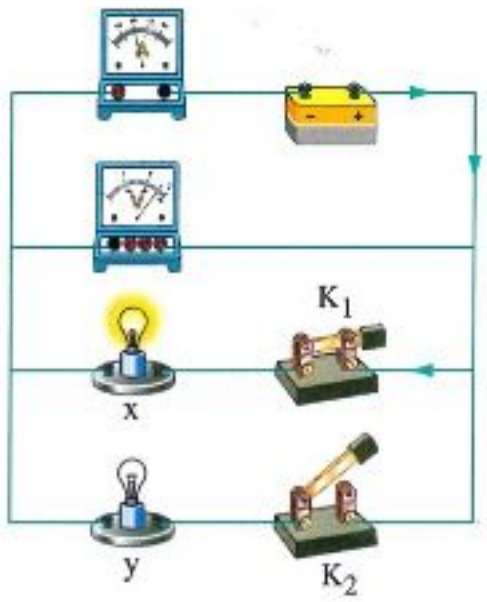
8 In the opposite circuit, an electric battery of negligible internal resistance is connected to two lamps x and y through two switches K_1 and K_2 respectively, with an ammeter and a voltmeter. If the resistance of lamp y is more than that of lamp x, **illustrate what happens to** the reading of each of the ammeter and voltmeter when switch K_1 is opened and switch K_2 is closed.



Electric power and electric energy

9 Two metal wires, the first has a resistance R where 10^{20} electrons pass across a section of it per second and the second has a resistance 2 R where 2×10^{20} electrons pass across a section of it per second. **Calculate** the ratio between the consumed power in the first wire and the consumed power in the second wire.

10 An electric heater whose coil is connected to an electrical source of potential difference 220 V and negligible internal resistance to heat the water, **what** is the effect of replacing the heater coil by another of higher electrical resistance on the rate of heating the water? **Why?**

11 In the two figures (1) and (2), if the consumed power in the two resistors R_1 and R_2 are equal and the ratio between the readings of the two ammeters $\left(\frac{A_1}{A_2}\right)$ equals $\frac{1}{2}$:

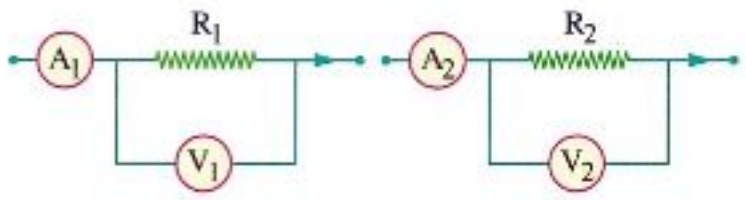


Figure (1) **Figure (2)**

(a) **Find** the ratio between the readings of the two voltmeters $\left(\frac{V_1}{V_2}\right)$.

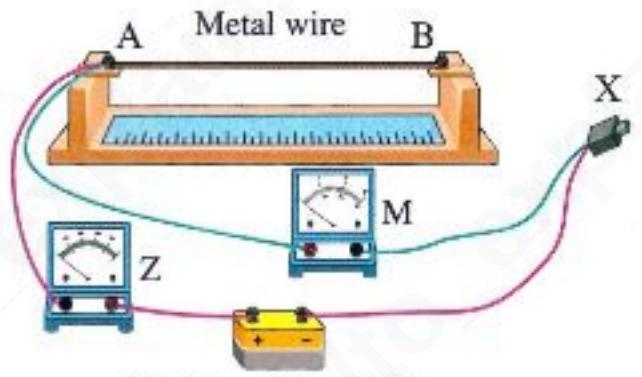
(b) **Explain why** it is not appropriate to use the readings of the two voltmeters and the two ammeters to satisfy Ohm's law.

The electric resistance

12 A student used the tools shown in the figure to study how the resistance of a wire (AB) of uniform cross-section changes with the change of its length:

(a) **What** is the role of (X) to acheive the aim of the experiment?

(b) **What** is the aim of using the two devices Z and M?



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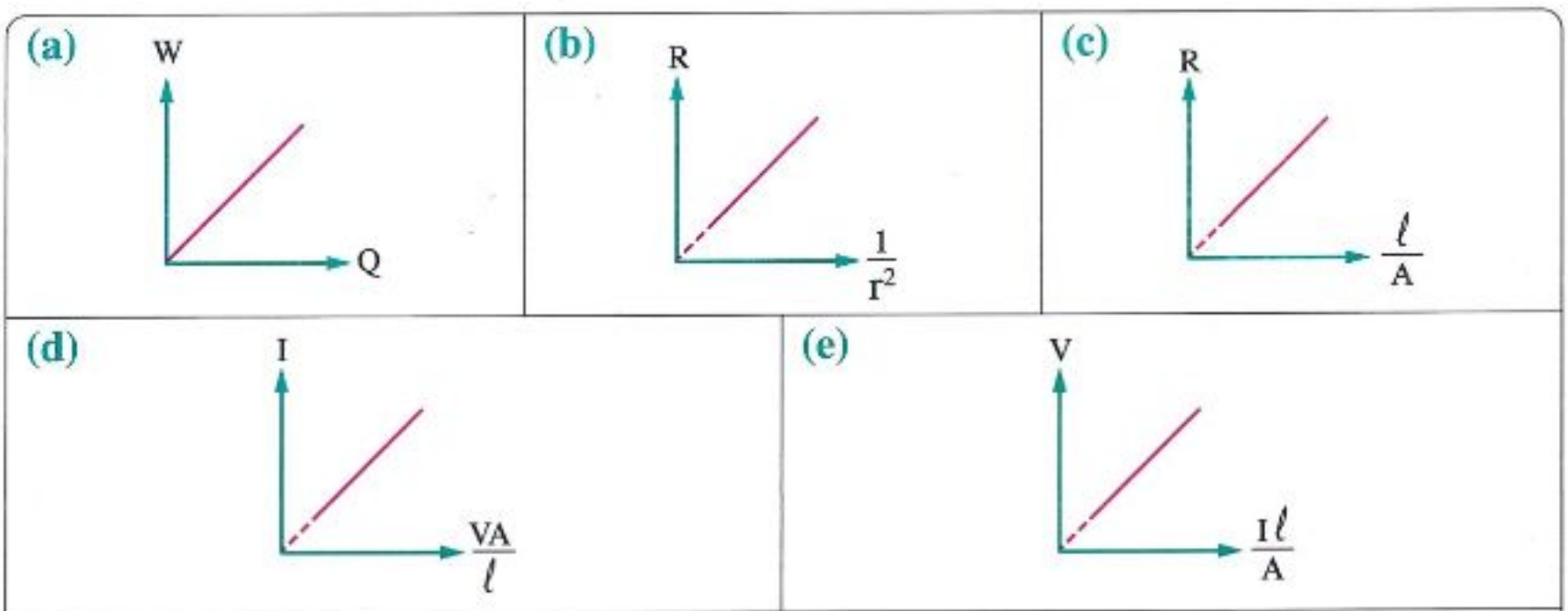
13 **How** can the electric resistance of a copper wire be increased at a certain temperature?

14 **What are the physical quantities that are measured in the following units?**

(a) Ampere.second **(b)** Volt.coulomb **(c)** Volt. ampere^{-1}

(d) Joule/ohm.coulomb **(e)** Volt.second.ohm^{-1}

15 **Write the mathematical relation and the equivalent to the slope for each of the following:**



Where: (Q) is the quantity of electric charges, (V) is the potential difference, (I) is the current intensity, (R) is the resistance, (ℓ) is the conductor length, (A) is the conductor cross-sectional area, (r) is the conductor radius, (W) is the work.

16 The opposite table shows the specifications of three metallic conductors which are made of different materials (x, y and z) and have the same cross-sectional area if σ refers to the electric conductivity of the material:

Conductor	Conductor length	Conductor resistance
x	2 m	1 Ω
y	3 m	4 Ω
z	3 m	6 Ω

(a) **What** is the ratio between σ_x, σ_y, σ_z?

(b) **Which** one of these materials is preferred to be used in the manufacture of the wires of the electric conductivity? **Explain your answer.**

17 A solid cube of side length 10 cm is made of a material whose resistivity is 10^{-7} Ω.m has been shaped into a cylindrical wire with a resistance of 20 Ω. **Calculate** the length of the wire.

18 A wire of length 2 m has a resistance 2 Ω, if the density of the wire's material is 7000 kg/m^3 and its resistivity is 10^{-6} Ω.m. **Calculate** the mass of the wire.

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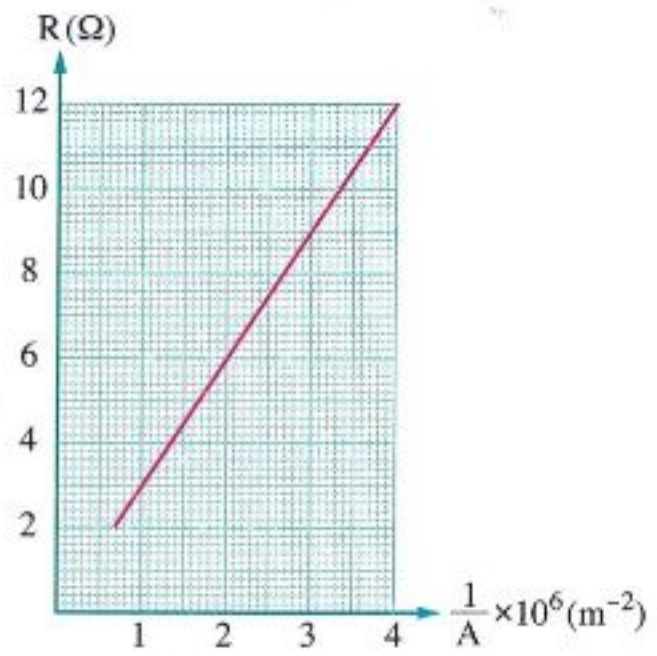
19 A group of wires made of the same material, each is 12 m long. The opposite figure represents the relation between the resistance (R) of each wire and the reciprocal of its cross-sectional area $\left(\frac{1}{A}\right)$, **find**:



(a) The electric resistance of a wire made of the same material and has the same length of the wires and its cross-sectional area is 0.0025 cm^2.

(b) The electric conductivity of the wires' material.

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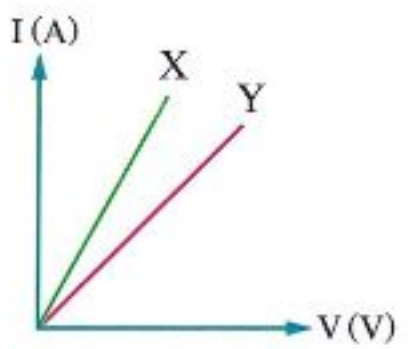
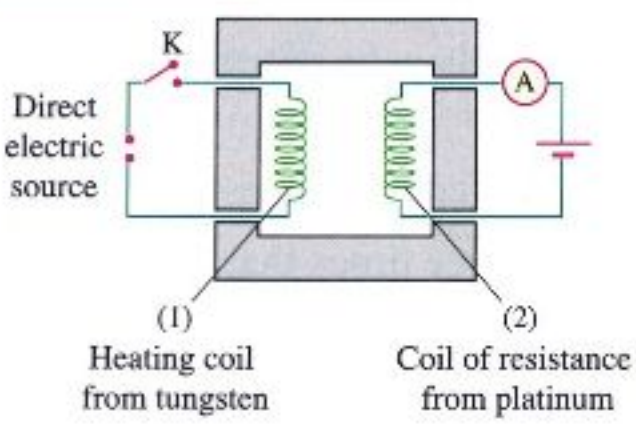
20 The opposite graph represents the relation between the electric current intensity (I) passing in two wires X, Y of uniform cross-section, made of the same material, having the same length and the potential difference between the ends of each wire.



Which of them is the thickest? **And why?**

---

21 In the opposite figure, a closed insulated chamber contains two coils, after closing the switch K which is connected to coil (1) for a period, it was observed that the reading of the ammeter connected to the coil (2) decreased. **How can you explain that?**



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22 An electric lamp A of power 80 W works on a potential difference of 220 V and an electric lamp B of power 20 W works on a potential difference of 24 V, if you know that the filaments of the two lamps are made of the same material and have the same length. **Calculate** the ratio between the radius of the two filaments $\left(\frac{r_A}{r_B}\right)$.

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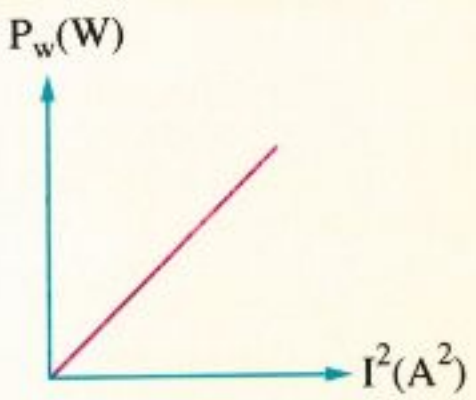
Questions of the Previous Years Exams on Lesson 1

1 The opposite graph represents the relation between the power consumed (P_W) in a conductor and the square of the current intensity (I^2) through this conductor, so the slope of the line representing the relationship equals ..... . *(Exp. 2025)*



(a) the resistance of the conductor

(b) the reciprocal of the resistance of the conductor

(c) the potential difference across the conductor

(d) the square of the potential difference across the conductor

2 An electric lamp is labelled (100 V, 80 W) which means ..... . *(Exp. 2025)*

(a) the electrical resistance of the lamp is 0.8 Ω

(b) the electrical resistance of the lamp is 1.25 Ω

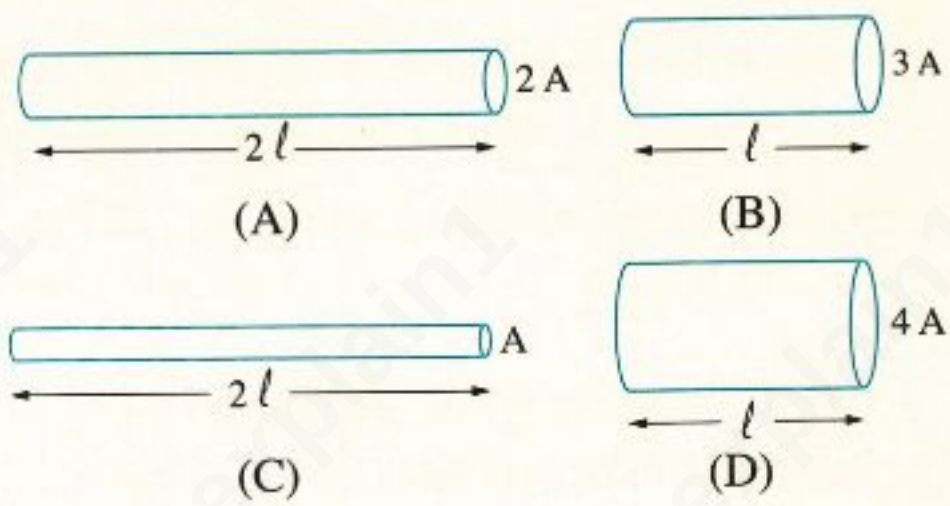
(c) when the potential difference across the lamp is 100 V, a current of 0.8 A flows through it

(d) when the potential difference across the lamp is 100 V, a current of 1.25 A flows through it

3 Two copper wires have the same length, if the cross-sectional area of the second wire is three times that of the first wire, the ratio between the resistance of the first wire and the resistance of the second wire $\left(\frac{R_1}{R_2}\right)$ equals ..... . *(Exp. May 21)*

(a) $\frac{3}{1}$ (b) $\frac{1}{3}$ (c) $\frac{1}{6}$ (d) $\frac{6}{1}$

4 The opposite figure shows four conductors of uniform cross-sections made of the same materials but with different dimensions, so their correct arrangement in an ascending order according to their electrical resistances is ..... *(Exp. May 21)*



(a) B ⟶ C ⟶ A ⟶ D

(b) D ⟶ A ⟶ C ⟶ B

(c) C ⟶ A ⟶ B ⟶ D

(d) D ⟶ B ⟶ A ⟶ C

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5 A conductor of length ℓ and cross-sectional area 3 A is connected between a potential difference V so that a current of intensity I passes in it, when the same potential difference is used with a different conductor of the same material as the first one, it was found that a current of intensity 3 I passes in it, so the length and the cross-sectional area of the second conductor are ..... . *(Exp. June 21)*

	Length	Cross-sectional area
(a)	2ℓ	18 A
(b)	3ℓ	3 A
(c)	18ℓ	2 A
(d)	$\frac{1}{3}\ell$	$\frac{1}{3}$ A

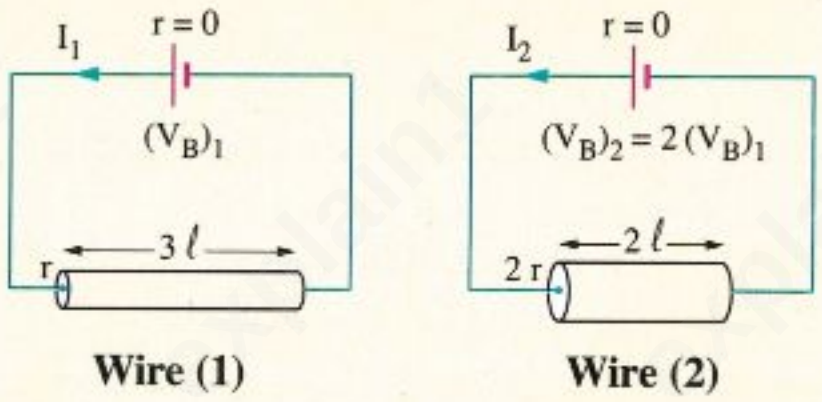
6 Two wires are made of the same material, the diameter of the first wire is 3 times the diameter of the second wire and the resistance of the second wire is 4 times the resistance of the first wire, so the length of the second wire is ..... the length of the first wire.

(a) $\frac{3}{4}$ (b) $\frac{72}{2}$ (c) $\frac{4}{9}$ (d) $\frac{36}{3}$ *(1^{st} session 21)*

7 A current of I intensity passes through a conductor of ℓ length and cross-sectional area A, when the battery is changed with a different one, the current passing through the same conductor becomes 3 I, so the cross-sectional area of the conductor becomes ..... .

(a) A (b) 3 A (c) $\frac{1}{3}$ A (d) 6 A *(2^{nd} session 21)*

8 Two wires (1) and (2) are made of the same material, wire (ℓ) has length (3ℓ) and radius (r) while wire (2) has length (2ℓ) and radius (2 r) as shown in the figure: *(1^{st} session 22)*



Wire (1) **Wire (2)**

So, the ratio $\left(\frac{I_1}{I_2}\right)$ = ...

(a) $\frac{12}{1}$ (b) $\frac{1}{12}$ (c) $\frac{3}{2}$ (d) $\frac{1}{6}$

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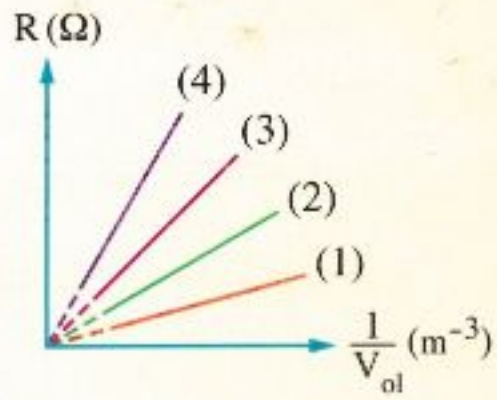
9 The graph shows the relation between the electric resistance (R) and the reciprocal of the volume $\left(\frac{1}{V_{ol}}\right)$ for many wires of same length but of different materials.

The correct arrangement of these wires concerning the conductivity (σ) of their materials is ..... *(2nd session 22)*



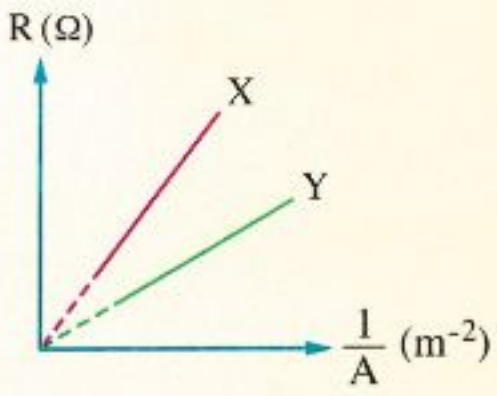
(a) $\sigma_4 > \sigma_1 > \sigma_3 > \sigma_2$

(b) $\sigma_1 > \sigma_3 > \sigma_2 > \sigma_4$

(c) $\sigma_1 > \sigma_2 > \sigma_3 > \sigma_4$

(d) $\sigma_4 > \sigma_3 > \sigma_2 > \sigma_1$

10 The two groups X and Y are wires of the same length and of different materials, the opposite figure represents the relation between the electric resistance (R) of the wire and the reciprocal of the cross-sectional area $\left(\frac{1}{A}\right)$, which of the following is correct? *(Exp. 23)*



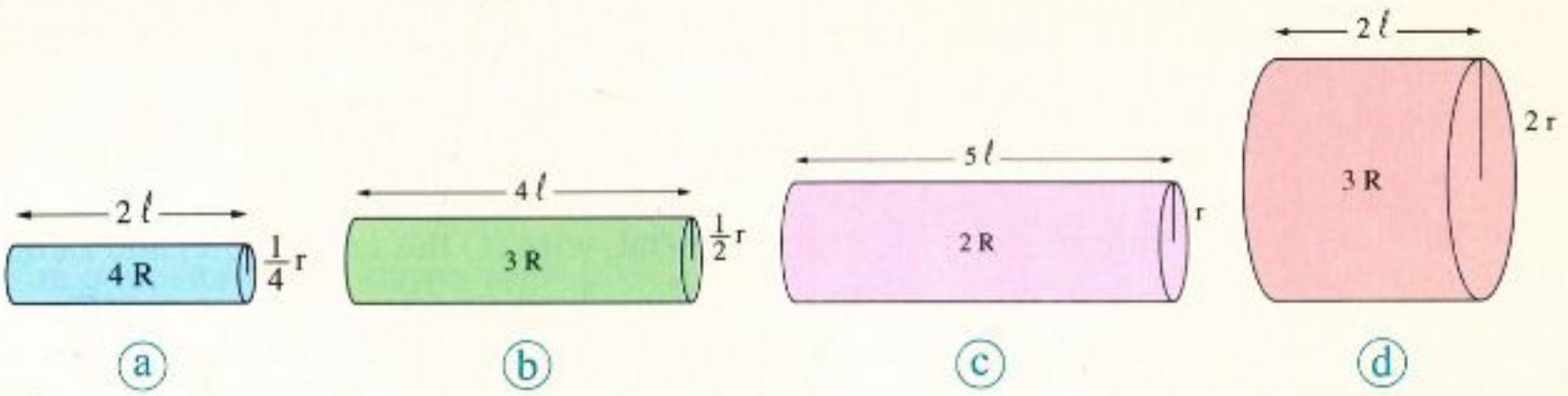
(a) Group X is made of a material with a higher resistivity.

(b) Group Y is made of a material with a higher resistivity.

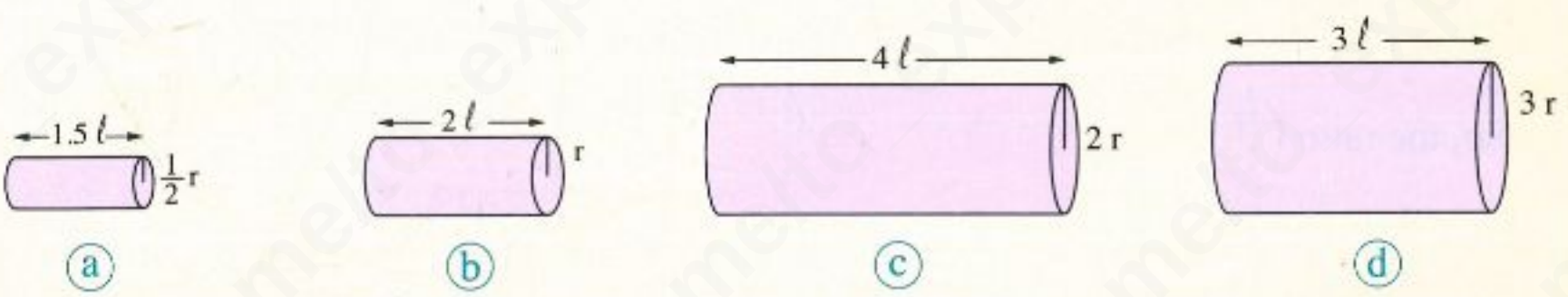
(c) Group X is made of a material with a higher electric conductivity.

(d) The electric conductivity of the two groups is equal.

11 The following figures illustrate four wires of different materials, using the data on the figures, which wire material has the greatest conductivity at the same temperature? *(1st session 23)*



12 The figure represents four aluminum wires. Which wire has the least electric resistance? *(2nd session 23)*



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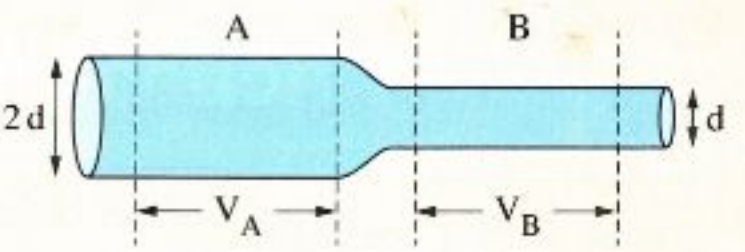
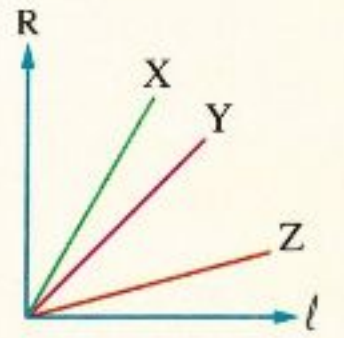
13 The figure represents a metallic conductor with different cross-sections. It is connected to the terminals of a battery in closed electric circuit. Knowing that the length of part (A) = The length of part (B).



So, the ratio: $\frac{\text{Potential difference } (V_A)}{\text{Potential difference } (V_B)}$ = ... *(1st session 24)*

(a) $\frac{R_B}{R_A}$ (b) $\frac{R_A}{R_B}$ (c) $\frac{2R_A}{R_B}$ (d) $\frac{4R_A}{R_B}$

14 The graph shows the relation between the change in the resistance of a number of wires made of three different materials X, Y and Z having the same cross-sectional area at the same temperature and the length. Which of the following choices is correct? *(1st session 24)*



(a) $\sigma_Z = \sigma_Y = \sigma_X$ (b) $\sigma_Z < \sigma_Y < \sigma_X$

(c) $\sigma_Z > \sigma_Y > \sigma_X$ (d) $\sigma_Z > \sigma_X > \sigma_Y$

15 Figure (1) represents an electric circuit which contains a conductor AB at temperature T_1, so the voltmeter reading was V_1. When the temperature of the conductor AB is raised to T_2, the reading of the voltmeter becomes V_2 as in figure (2). *(2nd session 24)*

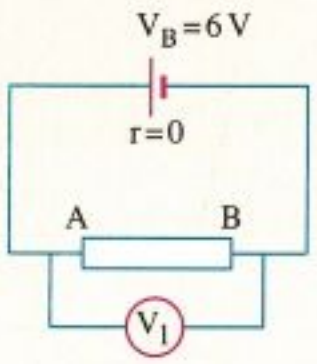


Figure (1)

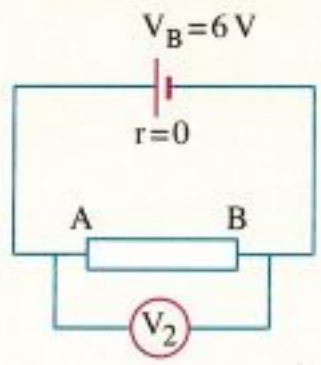


Figure (2)

Which of the following choices is correct?

(a) The reading of voltmeter V_2 = Zero

(b) The reading of voltmeter V_1 = The reading of voltmeter V_2

(c) The reading of voltmeter V_1 > The reading of voltmeter V_2

(d) The reading of voltmeter V_1 < The reading of voltmeter V_2

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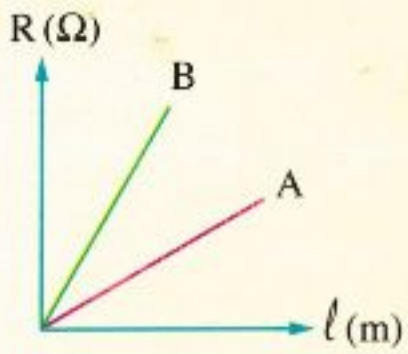
16 The opposite graph shows the relation between the resistances of two sets of wires A and B which are made of two different materials having the same cross-sectional area at constant temperature and the length, so which choice is correct?



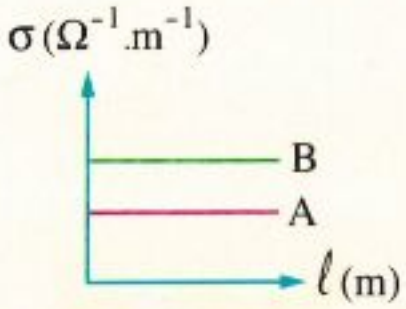


Figure (1)

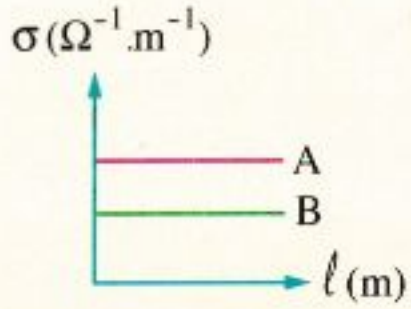


Figure (2)

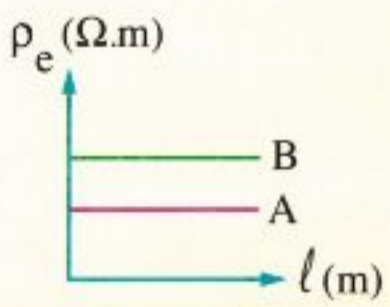


Figure (3)

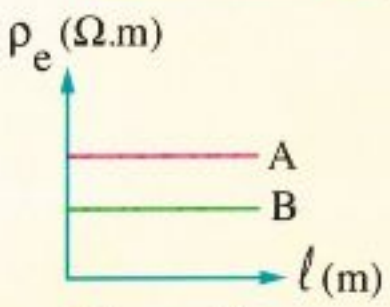


Figure (4)

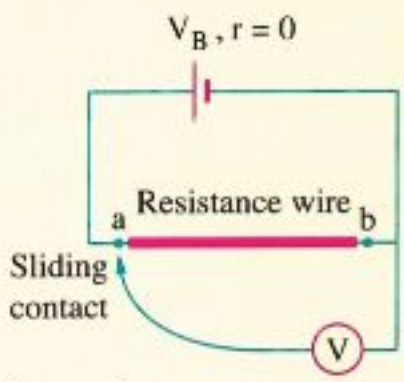
(a) Figures (1) and (3)
(b) Figures (2) and (4)
(c) Figures (1) and (4)
(d) Figures (2) and (3)

(2nd session 24)

---

17 A battery of emf V_B that has a negligible internal resistance is connected to a non-insulated resistance wire ab of uniform cross-section, a voltmeter and a sliding contact as shown in the opposite figure, so when moving the sliding contact from point a to b, the reading of the voltmeter ..... .

(Exp. 25)

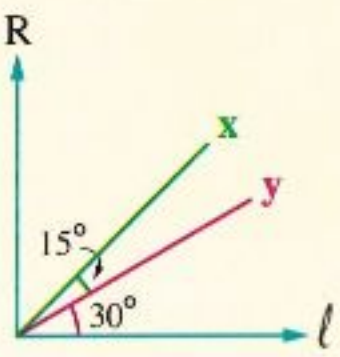


(a) increases
(b) decreases but it doesn't reach zero
(c) remains unchanged
(d) decreases until it reaches zero

---

18 Two long copper wires x and y are different in thickness, where the opposite graph represents the relation between the resistance (R) and the length (ℓ) taken from each wire, so the ratio between the cross-sectional areas of the two wires $\left(\frac{A_x}{A_y}\right)$ is ..... .

(Exp. 25)

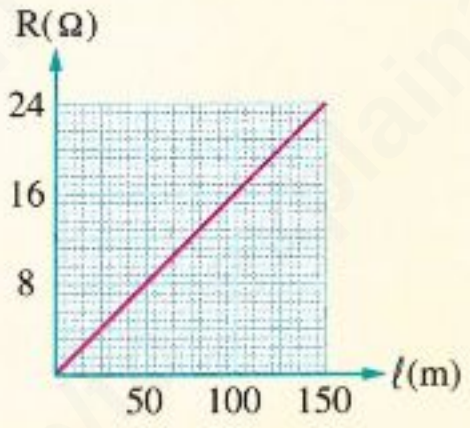


(a) $\frac{1}{3}$
(b) $\frac{3}{1}$
(c) $\frac{1}{\sqrt{3}}$
(d) $\frac{\sqrt{3}}{1}$

---

19 The opposite graph represents the relation between the electric resistance (R) of each wire of a group of wires made of the same material and having the same cross-sectional area that is 0.1 cm^2 and length (ℓ) for each of these wires, then the resistivity of the material of these wires (ρ_e) equals ..... .

(Exp. 25)



(a) 2.4×10^{-7} Ω.m
(b) 3.6×10^{-7} Ω.m
(c) 1.2×10^{-6} Ω.m
(d) 1.6×10^{-6} Ω.m

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Chapter 1

Questions on Lesson Two

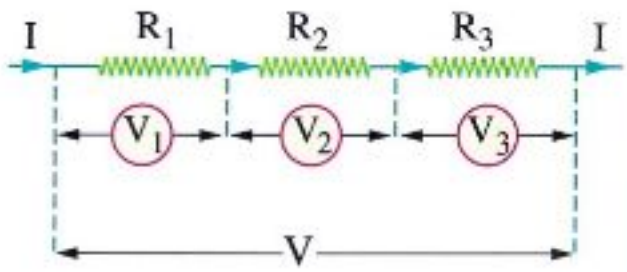
Resistors Connection

Interactive test

The questions signed by ✳ are answered in detail. ● Understand ○ Apply Higher Order Thinking Skills

Important guidelines

⇒ Resistors in series:



- To determine the equivalent resistance ($\grave{R}$):

$$\grave{R} = R_1 + R_2 + R_3$$

If N equal resistors each of resistance R are connected in series, then: $\grave{R} = NR$

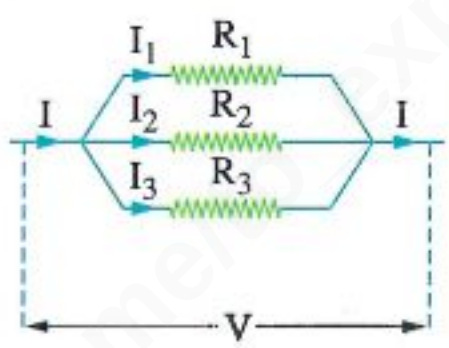
- To determine the total voltage (V): $V = V_1 + V_2 + V_3$

(Where the voltage is distributed across the resistors)

- To determine the current intensity (I): $I = \frac{V}{\grave{R}} = \frac{V_1}{R_1} = \frac{V_2}{R_2} = \frac{V_3}{R_3}$

(Where the current intensity through all resistors is the same)

⇒ Resistors in parallel:



- To determine the equivalent resistance ($\grave{R}$):

$$\frac{1}{\grave{R}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

- If N equal resistors each of resistance R are connected in parallel, then: $\grave{R} = \frac{R}{N}$

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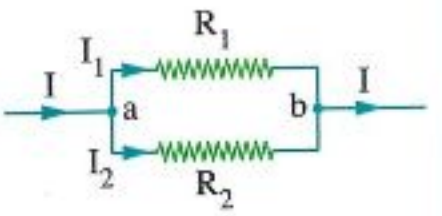
- If two different resistors R_1 and R_2 are connected in parallel; $\grave{R} = \frac{R_1 R_2}{R_1 + R_2}$
- To determine the potential difference (V): $V = I\grave{R} = I_1R_1 = I_2R_2 = I_3R_3$
  (Where the voltage is the same across each resistor)
- To determine the total current (I): $I = I_1 + I_2 + I_3$
  (Where the current is distributed on the resistors)

- To calculate the current intensity in a branch:

$$\grave{R} = \frac{R_1 R_2}{R_1 + R_2} \ , \ V_1 = V_2 = V_{ab} \ , \ I_1 R_1 = I_2 R_2 = I\grave{R}$$

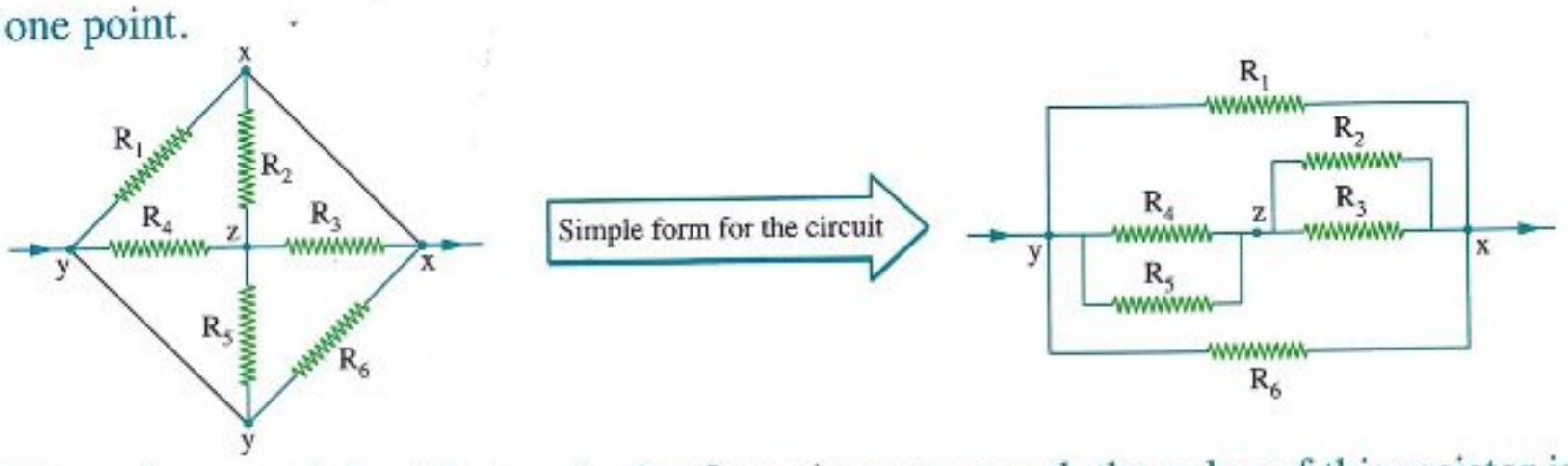
$$I_1 = \frac{V_{ab}}{R_1} \ , \ I_2 = \frac{V_{ab}}{R_2}$$



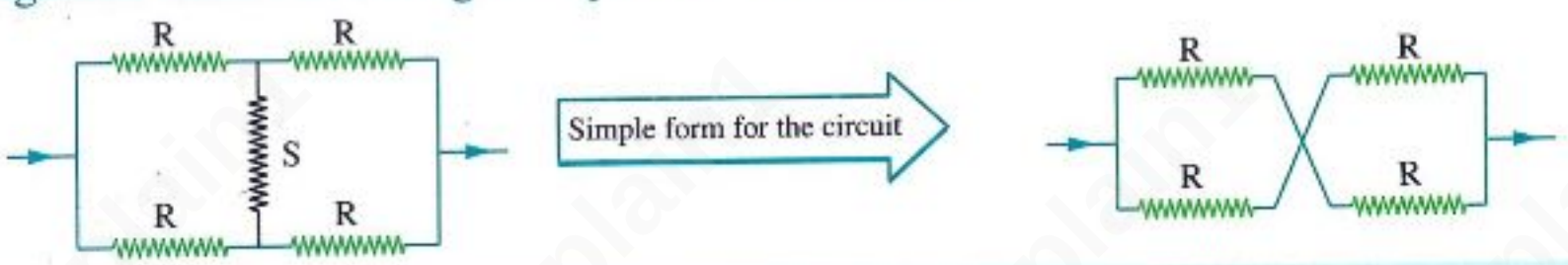
- In the case of having two branches only: $I_1 = I\frac{R_2}{(R_1 + R_2)}$, $I_2 = I\frac{R_1}{(R_1 + R_2)}$

- In the case where the terminals of a resistor are connected together by a conducting wire, its resistance is ignored when calculating the equivalent resistance because there is no potential difference between its terminals.

- In the case of having a connecting wire of no resistance, its ends can be considered as one point.



- When the potentials at the terminals of a resistor are equal, the value of this resistor is ignored when calculating the equivalent resistance.



For comparing the consumed power in two resistors

at constant electric current	at constant potential difference
$\frac{(P_w)_1}{(P_w)_2} = \frac{R_1}{R_2}$	$\frac{(P_w)_1}{(P_w)_2} = \frac{R_2}{R_1}$

https://t.me/to_explain1

First Multiple choice questions

1 Three resistors are connected in parallel, if one of them equals one ohm, then their equivalent resistance is ..... one ohm.

(a) less than
(b) greater than
(c) equal to
(d) the answer can't be determined unless knowing the values of the other two resistors

---

2 * Three resistors have resistances of 40 Ω, 60 Ω, 120 Ω, so their total equivalent resistance when connecting them:

(i) In series will be ..... .

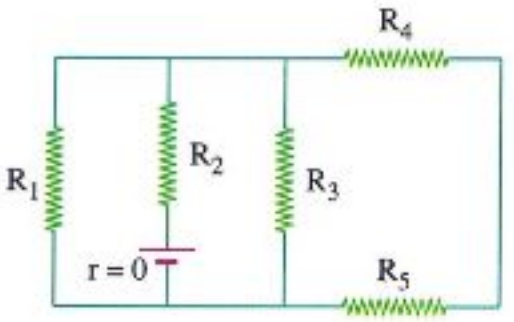
(a) 520 Ω (b) 220 Ω (c) 110 Ω (d) 34 Ω

(ii) In parallel will be ..... .

(a) 10 Ω (b) 20 Ω (c) 30 Ω (d) 40 Ω

---

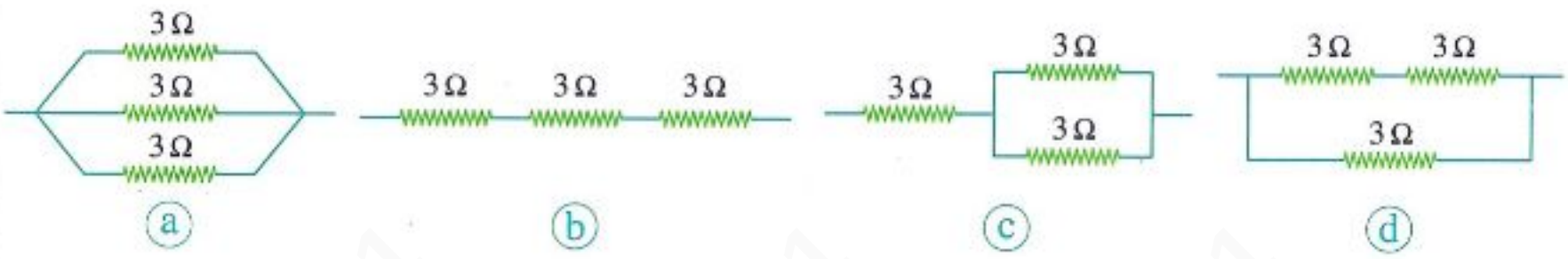
3 Which of the following statements is correct for the opposite electric circuit?



(a) Resistors R_2 and R_3 are connected in series.
(b) Resistors R_1 and R_3 are connected in parallel.
(c) Resistors R_4 and R_5 are connected in parallel.
(d) Resistors R_1 and R_2 are connected in parallel.

---

4 * You have three resistors, the resistance of each is 3 Ω. The resistors are connected in four different methods as shown in the following figures (a), (b), (c) and (d);



(a) (b) (c) (d)

so, the method of connection in which the equivalent resistance equals:

(i) 4.5 Ω is ..... .

(a) (a) (b) (b) (c) (c) (d) (d)

(ii) 2 Ω is ..... .

(a) (a) (b) (b) (c) (c) (d) (d)

(iii) 1 Ω is ..... .

(a) (a) (b) (b) (c) (c) (d) (d)

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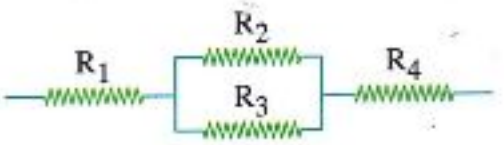
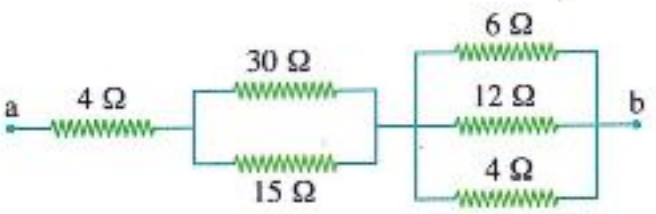
5 The opposite figure represents a part of an electric circuit, which of the resistors whose removal from the circuit leads to the increase of the value of the equivalent resistance?



(a) R_1 (b) R_2
(c) R_4 (d) R_1, R_2, R_3

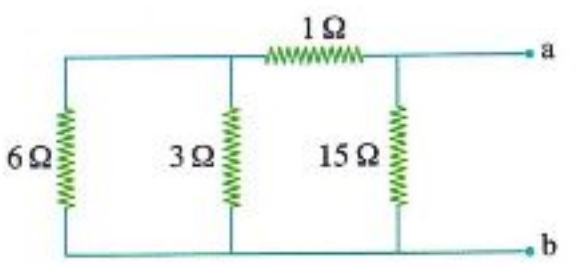
6 What is the equivalent resistance between points a and b in each of the following cases?

(i)



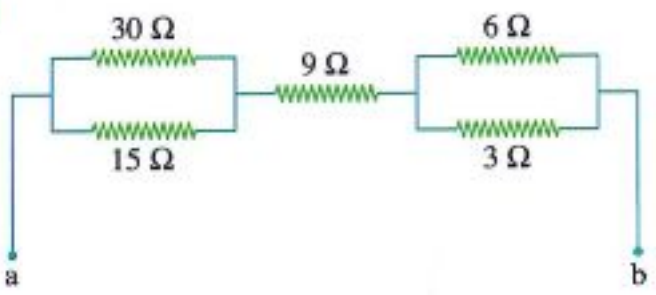
(a) 15 Ω (b) 16 Ω
(c) 17 Ω (d) 18 Ω

(ii)



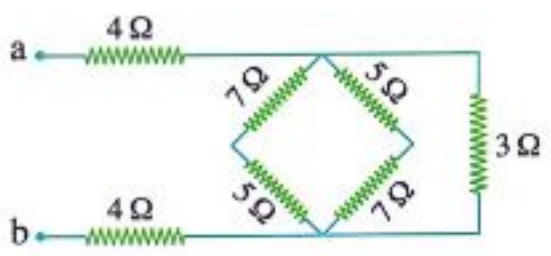
(a) 1 Ω (b) 1.5 Ω
(c) 2 Ω (d) 2.5 Ω

(iii)



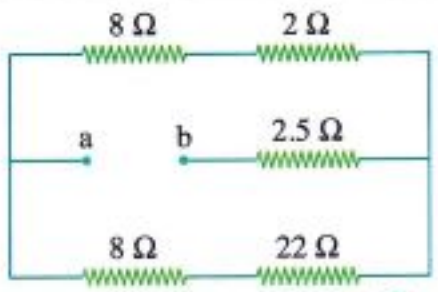
(a) 15 Ω (b) 21 Ω
(c) 24 Ω (d) 30 Ω

(iv)



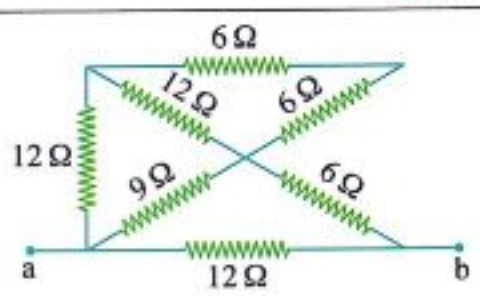
(a) 5 Ω (b) 10 Ω
(c) 15 Ω (d) 20 Ω

(v)



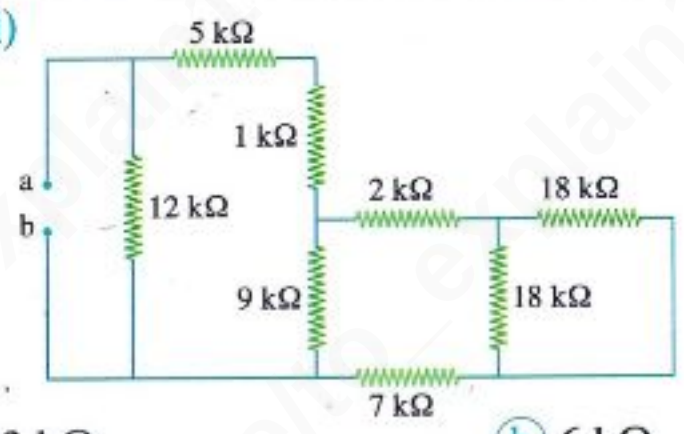
(a) 2.5 Ω (b) 5 Ω
(c) 7.5 Ω (d) 10 Ω

(vi)



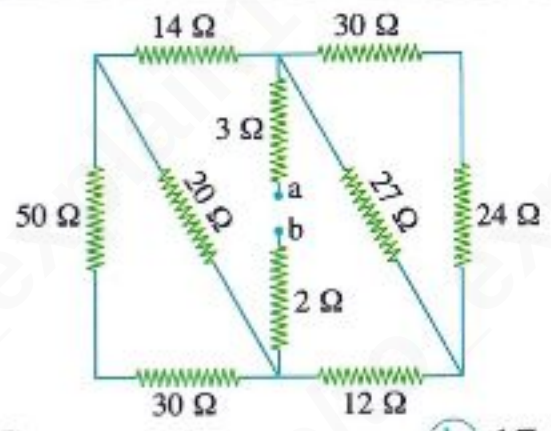
(a) 2 Ω (b) 4 Ω
(c) 6 Ω (d) 8 Ω

(vii)



(a) 3 kΩ (b) 6 kΩ
(c) 9 kΩ (d) 12 kΩ

(viii)



(a) 13 Ω (b) 17 Ω
(c) 20 Ω (d) 25 Ω

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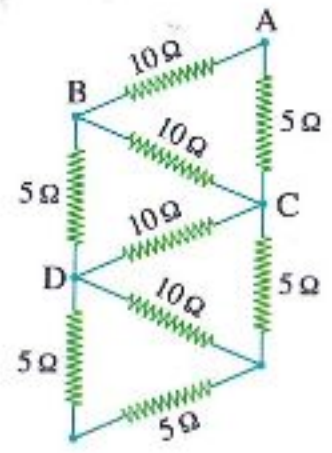
7 The equivalent resistance for the opposite electric circuit when connecting an electric source to the circuit between the points:



(i) A and B equals ..... .

(a) 20 Ω (b) 17 Ω

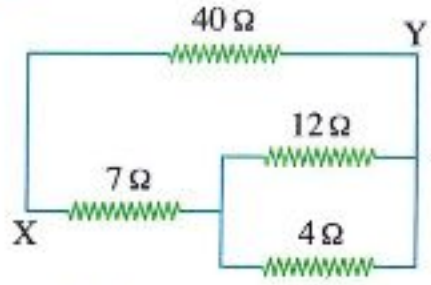
(c) 9 Ω (d) 5 Ω

(ii) B and C equals ..... .

(a) 1.25 Ω (b) 2.5 Ω (c) 3.75 Ω (d) 6.3 Ω

---

8 In the opposite figure:



(i) The equivalent resistance when a battery of negligible internal resistance is connected between X and Y is ..... .

(a) 2 Ω (b) 4 Ω (c) 6 Ω (d) 8 Ω

(ii) If a battery is connected instead of the 7 Ω resistor, the equivalent resistance of the circuit becomes ..... .

(a) 40 Ω (b) 41 Ω (c) 42 Ω (d) 43 Ω

---

9 Three resistors (x), (y) and (z) are connected together with a battery and a variable resistor (S) as shown in figure (1). Figure (2) graphically represents the relation between the potential difference (V) across each of the three resistors and the current intensity (I) flowing through each of them:

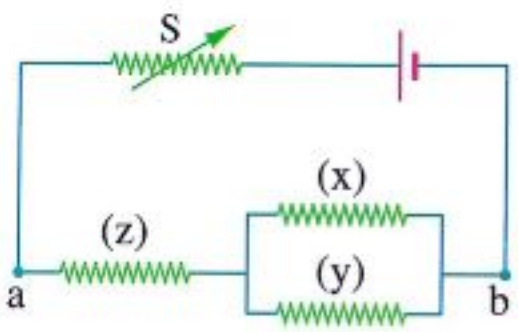


Figure (1)

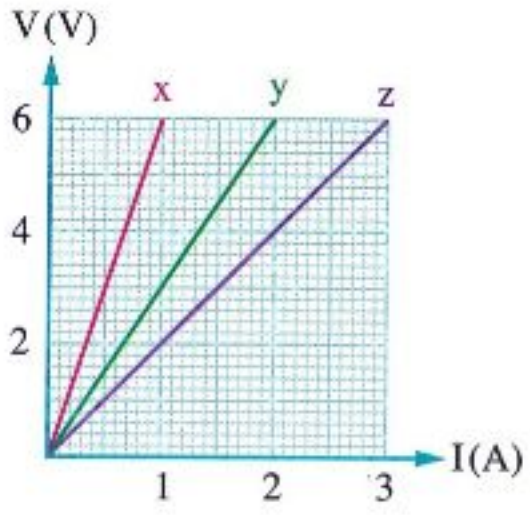


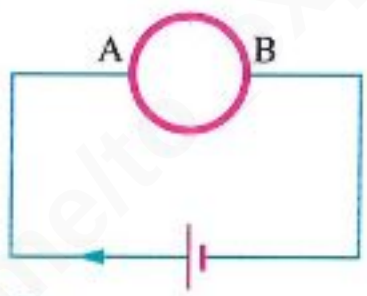
Figure (2)

Then the equivalent resistance between points (a) and (b) shown in figure (1) is equal to ..... .

(a) 1 Ω (b) 3 Ω (c) 4 Ω (d) 11 Ω

---

10 A wire of resistance 48 Ω is reshaped as a closed circular ring, then a battery is connected between two points on the circumference of the ring and along its diameter as in the figure. The equivalent resistance between points A, B is ..... .



(a) 96 Ω (b) 48 Ω (c) 24 Ω (d) 12 Ω

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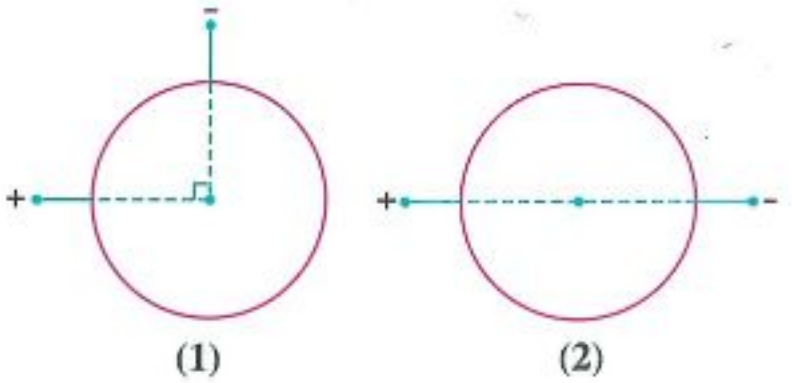
11 A straight wire of resistance R is wrapped in the form of a circular ring then connected in two different methods to an electric source as in the opposite figures (1) and (2), so the ratio between the equivalent resistance in the two figures $\left(\frac{R_1}{R_2}\right)$ equals ..... .



(a) $\frac{3}{4}$ (b) $\frac{4}{3}$ (c) $\frac{2}{1}$ (d) $\frac{1}{2}$

---

12 ✱ A wire of uniform cross-section carries a current of intensity 0.1 A when the potential difference between its terminals becomes 1.2 V. If the wire is bent into the shape of a square of consecutive vertices abcd, so the equivalent resistance of the wire if:

(i) the terminals of the source are connected to points a and c equals ..... .

(a) 2 Ω (b) 3 Ω (c) 4 Ω (d) 6 Ω

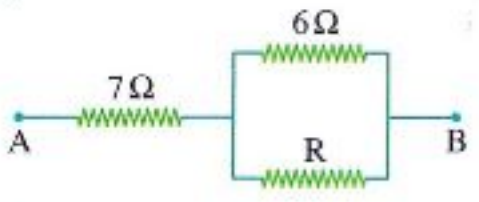
(ii) the terminals of the source are connected to points a and d equals ..... .

(a) 6 Ω (b) 4.5 Ω (c) 2.25 Ω (d) 1.5 Ω

---

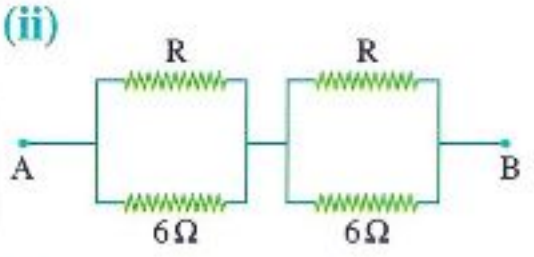
13 Each of the following figures illustrates a section of an electrical circuit in which the equivalent resistance between points A and B is equal to 9 Ω. So, what is the value of R in each of them?

(i)



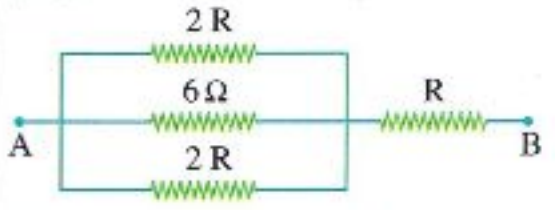
(a) 1 Ω (b) 2 Ω
(c) 3 Ω (d) 6 Ω

(ii)



(a) 4 Ω (b) 6 Ω
(c) 12 Ω (d) 18 Ω

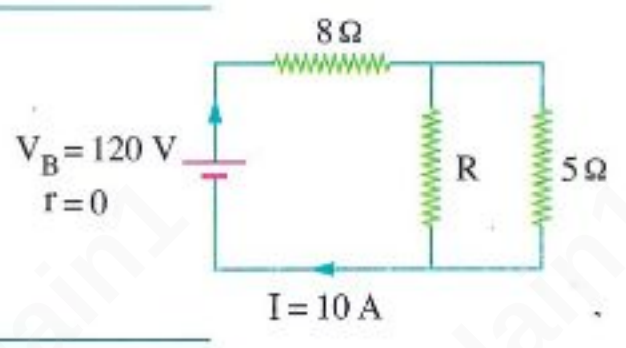
(iii)



(a) 8 Ω (b) 6 Ω
(c) 5 Ω (d) 3 Ω

---

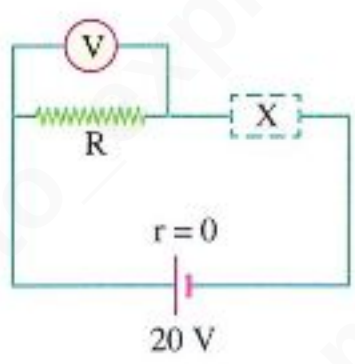
14 In the electric circuit shown in the figure, the value of R equals ..... .



(a) 20 Ω (b) 40 Ω
(c) 60 Ω (d) 80 Ω

---

15 The opposite figure represents a closed electric circuit in which there is an unknown component X, if the reading of the voltmeter is 5 V, the component X is represented by the form ..... .



(a) R (b) 2 R
(c) 3 R (d) 4 R

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16 ✱ A number of resistors (N), each of 40 ohms, are connected together either in series or in parallel with an electric source of potential difference 120 V, so an electric current of intensity 15 amperes passes through the circuit, so the number of resistors (N) equals ..... .

(a) 3 (b) 4 (c) 5 (d) 6

17 ✱ An electric circuit in a house consists of an electric source that has a terminal potential difference of 110 V, a fuse whose wire can't withstand a current greater than 5 A and other components of equivalent resistance that equals 2 Ω. What is the maximum number of similar lamps that each has a resistance of 620 Ω, where they can be turned on at the same time without damaging the fuse wire?

(a) 10 (b) 27 (c) 31 (d) 40

18 A number of equal resistors are connected in series, so their equivalent resistance was 100 Ω and when they are connected in parallel, their equivalent resistance becomes 4 Ω, then the resistance of each resistor of them is ..... .

(a) 20 Ω (b) 25 Ω (c) 100 Ω (d) 104 Ω

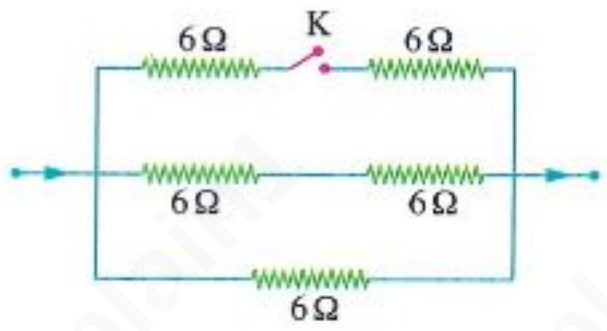
19 ✱ When two resistors R_1 and R_2 are connected in parallel, their equivalent resistance equals 6 Ω and when they are connected in series, their equivalent resistance equals 27 Ω, so the value of one of them is ..... .

(a) 8 Ω (b) 12 Ω (c) 15 Ω (d) 18 Ω

20 A set of n identical resistors are connected in series so that their equivalent resistance equals R_1 and when the same set of resistors are connected in parallel, their equivalent resistance equals R_2. The number of resistors (n) is equal to ..... .

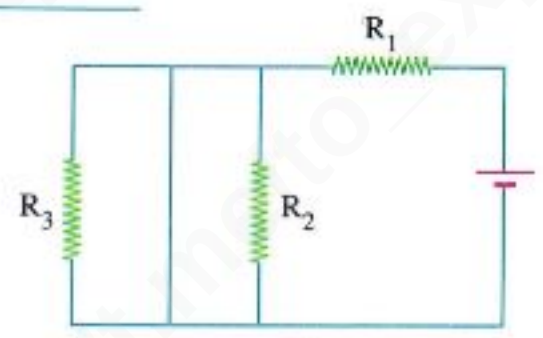
(a) $\frac{R_1}{R_2}$ (b) $\left(\frac{R_1}{R_2}\right)^2$ (c) $\sqrt{\frac{R_1}{R_2}}$ (d) $\sqrt{\frac{R_2}{R_1}}$

21 In the opposite electric circuit, the difference between the equivalent resistance of the circuit in the cases of opening and closing the switch (K) equals ..... .



(a) 1 Ω (b) 2 Ω
(c) 4 Ω (d) 6 Ω

22 From the opposite circuit, through which resistor does an electric current pass?

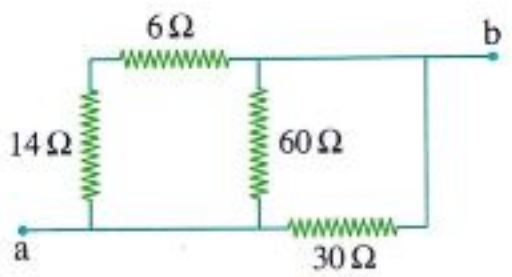


(a) R_1 only (b) R_1, R_2
(c) R_1, R_3 (d) R_1, R_2, R_3

https://t.me/to_explain1

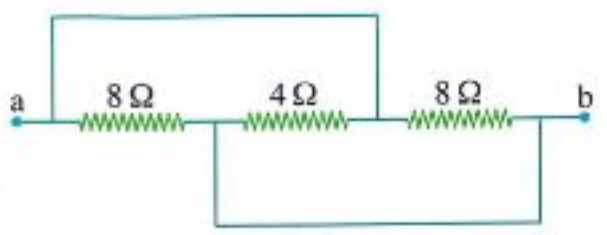
23 What is the equivalent resistance between points a and b in each of the following cases?

(i)



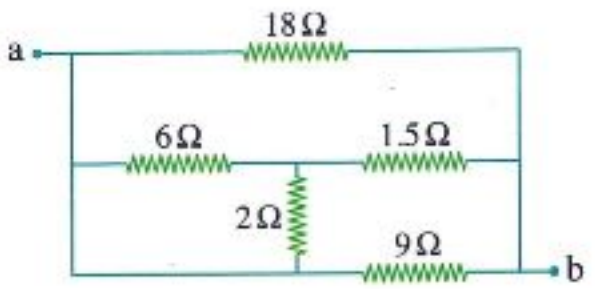
(a) 5 Ω (b) 10 Ω
(c) 30 Ω (d) 60 Ω

(ii)



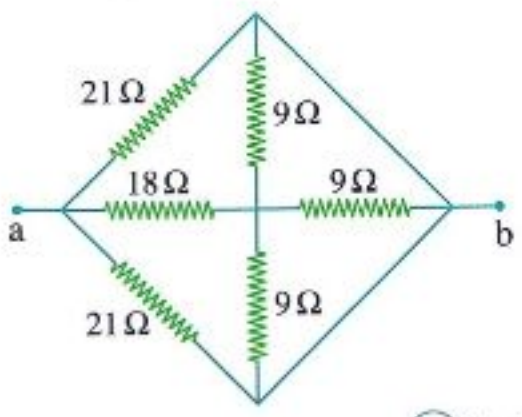
(a) 1 Ω (b) 2 Ω
(c) 3 Ω (d) 4 Ω

(iii)



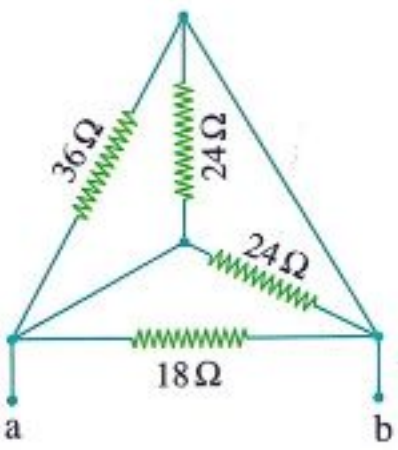
(a) 9 Ω (b) 6 Ω
(c) 3 Ω (d) 2 Ω

(iv)



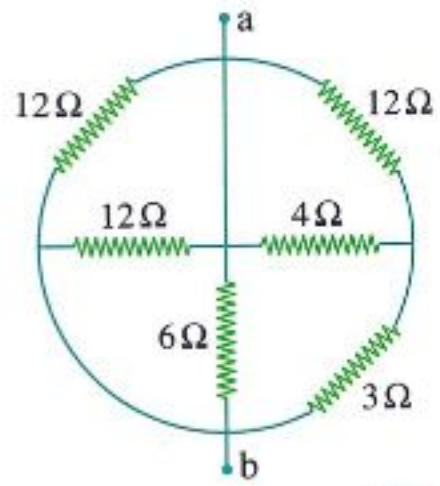
(a) 3 Ω (b) 7 Ω
(c) 9 Ω (d) 11 Ω

(v)



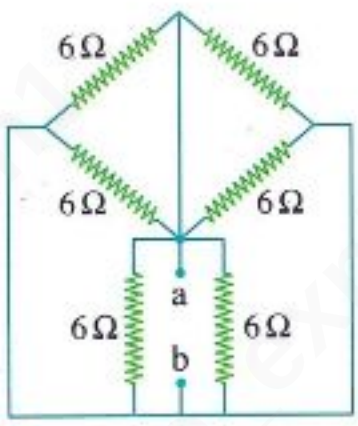
(a) 3 Ω (b) 5 Ω
(c) 6 Ω (d) 8 Ω

(vi)



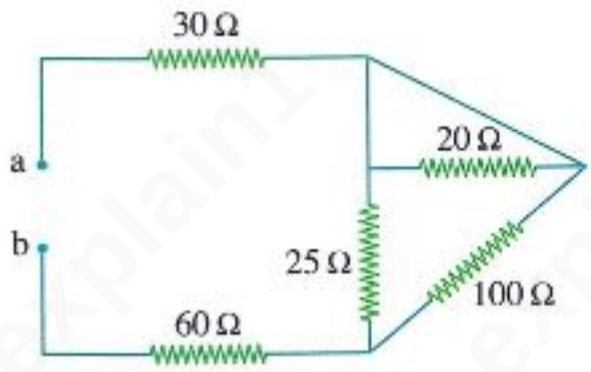
(a) 1 Ω (b) 1.5 Ω
(c) 2 Ω (d) 2.5 Ω

(vii)



(a) 1 Ω (b) 3 Ω
(c) 6 Ω (d) 12 Ω

(viii)



(a) 45 Ω (b) 72 Ω
(c) 90 Ω (d) 110 Ω

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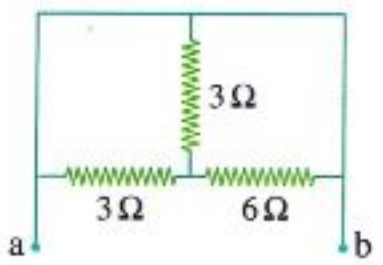
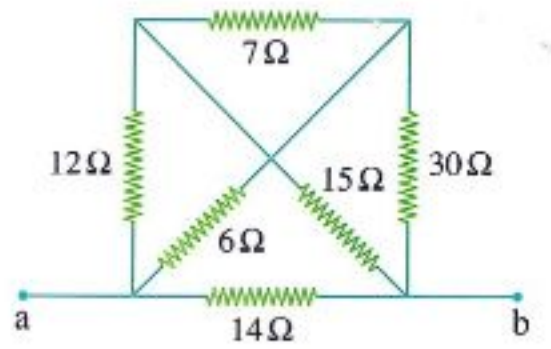
(ix)



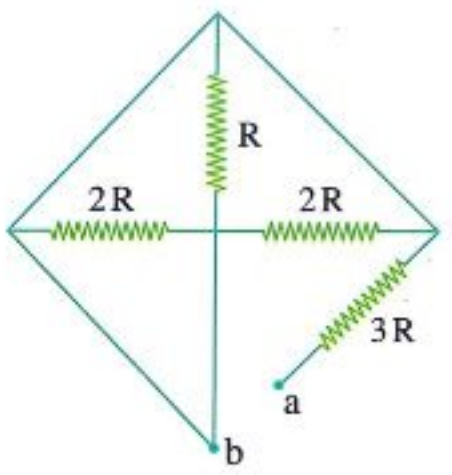
(a) 0 Ω (b) 1 Ω
(c) 5 Ω (d) 2 Ω

(x)



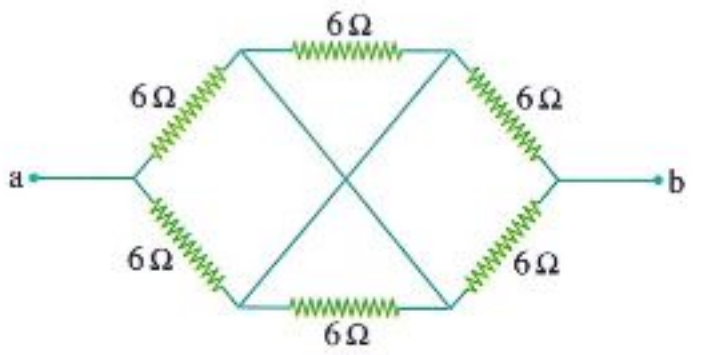
(a) 4 Ω (b) 7 Ω
(c) 14 Ω (d) 15 Ω

(xi)



(a) R (b) 2 R
(c) 3 R (d) 6 R

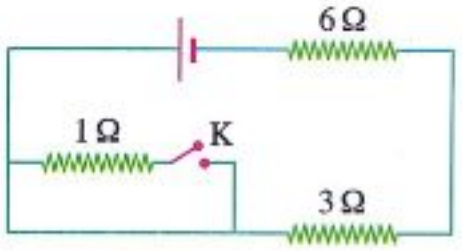
(xii)



(a) 18 Ω (b) 12 Ω
(c) 9 Ω (d) 6 Ω

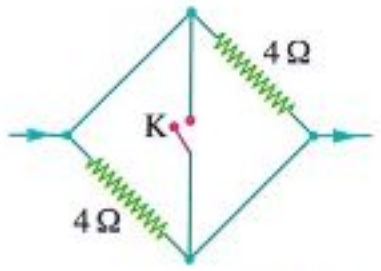
24 What is the equivalent resistance before and after closing the switch K respectively in each of the following cases?

(i)



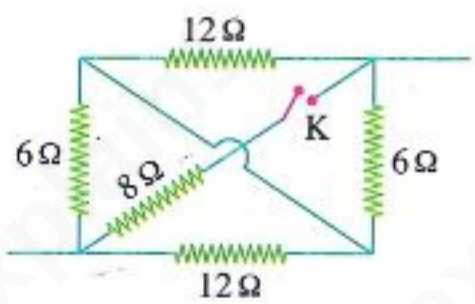
(a) 9 Ω, 10 Ω (b) 9 Ω, 9 Ω
(c) 6 Ω, 3 Ω (d) 6 Ω, 6 Ω

(ii)



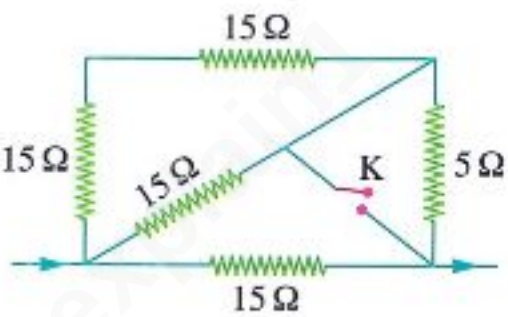
(a) 0, 2 Ω (b) 2 Ω, 0
(c) 8 Ω, 0 (d) 4 Ω, 0

(iii)



(a) 8 Ω, 2 Ω (b) 9 Ω, 4 Ω
(c) 8 Ω, 4 Ω (d) 36 Ω, 6 Ω

(iv)



(a) 7.5 Ω, 6 Ω (b) 3 Ω, 6 Ω
(c) 15 Ω, 7.5 Ω (d) 7.5 Ω, 3.5 Ω

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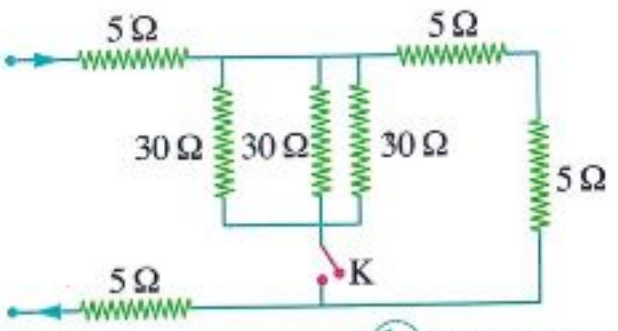
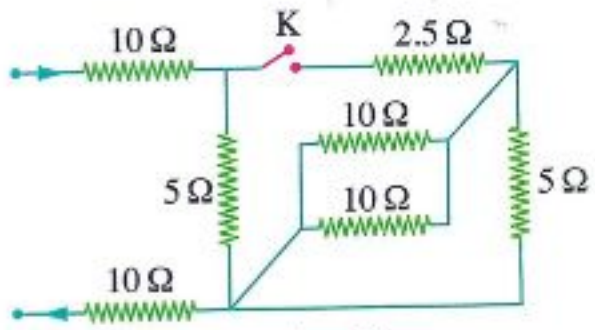
(v)



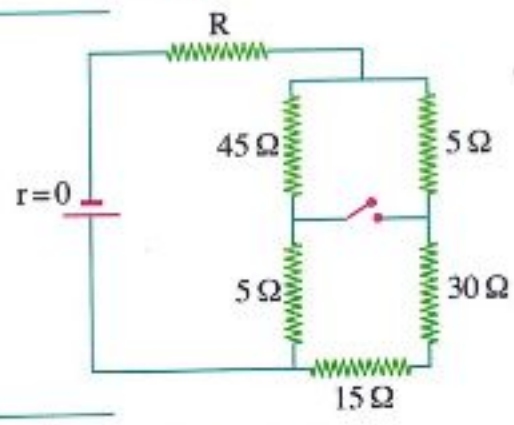
(a) 10 Ω, 20 Ω (b) 15 Ω, 20 Ω
(c) 20 Ω, 15 Ω (d) 20 Ω, 10 Ω

(vi)



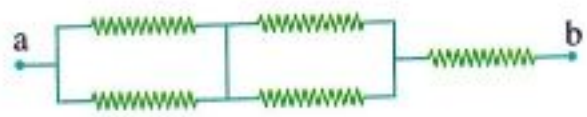
(a) 10 Ω, 22.5 Ω (b) 25 Ω, 22.5 Ω
(c) 25 Ω, 7.5 Ω (d) 30 Ω, 15 Ω

25 ✱ In the opposite circuit, when the switch is closed, the equivalent resistance of the circuit decreases to half its initial value, hence the resistance of R equals ..... .

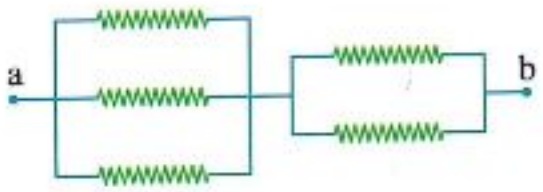


(a) 3 Ω (b) 5 Ω
(c) 7 Ω (d) 11 Ω

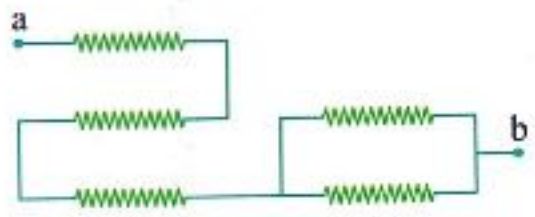
26 Five identical resistors are connected together as shown in the opposite figure so that their equivalent resistance is found to be R_o. If the five resistors are reconnected in different ways, which of the following connection ways would make the equivalent resistance of the group equal to $\frac{1}{2} R_o$?



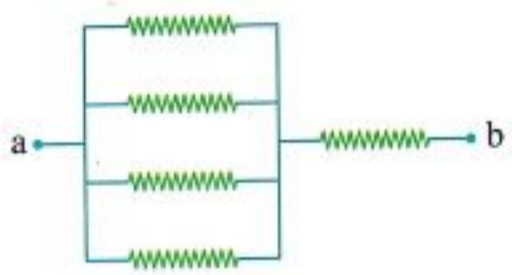
(a)



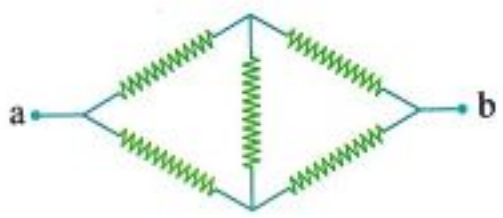
(b)



(c)

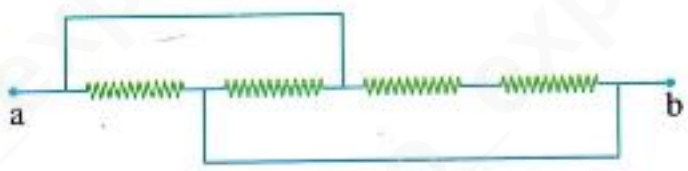


(d)

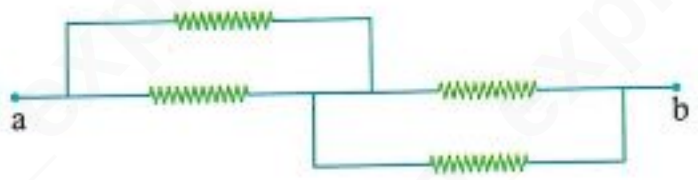


27 ✱ Four identical resistors are connected in different ways as shown in the following figures. In which of these figures is the equivalent resistance between points a and b the largest?

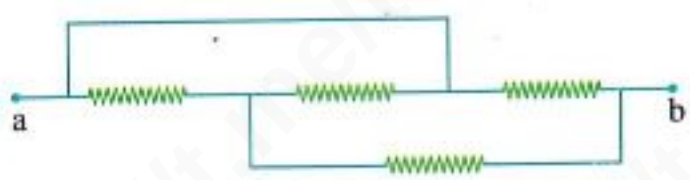
(a)



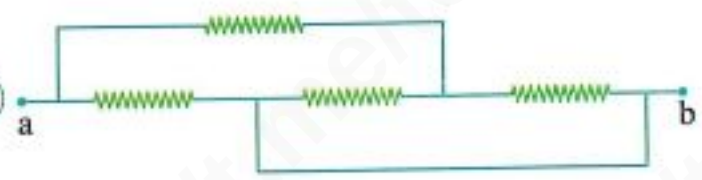
(b)



(c)



(d)



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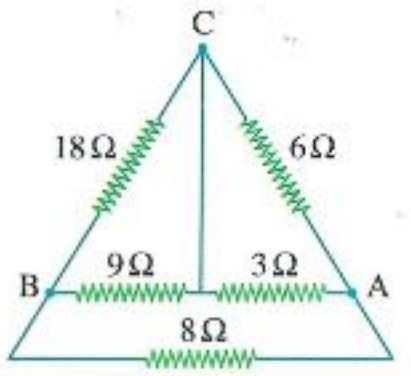
28 The equivalent resistance of the set of resistors shown in the opposite figure when the electric source is connected between:



(i) points A and B equals ..... .

(a) 2 Ω (b) 4 Ω

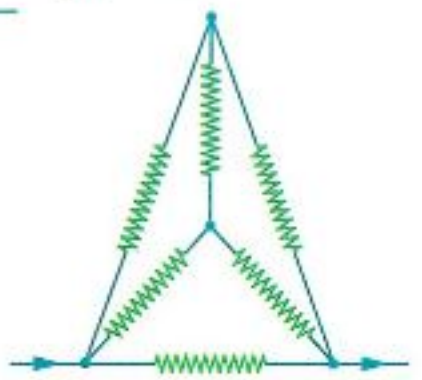
(c) 6 Ω (d) 8 Ω

(ii) points C and B equals ..... .

(a) 3.75 Ω (b) 6 Ω (c) 7.5 Ω (d) 10 Ω

---

29 * In the electric circuit shown in the figure, if the resistance of each resistor = R, the equivalent resistance of the circuit = ...

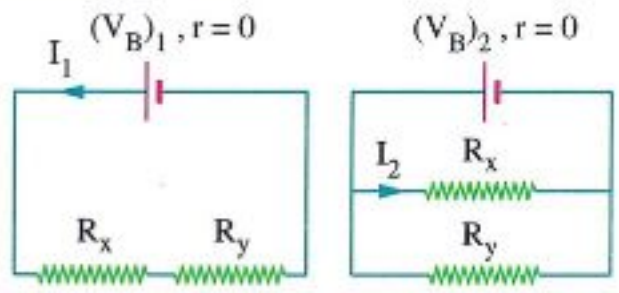


(a) 6 R (b) 3 R

(c) $\frac{R}{2}$ (d) $\frac{R}{6}$

---

30 In the two opposite electric circuits, the current intensities I_1 and I_2 are equal, so the ratio between the two electromotive forces of the two batteries $\left(\frac{(V_B)_1}{(V_B)_2}\right)$ is equal to ..... .



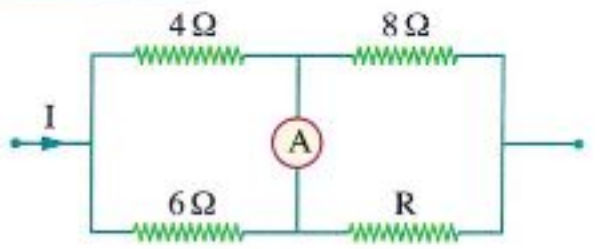
Circuit (1) Circuit (2)

(a) $\frac{R_y}{R_x}$ (b) $\frac{R_x}{R_y}$

(c) $\frac{R_x + R_y}{R_y}$ (d) $\frac{R_x + R_y}{R_x}$

---

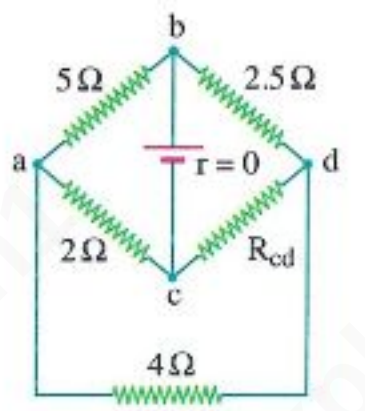
31 * The opposite figure represents a part of an electric circuit, if the ammeter reading equals zero, the resistance of resistor R equals ..... .



(a) 8 Ω (b) 9 Ω (c) 12 Ω (d) 24 Ω

---

32 In the opposite electric circuit, what is the value of resistance R_{cd} if the potential difference across the 4 Ω resistance is zero?

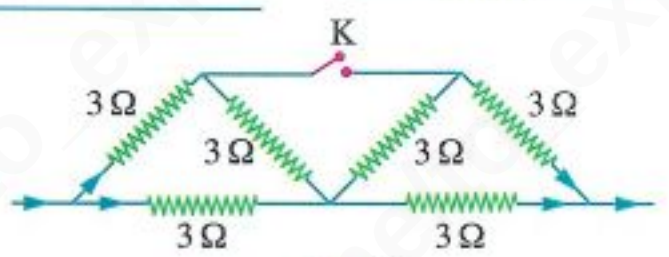


(a) 0.5 Ω (b) 1 Ω

(c) 2 Ω (d) 4 Ω

---

33 In the opposite electric circuit, the ratio between the equivalent resistance of the circuit in the cases of opening and closing the switch (K) equals ..... .



(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{4}{3}$ (d) $\frac{5}{2}$

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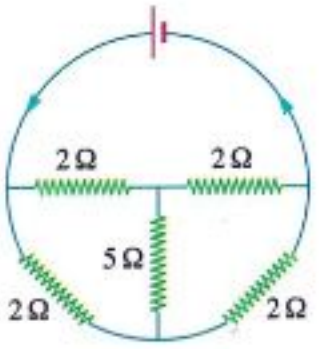
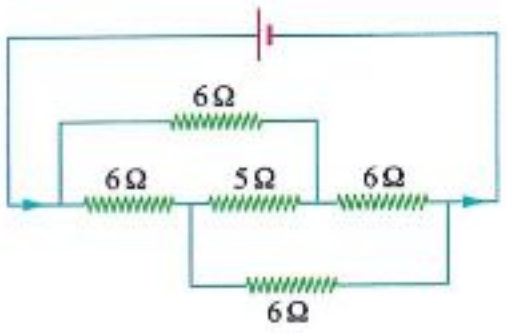
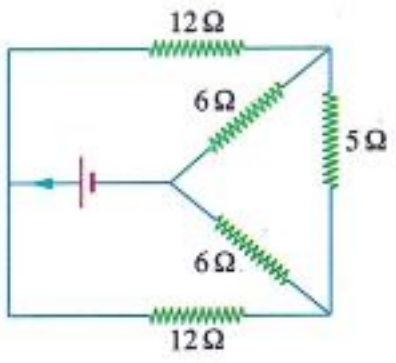
34 The following figures represent four electric circuits. So, the circuits in which the resistor of the value 5 Ω carries no current are ..... .



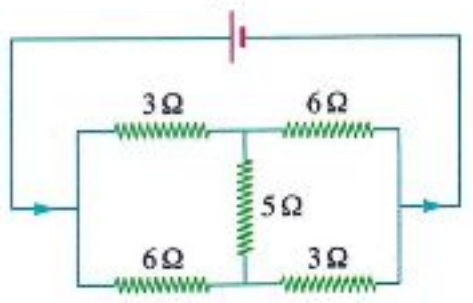
(1)



(2)



(3)



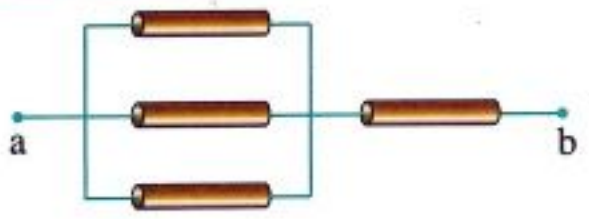
(4)

ⓐ (1) and (2) only ⓑ (3) and (4) only

ⓒ (1), (2) and (3) only ⓓ (2), (3) and (4) only

---

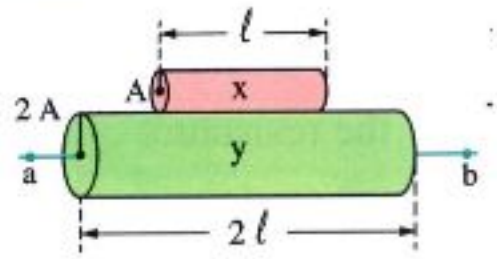
35 A metal wire of uniform cross-section and electrical resistance R was divided into four identical parts, and these parts were connected together as shown in the opposite figure, so the equivalent resistance of the group between points (a) and (b) equals ..... .



ⓐ $\frac{R}{12}$ ⓑ $\frac{R}{6}$ ⓒ $\frac{R}{4}$ ⓓ $\frac{R}{3}$

---

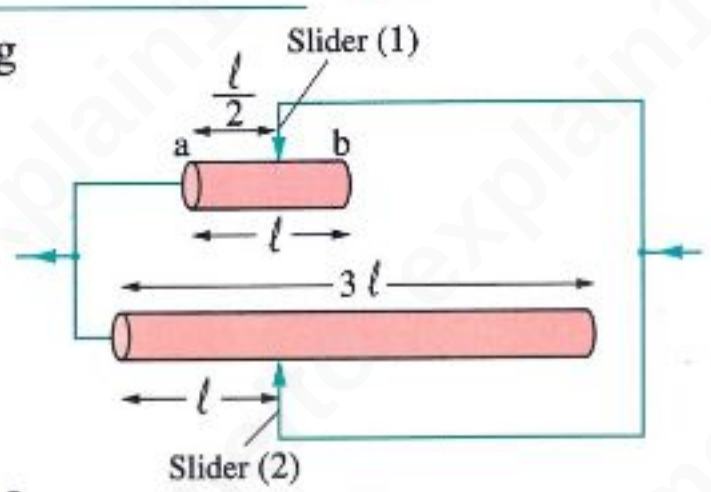
36 Two non-insulated conductors x and y of uniform cross-section, have lengths of ℓ and 2ℓ, cross-sectional areas of A and 2A, and electrical conductivities 8 σ and σ respectively. The conductors are placed in perfect contact as shown in the opposite figure, so if the electrical resistance of conductor x is 5 Ω, the equivalent resistance of them when connecting an electrical source between points a and b is equal to ..... .



ⓐ 7.5 Ω ⓑ 14 Ω ⓒ 20 Ω ⓓ 24 Ω

---

37 Two conductors are made of the same material having uniform cross-sections of the same cross-sectional area. They are connected together using two sliders (1) and (2) in an electric circuit as shown in the opposite figure so that their equivalent resistance equals R. Then, when moving slider (1) to position (b), the equivalent resistance becomes ..... .



ⓐ $\frac{R}{2}$ ⓑ $\frac{2}{3}R$ ⓒ $\frac{3}{2}R$ ⓓ 2 R

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38 ✻ In figure (1), a wire of uniform cross-section has length (ℓ) and resistance (R). If it is cut into two halves and one of the halves is drawn and then the two halves are reconnected together so that the total length of the wire becomes (3ℓ) as shown in figure (2). Then the total resistance of the wire in figure (2) is equal to ..... .

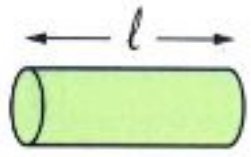


Figure (1)

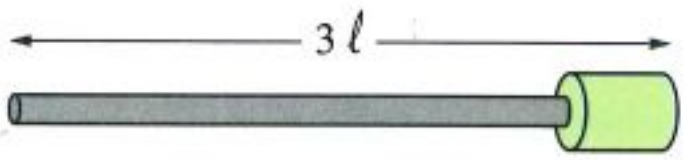
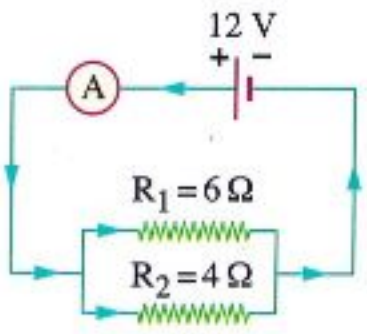


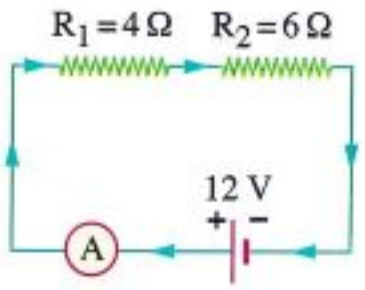
Figure (2)

(a) 12.5 R (b) 13 R (c) 25 R (d) 25.5 R

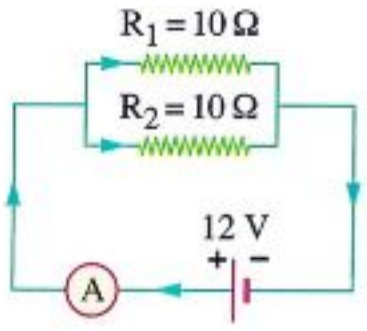
39 In which of the following electric circuits the intensity of the electric current which passes in one of the two resistors differs from the other resistor?



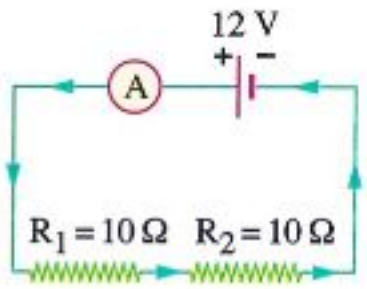
(a)



(b)

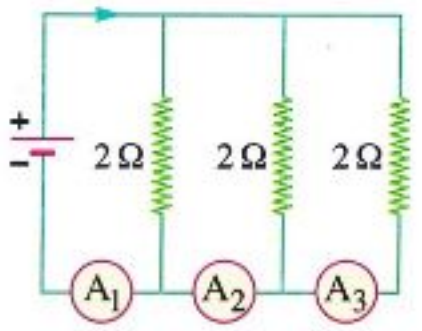


(c)



(d)

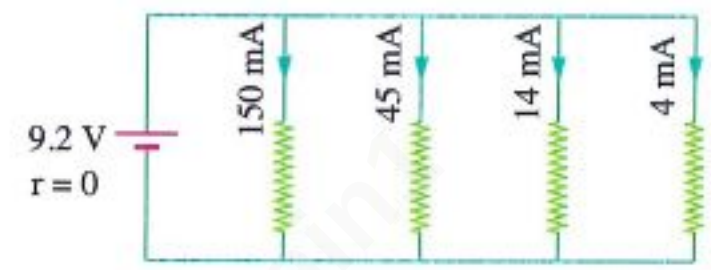
40 In the electric circuit shown in the figure, if the reading of the ammeter A_1 equals 1.2 A, the reading of the ammeter A_2 equals ..... .



(a) 0.2 A (b) 0.4 A

(c) 0.6 A (d) 0.8 A

41 Four resistors are connected in parallel to a battery of emf 9.2 V, hence the current intensities through them are 4 mA, 14 mA, 45 mA and 150 mA as shown in the opposite circuit, so:



(i) The total resistance of the circuit equals ..... .

(a) 9.71 Ω (b) 13.35 Ω (c) 29.53 Ω (d) 43.19 Ω

(ii) If the largest resistance is replaced with another of double its value, the total current intensity through the battery, will equal ..... .

(a) 105.5 mA (b) 211 mA (c) 422 mA (d) 633 mA

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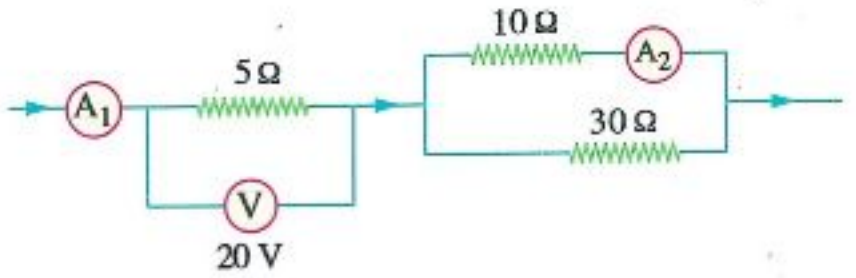
42 In the electric circuit shown in the figure:



(i) The reading of ammeter A_1 equals ..... .

(a) 2 A (b) 4 A

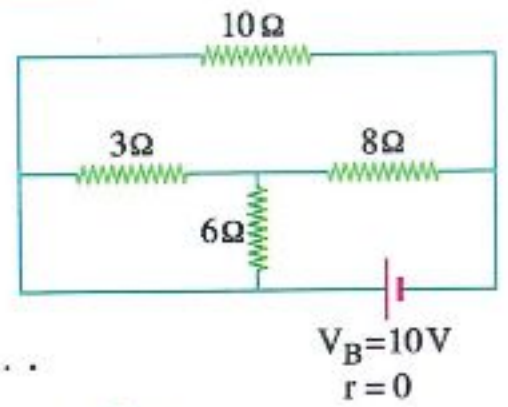
(c) 6 A (d) 8 A

(ii) The reading of ammeter A_2 equals ..... .

(a) 1 A (b) 2 A (c) 3 A (d) 4 A

---

43 ✳ In the opposite circuit:



(i) The equivalent resistance of the circuit equals ..... .

(a) 5 Ω (b) 9 Ω

(c) 11 Ω (d) 13 Ω

(ii) The total current intensity passing in the circuit equals ..... .

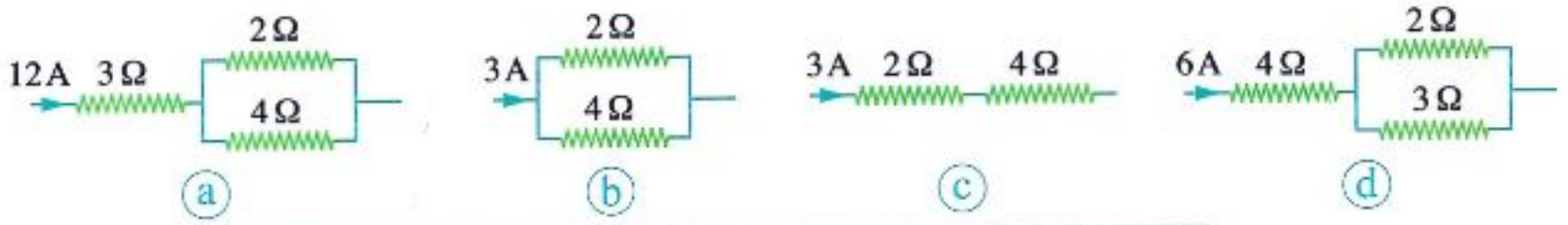
(a) 0.5 A (b) 2 A (c) 3.5 A (d) 4 A

(iii) The current intensity passing through the 6 Ω resistor equals ..... .

(a) 0.13 A (b) 0.91 A (c) 0.33 A (d) 0.45 A

---

44 In which of the following figures, the potential difference across the 4 Ω resistor equals 4 V?



(a) (b) (c) (d)

---

45 In the opposite electric circuit, the ratio of $\left(\frac{I_1}{I}\right)$ equals ..... .

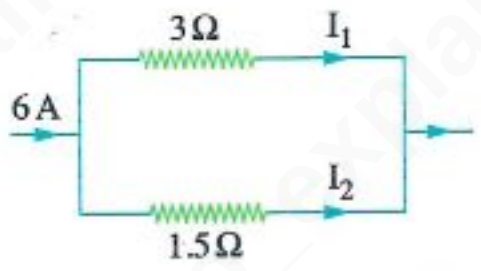
(a) $\frac{1}{2}$ (b) $\frac{1}{3}$

(c) $\frac{1}{4}$ (d) $\frac{1}{6}$

---

46 Each of the following figures represents section of electric circuit. What are the intensities of currents I_1 and I_2 respectively?

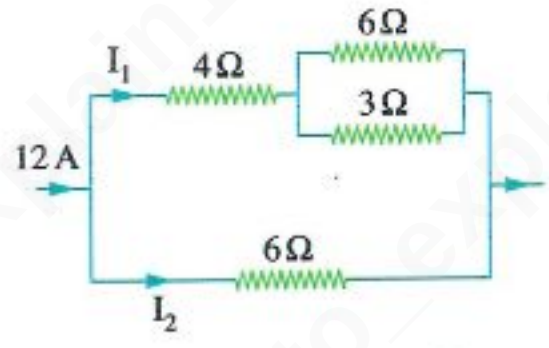
(i)



(a) 1 A, 5 A (b) 2 A, 4 A

(c) 4 A, 2 A (d) 5 A, 1 A

(ii)



(a) 3 A, 6 A (b) 3 A, 9 A

(c) 6 A, 6 A (d) 6 A, 9 A

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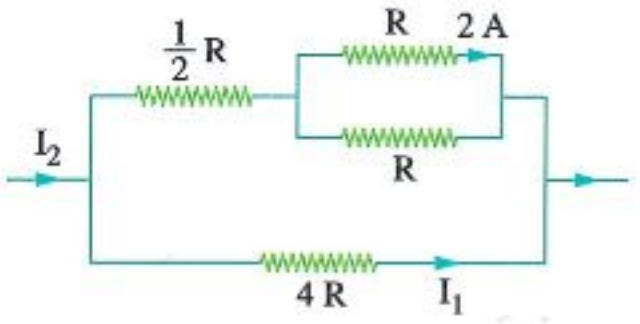
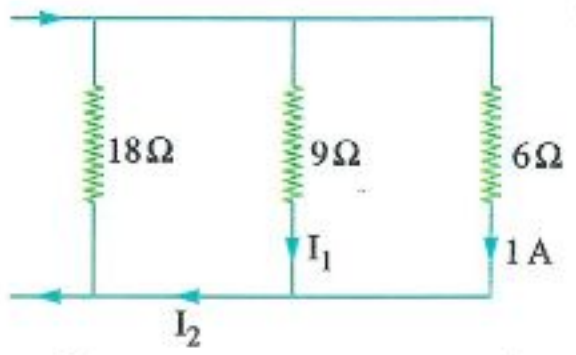
(iii)



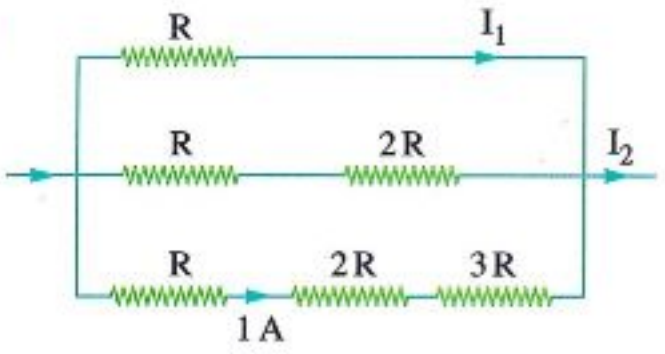
(a) 4 A, 6 A
(b) 4 A, 3 A
(c) 1 A, 4 A
(d) 1 A, 5 A

(iv)



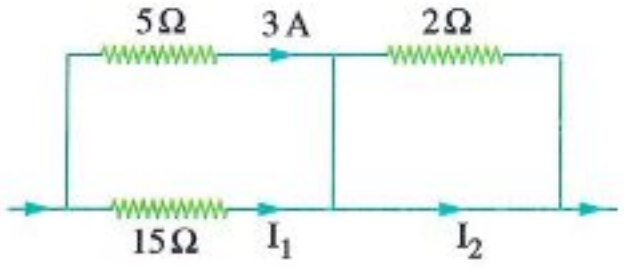
(a) $\frac{1}{2}$ A, $\frac{3}{2}$ A
(b) $\frac{1}{2}$ A, $\frac{5}{3}$ A
(c) $\frac{2}{3}$ A, $\frac{5}{3}$ A
(d) $\frac{2}{3}$ A, $\frac{1}{2}$ A

(v)



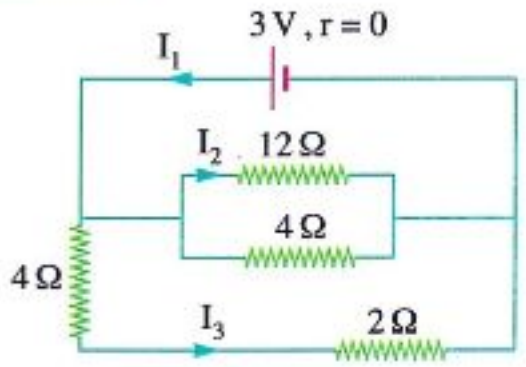
(a) 6 A, 5 A
(b) 6 A, 9 A
(c) 12 A, 5 A
(d) 12 A, 9 A

(vi)



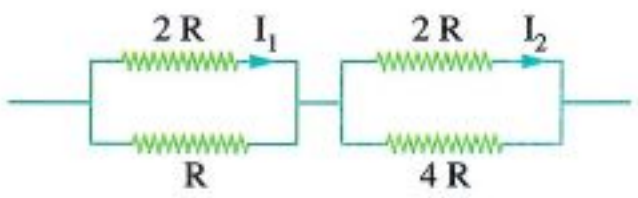
(a) 0.5 A, 2 A
(b) 1 A, 2 A
(c) 0.5 A, 4 A
(d) 1 A, 4 A

47 In the opposite electric circuit, the ratio of $\left(\frac{I_2}{I_3}\right)$ equals ..... .



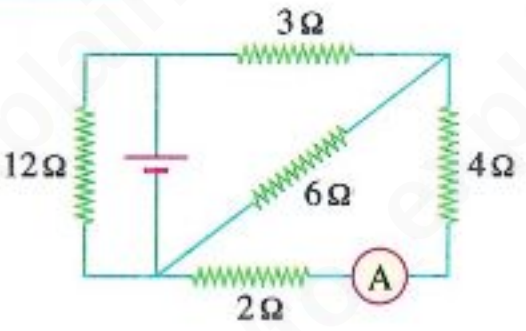
(a) $\frac{1}{4}$
(b) $\frac{1}{3}$
(c) $\frac{1}{2}$
(d) $\frac{3}{4}$

48 The opposite figure represents a part of an electric circuit, then the ratio between the two currents $\left(\frac{I_1}{I_2}\right)$ equals ..... .



(a) $\frac{1}{1}$
(b) $\frac{2}{1}$
(c) $\frac{1}{2}$
(d) $\frac{1}{4}$

49 In the opposite figure, if the ammeter reading is 1 A, then the electric current intensity through the 12 Ω resistor equals ..... .



(a) 0.5 A
(b) 1 A
(c) 1.5 A
(d) 2 A

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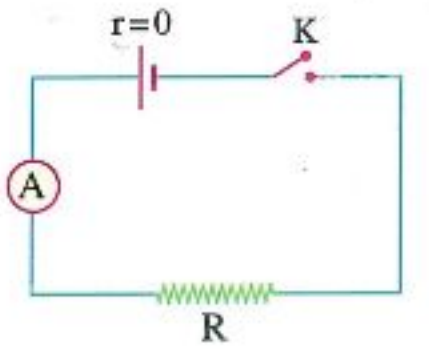
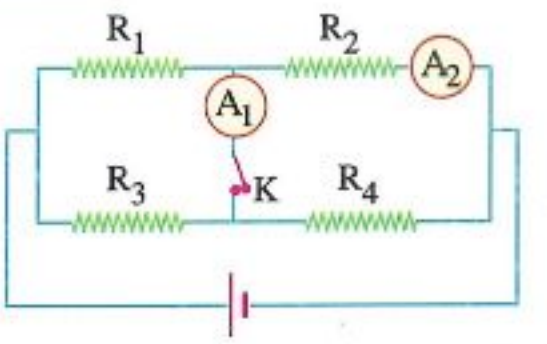
50 In the opposite simple electric circuit, the ammeter reads 5 A when the switch (K) is closed but when a 2 Ω resistor is connected in series with resistor R in this circuit, the ammeter reading gets decreased to 4 A. So, the value of the resistor R is ..... .



(a) 4 Ω (b) 8 Ω (c) 12 Ω (d) 16 Ω

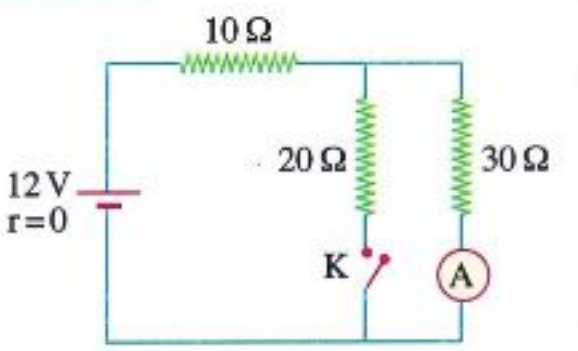
51 In the opposite circuit if the reading of the ammeter A_1 equals zero, then when the switch K is opened the reading of the ammeter A_2 ..... .



(a) increases (b) decreases

(c) remains unchanged (d) becomes zero

52 ✳ From the opposite circuit:



(i) What is the reading of the ammeter when the switch K is open?

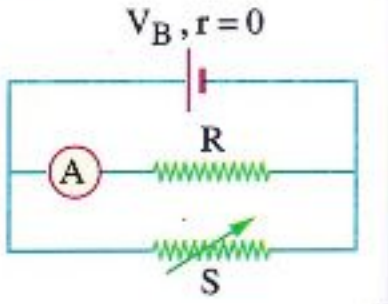
(a) 0.21 A (b) 0.3 A

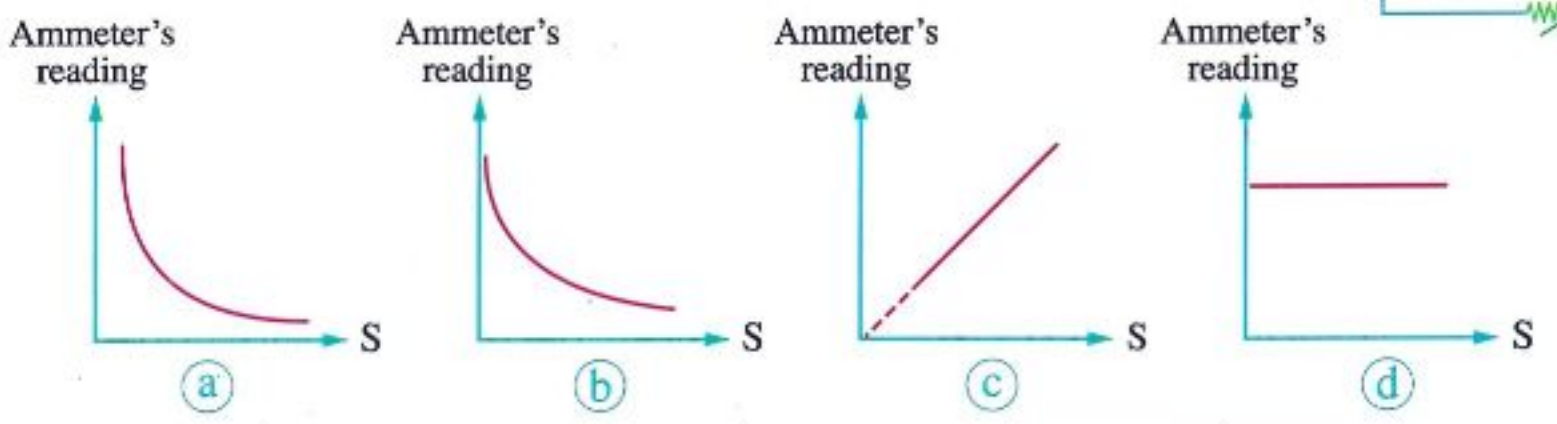
(c) 0.43 A (d) 1.6 A

(ii) What is the reading of the ammeter when the switch K is closed?

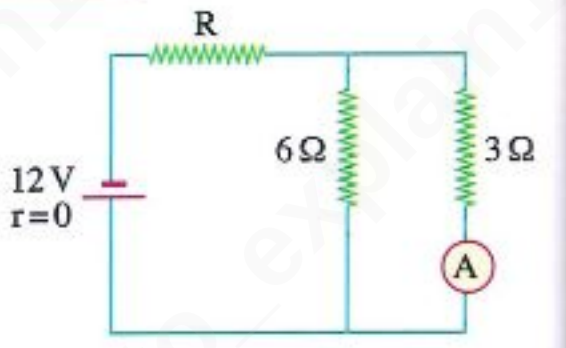
(a) 5.4 A (b) 1.52 A (c) 0.34 A (d) 0.22 A

53 Which of the following graphs represents the relation between the ammeter's reading and the value of variable resistance S?





54 ✳ If the ammeter reading in the opposite circuit is 2 A, so:



(i) The current intensity that passes in the circuit equals ..... .

(a) 6 A (b) 9 A

(c) 5 A (d) 3 A

(ii) The resistance of R equals ..... .

(a) 4 Ω (b) 2 Ω (c) 1 Ω (d) 0.5 Ω

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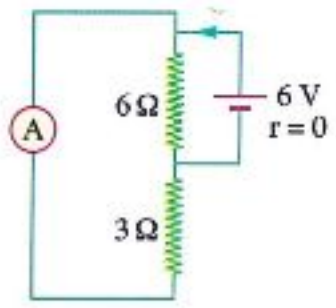
55 In the opposite electric circuit, the reading of the ammeter (A) equals ..... .



(a) 1 A (b) 2 A

(c) 3 A (d) 4 A

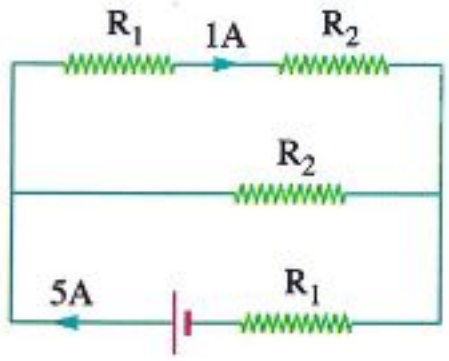
---

56 ✱ Three resistors of 1 Ω, 3 Ω and 6 Ω are connected to an electric source where the electric current intensity through them are 0.3 A, 0.2 A, 0.1 A respectively, so the equivalent resistance of the circuit equals ..... .

(a) 1 Ω (b) 2 Ω (c) 3 Ω (d) 4 Ω

---

57 In the opposite circuit, the ratio $\left(\frac{R_1}{R_2}\right)$ is ..... .

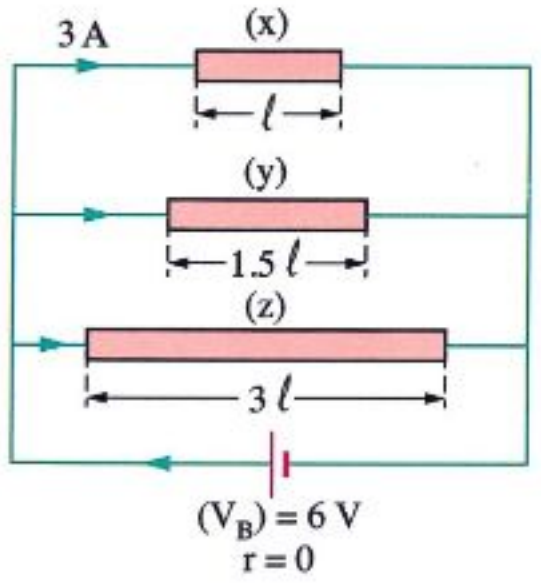


(a) $\frac{3}{2}$ (b) $\frac{3}{1}$

(c) $\frac{4}{1}$ (d) $\frac{4}{3}$

---

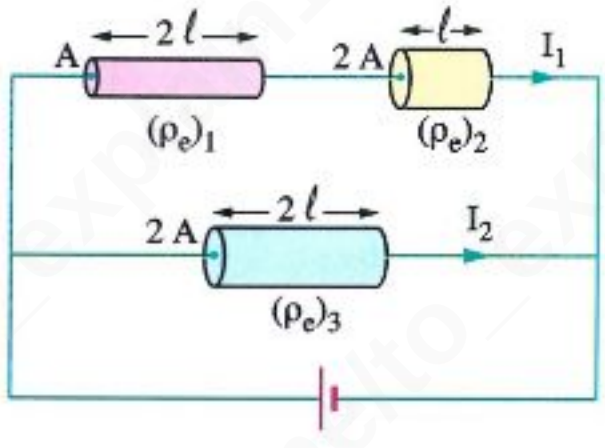
58 Three conductors (x), (y) and (z) made of the same metal and having equal cross-sectional areas but different lengths are connected together in parallel and then to a battery with an electromotive force of 6 V and negligible internal resistance, as shown in the opposite circuit. If the current flowing through conductor (x) is 3A, then the current flowing through the circuit if the conductors are connected in series and then to the same battery is equal to ..... .



(a) $\frac{2}{11}$ A (b) $\frac{3}{11}$ A (c) $\frac{6}{11}$ A (d) $\frac{9}{11}$ A

---

59 In the opposite electric circuit, if $I_1 = I_2$, then .....



(a) $(\rho_e)_3 = (\rho_e)_1 + (\rho_e)_2$

(b) $(\rho_e)_3 = (\rho_e)_1 + 2\,(\rho_e)_2$

(c) $(\rho_e)_3 = 2\,(\rho_e)_1 + \frac{(\rho_e)_2}{2}$

(d) $(\rho_e)_3 = \sqrt{(\rho_e)_1 + (\rho_e)_2}$

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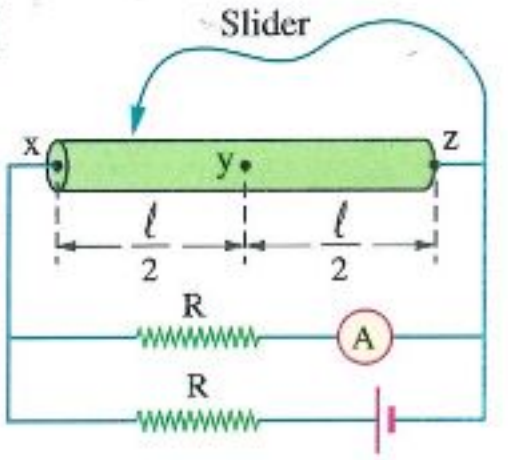
60 A metal rod (xyz) of uniform cross-section, length ℓ and electrical resistance R is connected in an electrical circuit as shown in the opposite figure. At which position on the rod should the slider be placed to get the largest possible ammeter reading?



(a) At position (x)

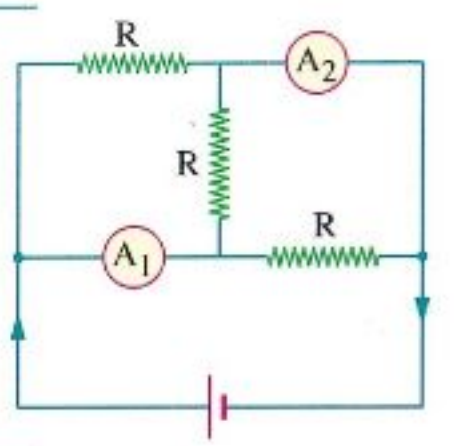
(b) At position (y)

(c) At position (z)

(d) The ammeter readings are equal at all three positions.

---

61 In the opposite circuit, the ratio between the readings of ammeters $\left(\frac{A_1}{A_2}\right)$ is ..... .

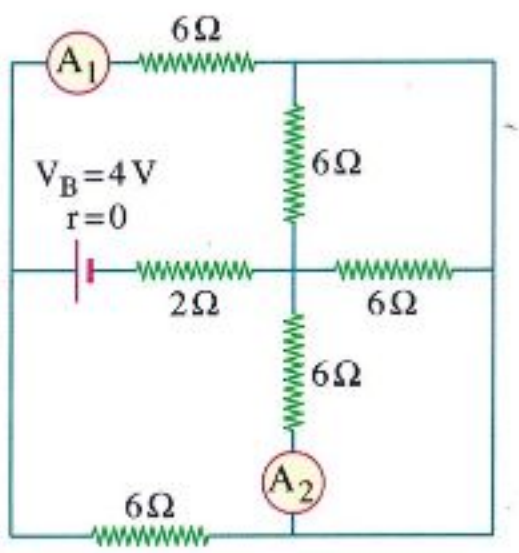


(a) $\frac{1}{2}$ (b) $\frac{2}{3}$

(c) $\frac{1}{1}$ (d) $\frac{3}{2}$

---

62 The ratio between the readings of the two ammeters $\left(\frac{A_1}{A_2}\right)$ in the opposite electrical circuit equals ..... .

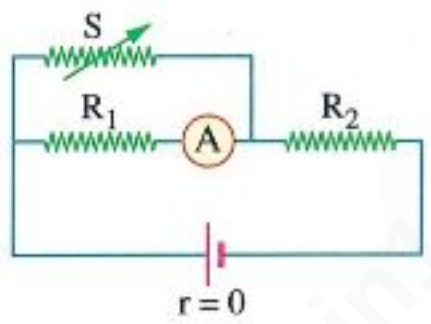


(a) $\frac{1}{1}$ (b) $\frac{2}{1}$

(c) $\frac{3}{1}$ (d) $\frac{3}{2}$

---

63 In the opposite electric circuit, when the value of the variable resistor S increases, the ammeter reading ..... .

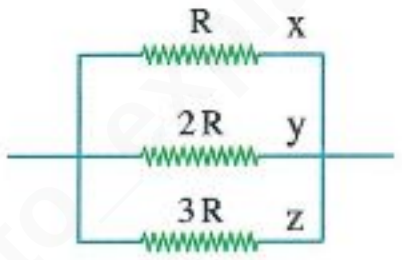


(a) increases (b) vanishes

(c) remains constant (d) decreases but does not vanish

---

64 The opposite figure represents three resistors x, y and z that are connected in parallel, so the ratio of the current intensity that passes in each of them respectively is ..... .



(a) 6 : 3 : 2 (b) 3 : 2 : 1

(c) 2 : 3 : 1 (d) 2 : 3 : 6

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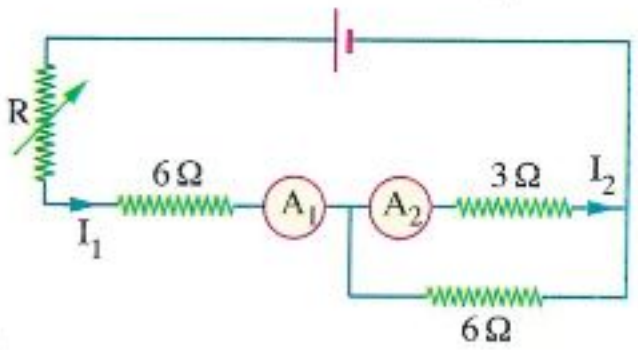
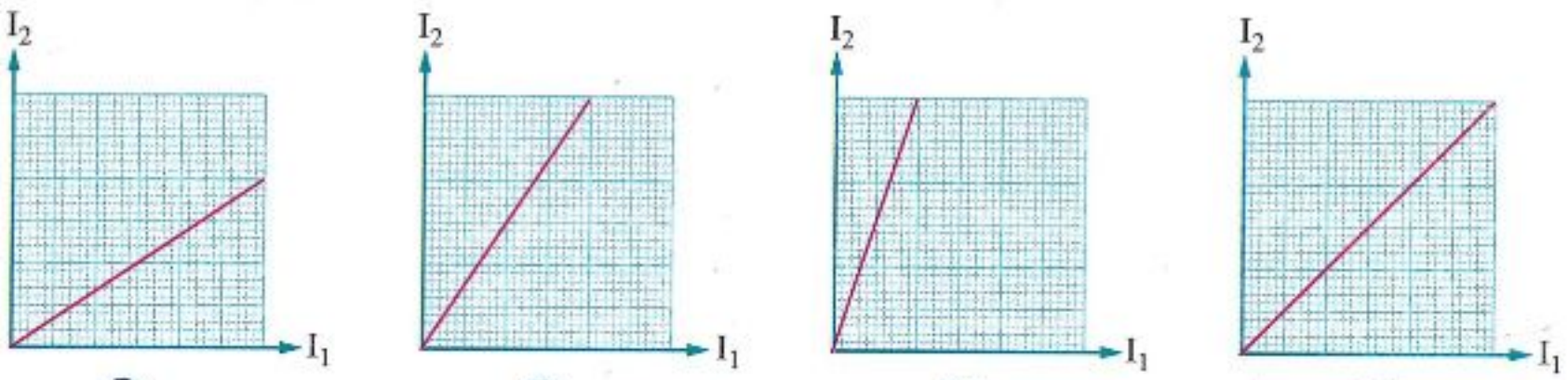
65 ✱ Which of the following graphs represents the relation between the readings of the two ammeters A_1 and A_2 when changing the resistance of rheostat (R)?

(Notice that: I_1, I_2 are drawn with the same scale)

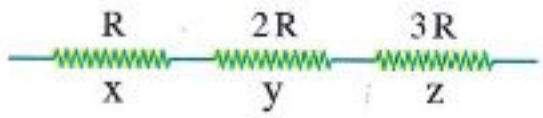




(a) (b) (c) (d)

---

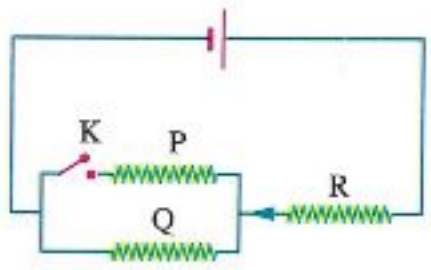
66 The opposite figure represents three resistors x, y and z that are connected in series, the ratio between the potential differences across each of them respectively equals ..... .



(a) 3 : 2 : 1 (b) 2 : 3 : 1 (c) 1 : 1 : 1 (d) 1 : 2 : 3

---

67 In the opposite electric circuit, three identical resistors are connected to an electric source, so when switch K is closed, ...



(a) the current in R decreases and in Q increases

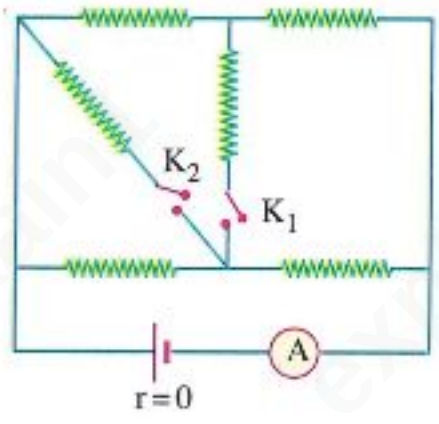
(b) the current in R decreases and in Q decreases

(c) the current in R increases and in Q decreases

(d) the current in R increases and in Q increases

---

68 In the opposite electric circuit, if the electrical resistors are identical, what happens to the ammeter reading when closing:



	switch K_1 only?	switch K_2 only?
(a)	Decreases	Increases
(b)	Decreases	Doesn't change
(c)	Doesn't change	Increases
(d)	Doesn't change	Doesn't change

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69 ✱ Wire ab carries an electric current of intensity 3 mA. The wire is connected in parallel to another wire of the same material and the same length but its diameter is three times as large as the first wire (ab), so the total current intensity which is required to be passed to keep the potential difference between the terminals of wire ab constant is ..... .

(a) 0.02 A (b) 0.1 A (c) 0.03 A (d) 0.5 A

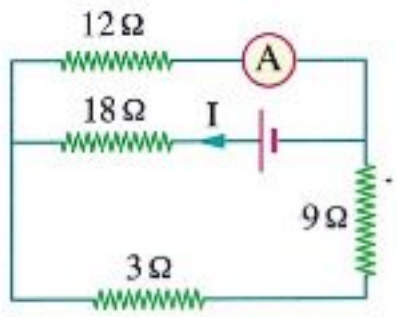
70 ✱ Two wires A and B which have the same length are made of the same material, the cross-sectional area of wire A is double that of B. The two wires are connected together in parallel in an electric circuit and when the circuit is closed, the intensity of the passing current in the circuit becomes 3 A, so the current intensity through each of them; I_A and I_B, is ..... respectively.

(a) 2 A, 1 A (b) 2 A, 3 A (c) 3 A, 3 A (d) 2 A, 2 A

71 ✱ An electric current of intensity 8 mA was passing through a thin metallic wire and when another wire of the same metal and the same length is connected in parallel with the first wire, the current has increases to 10 mA. To keep the potential difference across the wire unchanged, the ratio between the radii of the two wires $\left(\frac{r_1}{r_2}\right)$ must be ..... .

(a) $\frac{1}{2}$ (b) $\frac{3}{2}$ (c) $\frac{2}{1}$ (d) $\frac{5}{3}$

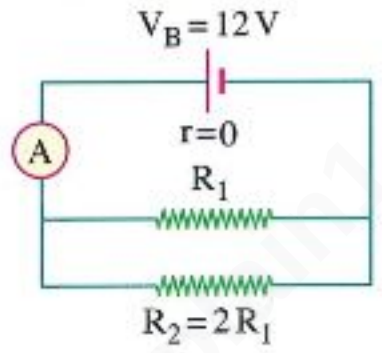
72 In the opposite electric circuit, the ammeter reading equals ..... .



(a) I (b) $\frac{I}{2}$

(c) $\frac{I}{3}$ (d) $\frac{I}{6}$

73 In the opposite figure, if the intensity of the passing electric current in resistor R_1 is 2 A, the equivalent resistance of the circuit is ..... .

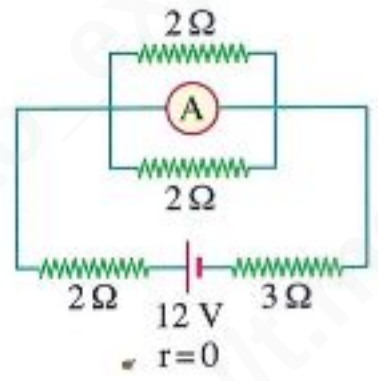


(a) 3 Ω (b) 4 Ω

(c) 6 Ω (d) 12 Ω

74 The reading of the ammeter in the opposite electric circuit is ..... .

(Knowing that the resistance of the ammeter is negligible)



(a) 1 A (b) 1.2 A

(c) 2 A (d) 2.4 A

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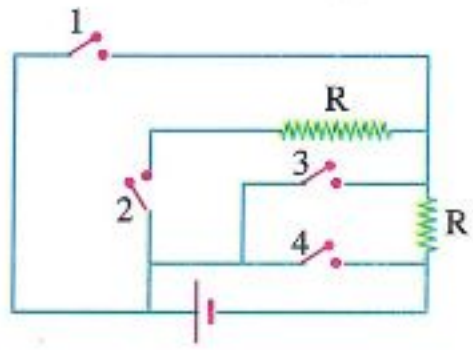
75 In the opposite electric circuit, the electric current through the battery becomes minimum value when closing switch ..... .

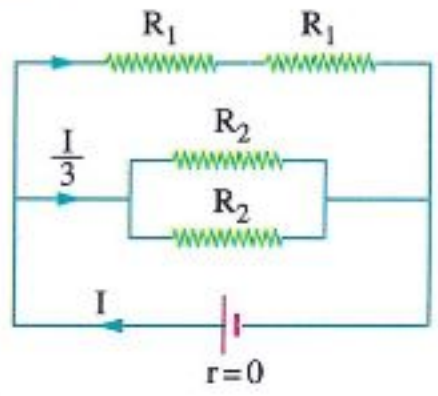


(a) 1 (b) 2

(c) 3 (d) 4

---

76 In the opposite electric circuit, the ratio between the values of the two resistors $\left(\frac{R_1}{R_2}\right)$ equals ..... .

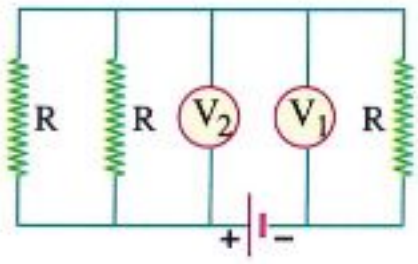


(a) $\frac{1}{2}$ (b) $\frac{1}{4}$

(c) $\frac{1}{8}$ (d) $\frac{1}{16}$

---

77 ✳ From the opposite figure, the ratio between the voltmeter readings $\left(\frac{V_1}{V_2}\right)$ equals ..... .

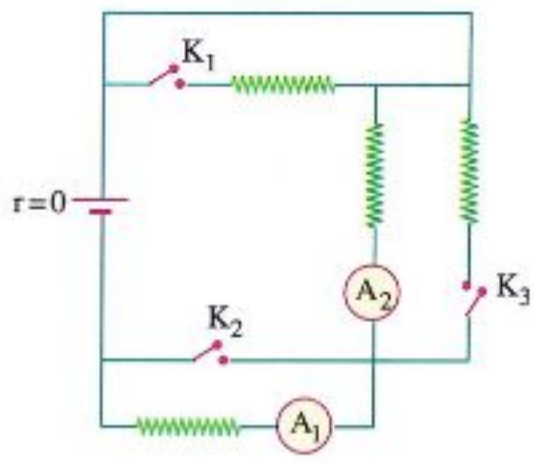


(a) $\frac{1}{2}$ (b) $\frac{1}{3}$

(c) $\frac{2}{1}$ (d) $\frac{3}{1}$

---

78 In the opposite electric circuit, what happens to the readings of the two ammeters A_1 and A_2, respectively, when closing:



(i) switch K_1 only?

(a) Does not change, increases.

(b) Decreases, does not change.

(c) Does not change, does not change.

(d) Increases, decreases.

(ii) switch K_2 only?

(a) Increases, vanishes. (b) Decreases, vanishes.

(c) Vanishes, decreases. (d) Vanishes, increases.

(iii) switch K_3 only?

(a) Increases, decreases. (b) Increases, does not change.

(c) Does not change, increases. (d) Decreases, increases.

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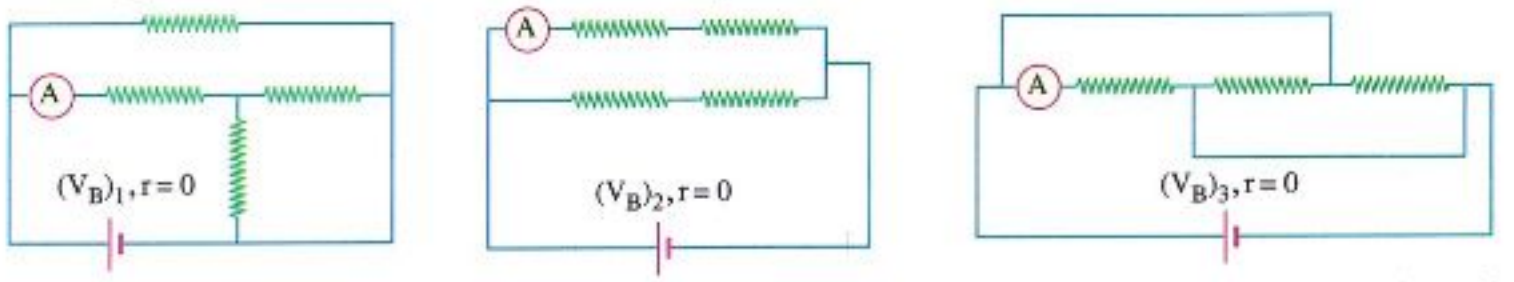
79 Each of the following electric circuits consists of a battery with negligible internal resistance, a number of identical resistors, and an ammeter:

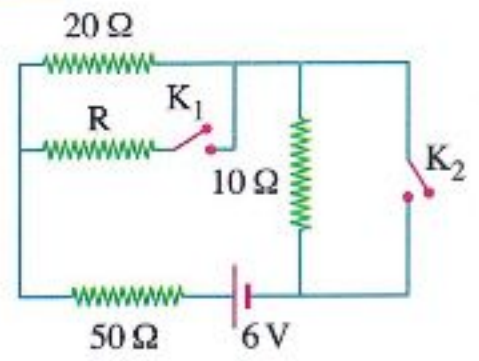


If the reading of the ammeter in each of them is the same, then the correct order of the electromotive forces of these batteries is .....

(a) $(V_B)_1 > (V_B)_2 > (V_B)_3$
(b) $(V_B)_3 > (V_B)_2 > (V_B)_1$
(c) $(V_B)_2 > (V_B)_1 > (V_B)_3$
(d) $(V_B)_2 > (V_B)_3 > (V_B)_1$

---

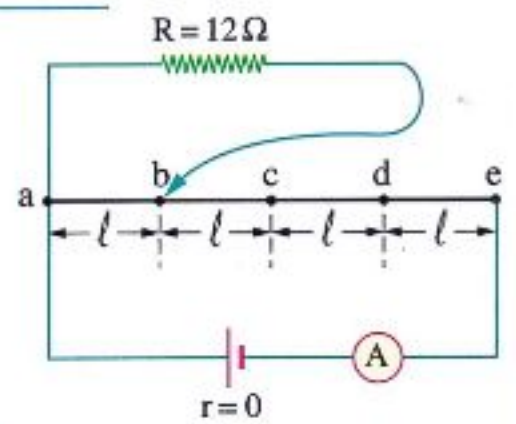
80 ✱ In the opposite electric circuit, the intensity of current passing in resistance 20 Ω doesn't change in the case of closing switches K_1 and K_2 together or opening them together, so the resistance of R equals ..... .



(a) 50 Ω
(b) 100 Ω
(c) 150 Ω
(d) 200 Ω

---

81 In the opposite electric circuit, a wire ae has a uniform cross-section and a resistance of 24 Ω. If the ammeter reading in this case equals I_1 and when the slider is moved from position b to position d, it becomes I_2, so the ratio $\left(\frac{I_1}{I_2}\right)$ equals ..... .

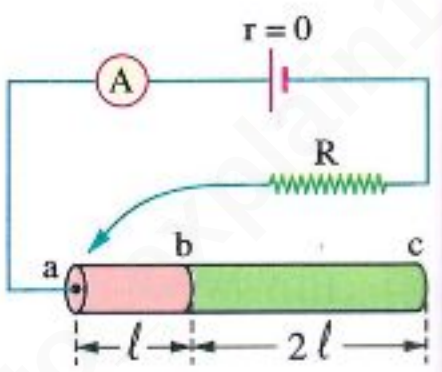


(a) $\frac{1}{2}$
(b) $\frac{2}{1}$
(c) $\frac{3}{5}$
(d) $\frac{5}{3}$

---

82 Two non-insulated metal conductors (ab) and (bc) of equal cross-sectional areas have lengths ℓ and 2ℓ, and resistivities ρ_e and $2\rho_e$ respectively. The two conductors are connected together in an electrical circuit as shown in the following figure, and the following table shows the change in the ammeter reading with the change in the slider position in the circuit,

Slider position	Ammeter reading
a	I
b	$\frac{1}{2}$I
c	?

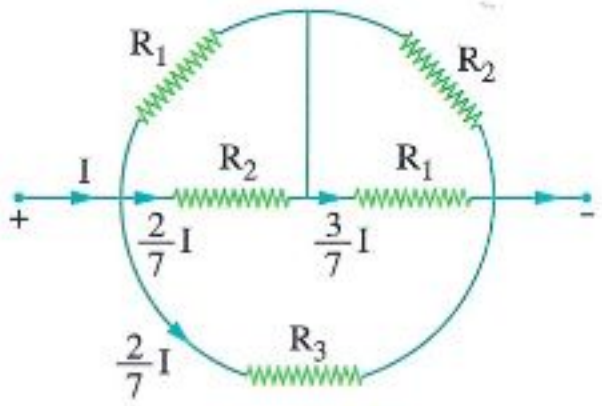


So, the ammeter reading when the slider becomes at position (c) will be ..... .

(a) $\frac{1}{3}$I
(b) $\frac{1}{4}$I
(c) $\frac{1}{6}$I
(d) $\frac{1}{8}$I

https://t.me/to_explain1

83 ✱ Several electrical resistors are connected together where the electric currents that pass through them have intensities as shown in the opposite figure, so the correct order of resistors R_1, R_2, and R_3 concerning their values is .....



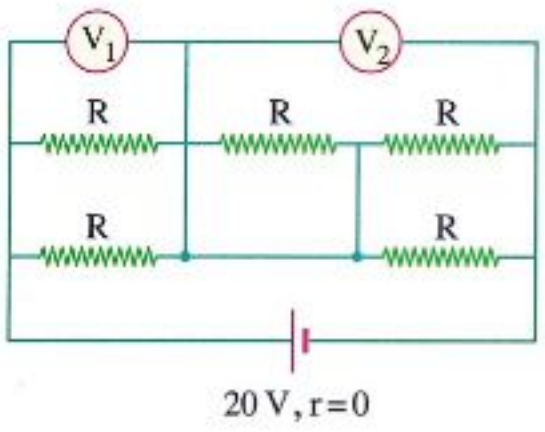
(a) $R_3 < R_2 < R_1$ (b) $R_1 < R_2 < R_3$

(c) $R_3 < R_2 = R_1$ (d) $R_2 = R_3 < R_1$

---

84 What are the readings of the two voltmeters V_1 and V_2 respectively in each of the following figures?

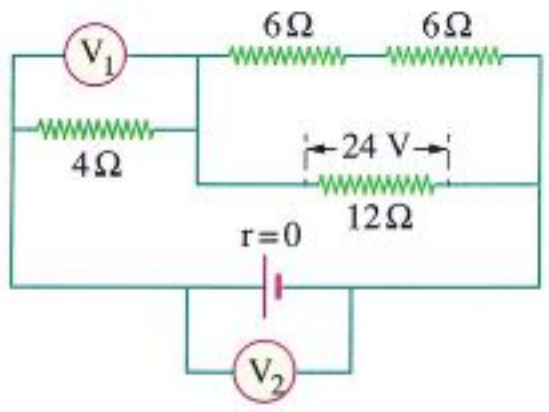
(i)



(a) 10 V, 10 V (b) 10 V, 20 V

(c) 20 V, 10 V (d) 20 V, 20 V

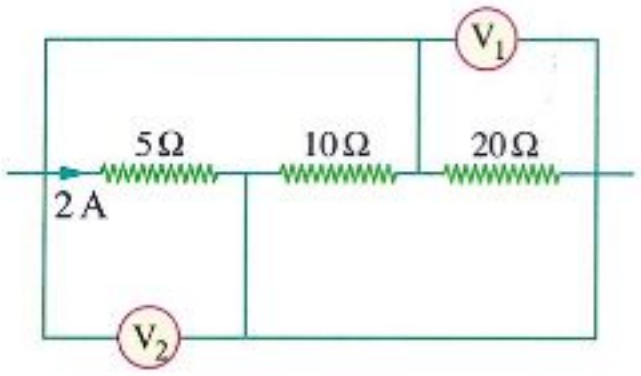
(ii)



(a) 16 V, 36 V (b) 16 V, 40 V

(c) 36 V, 36 V (d) 36 V, 40 V

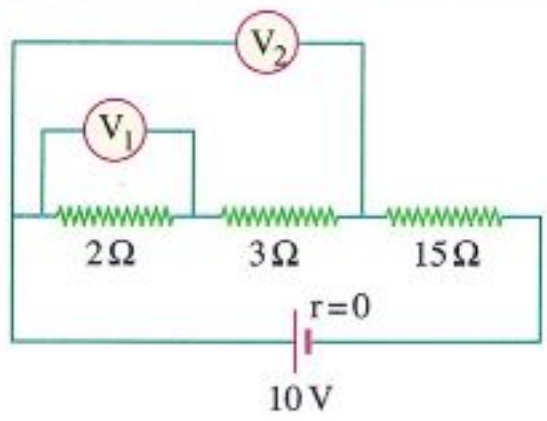
(iii)



(a) 10 V, 10 V (b) 10 V, 40 V

(c) 40 V, 10 V (d) 40 V, 40 V

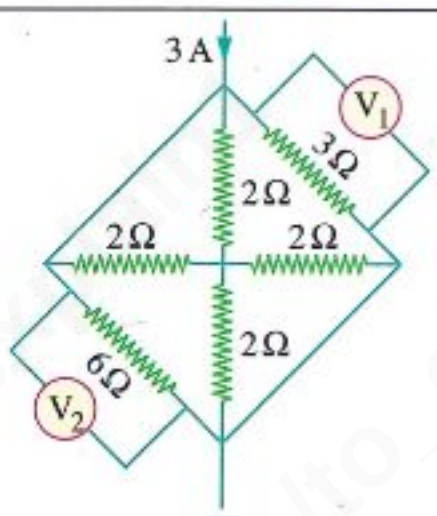
(iv)



(a) 1 V, 1.5 V (b) 1 V, 2.5 V

(c) 2 V, 1.5 V (d) 2 V, 2.5 V

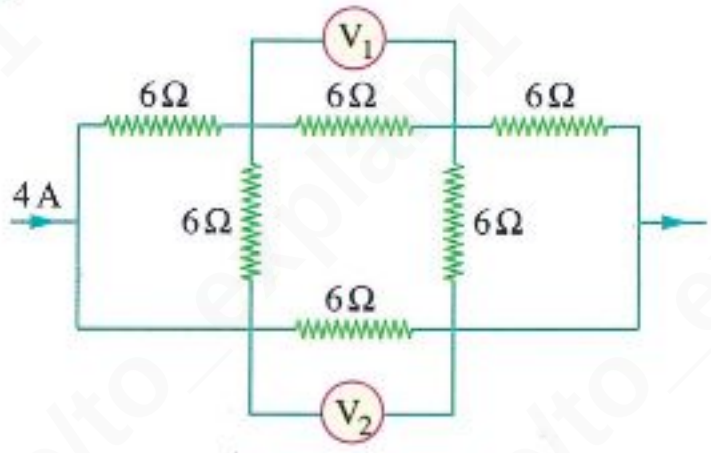
(v)



(a) 1.5 V, 3 V (b) 1.5 V, 1.5 V

(c) 3 V, 6 V (d) 3 V, 3 V

(vi)



(a) 12 V, 12 V (b) 4 V, 12 V

(c) 16 V, 16 V (d) 8 V, 16 V

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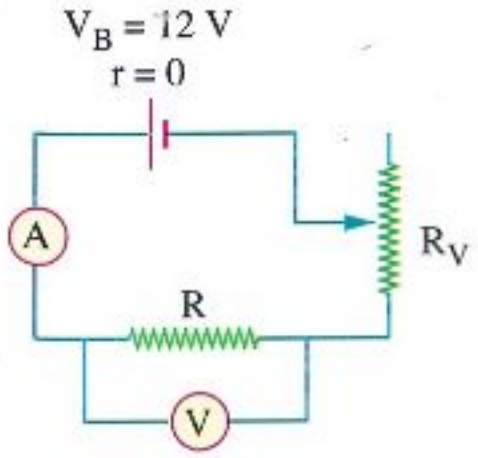
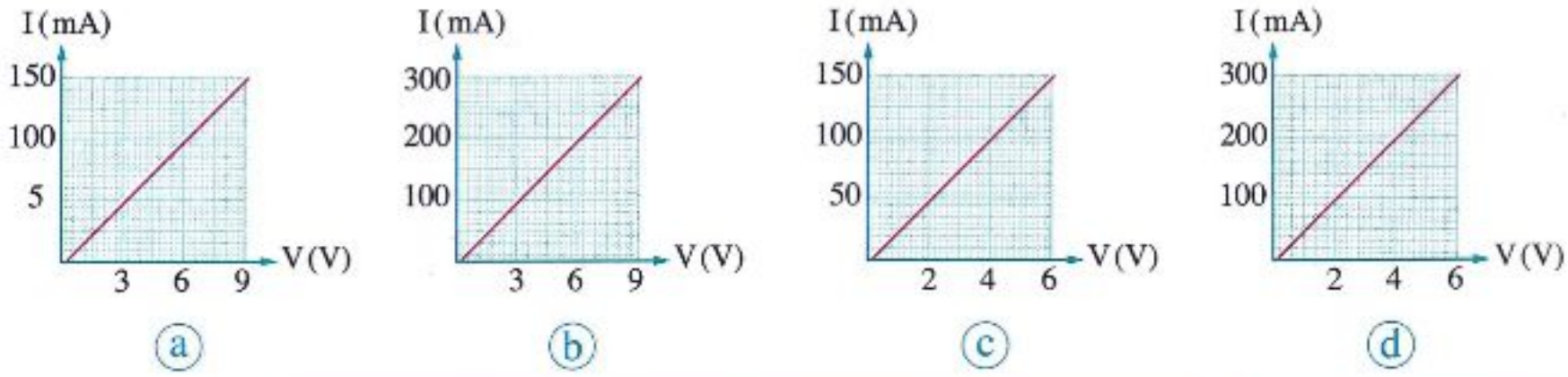
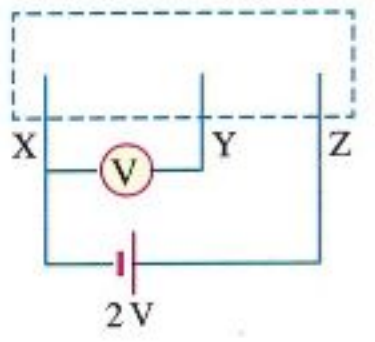
85 In one of the experiments to verify Ohm's law practically using the opposite electrical circuit, when the resistance taken from the rheostat was 20 Ω, the ammeter reading was 150 mA. Which of the following graphs correctly represents the relation between the ammeter reading (I) and the voltmeter reading (V) in this circuit?

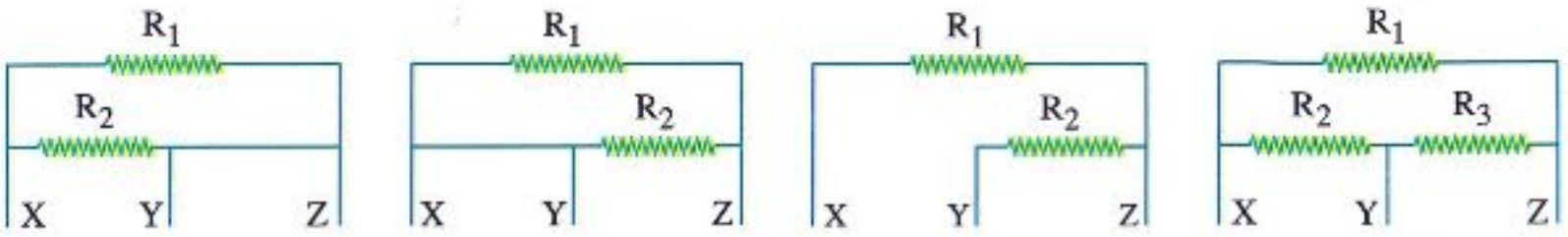




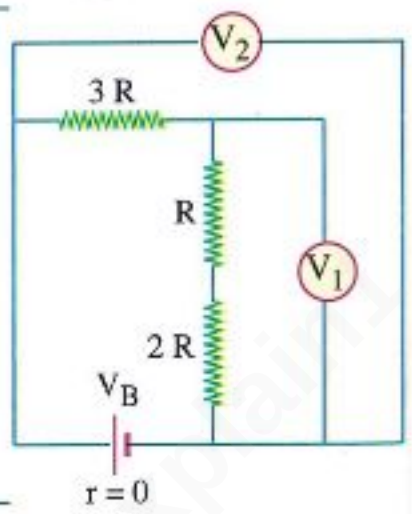
86 The opposite figure represents a part of an electric circuit that consists of a battery of electromotive force 2 V and negligible internal resistance and a voltmeter, which of the following figures complete that circuit at points X, Y and Z in order for the voltmeter to read 1.5 V?

(Consider the resistance of the voltmeter to be infinite)





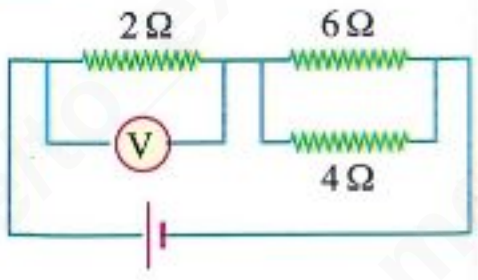
87 In the opposite electric circuit, the ratio between the readings of $\left(\frac{V_1}{V_2}\right)$ is ..... .



(a) $\frac{1}{1}$ (b) $\frac{1}{2}$

(c) $\frac{1}{3}$ (d) $\frac{1}{6}$

88 In the opposite electric circuit, if the reading of the voltmeter is 4 V, the electric current intensity that passes through the 6 Ω resistor equals ..... .



(a) 0.8 A (b) 1 A

(c) 1.2 A (d) 2 A

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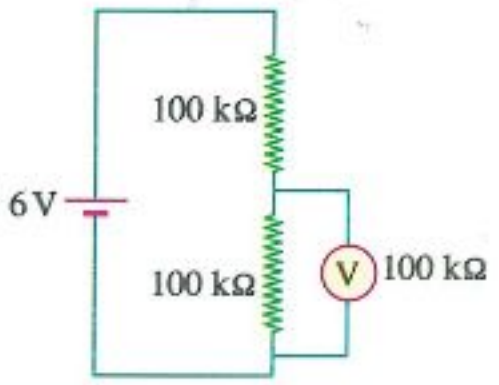
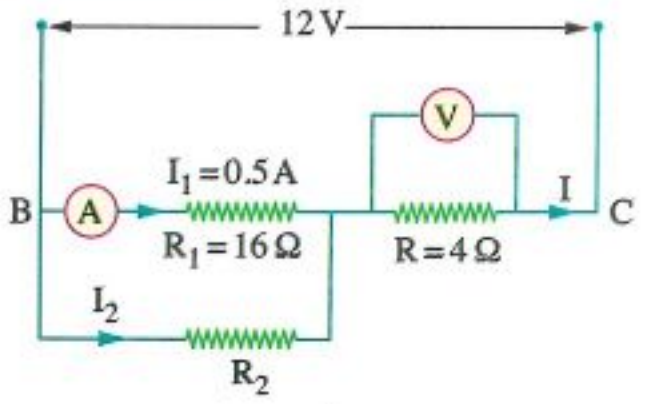
89 In the opposite figure, if the resistance of the voltmeter is 100 kΩ, how much does it read?



(a) 0 (b) 2 V
(c) 3 V (d) 4 V

---

90 The opposite figure represents a part of an electric circuit, so:



(i) The voltmeter reading (V) equals ..... .

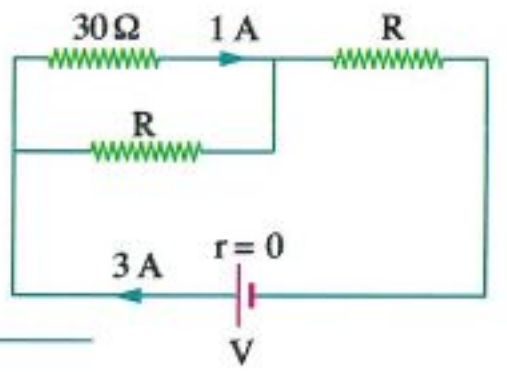
(a) 8 V (b) 4 V
(c) 2.5 V (d) 1.3 V

(ii) The resistance of R_2 equals ..... .

(a) 3 Ω (b) 5 Ω (c) 9 Ω (d) 16 Ω

---

91 In the opposite circuit, the potential difference between the terminals of the source (V) is ..... .

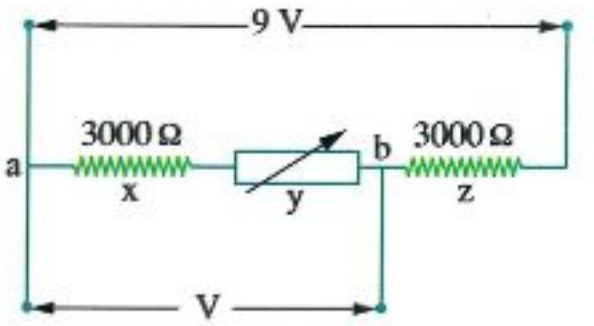


(a) 25 V (b) 50 V
(c) 75 V (d) 100 V

---

92 ✱ In the opposite figure:

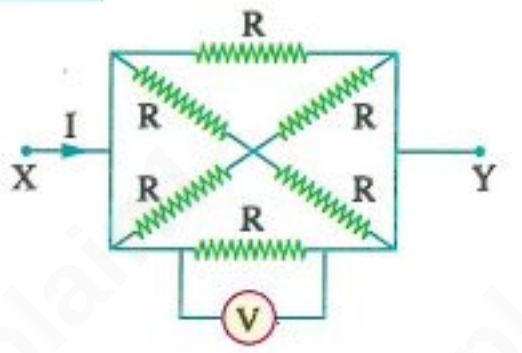
There are two fixed resistors x and z and a variable resistor y changes from zero to 3000 Ω, so the range of potential differences between the two points a and b is from ..... .



(a) 0 to 6 V (b) 3 V to 6 V
(c) 4.5 V to 6 V (d) 4.5 V to 9 V

---

93 The opposite figure represents a part of an electric circuit. If the voltmeter reads 1V, then the potential difference between the two points X and Y equals ..... .

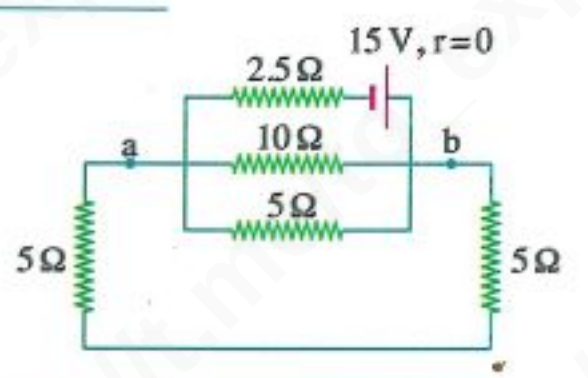


(a) 1 V (b) 2 V
(c) 3 V (d) 4 V

---

94 ✱ In the opposite electric circuit:

(i) The total resistance in the circuit equals ..... .



(a) 3 Ω (b) 5 Ω
(c) 9 Ω (d) 11 Ω

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(ii) The total current intensity passing in the circuit equals ..... .

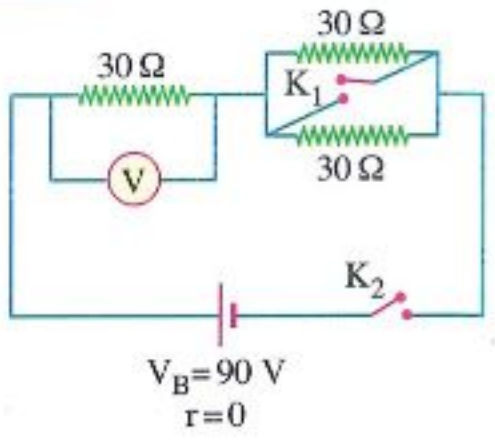
(a) 12 A (b) 5 A (c) 3 A (d) 2 A

(iii) The potential difference between the two points a and b equals ..... .

(a) 2.5 V (b) 5 V (c) 6 V (d) 7.5 V

---

95 ✱ In the opposite circuit, the reading of the voltmeter when:



(i) Switch K_2 is closed and switch K_1 is opened equals ..... .

(a) 20 V (b) 30 V

(c) 60 V (d) 40 V

(ii) Switch K_2 is closed and switch K_1 is closed equals ..... .

(a) 30 V (b) 40 V

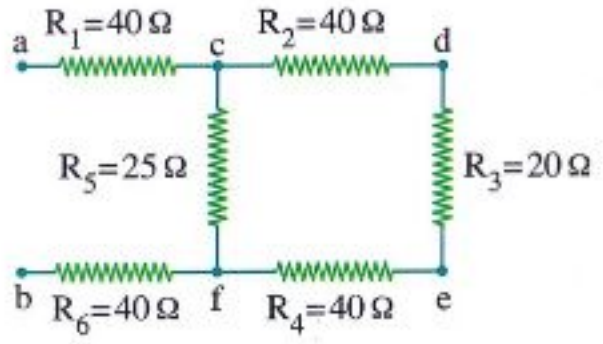
(c) 90 V (d) 60 V

(iii) Switch K_2 is opened and switch K_1 is closed equals ..... .

(a) 0 (b) 20 V (c) 40 V (d) 60 V

---

96 The opposite figure represents a part of an electric circuit, so if the potential difference V_{ab} equals 200 V;



(i) The equivalent resistance of this part of the circuit equals ..... .

(a) 100 Ω (b) 80 Ω

(c) 75 Ω (d) 54 Ω

(ii) The current intensity passing through resistance R_1 equals ..... .

(a) 5 A (b) 3.5 A (c) 2 A (d) 1.6 A

(iii) The current intensity through resistance R_5 equals ..... .

(a) 0.1 A (b) 0.4 A (c) 1.4 A (d) 1.6 A

(iv) The potential difference between the two points e and d equals ..... .

(a) 16 V (b) 12 V (c) 10 V (d) 8 V

---

97 ✱ Three resistors of 60 Ω, 40 Ω and 20 Ω are connected to an electric source where the potential difference across them are 30 V, 20 V and 50 V respectively, so the equivalent resistance of the circuit equals ..... .

(a) 16.67 Ω (b) 12.23 Ω (c) 10.53 Ω (d) 9.75 Ω

---

98 ✱ A voltmeter of 500 Ω resistance is connected in parallel to an unknown resistance, then an ammeter of negligible resistance is connected to them in series and when the terminals of this circuit are connected to an electric cell, the ammeter reading becomes 0.01 A and the voltmeter reading becomes 3 V, so the value of the unknown resistance is ..... .

(a) 900 Ω (b) 800 Ω (c) 750 Ω (d) 620 Ω

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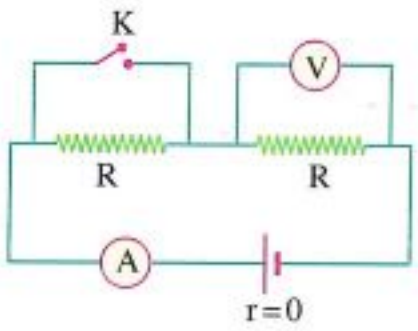
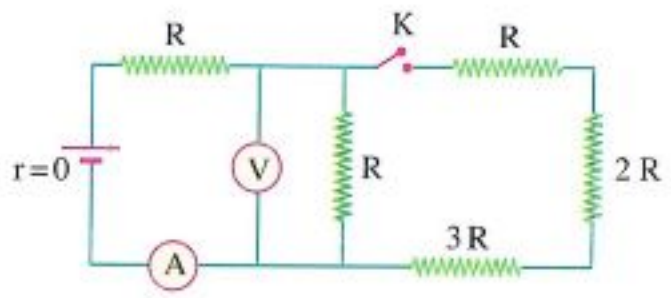
99 What happens to the readings of the ammeter and voltmeter, respectively, when the switch K is closed in each of the following cases?

(i)



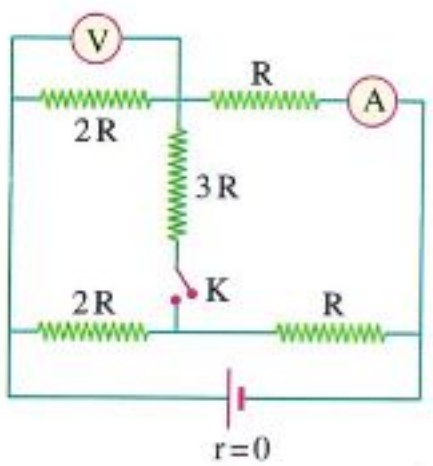
(a) Increases, increases.
(b) Decreases, decreases.
(c) Decreases, increases.
(d) Increases, decreases.

(ii)



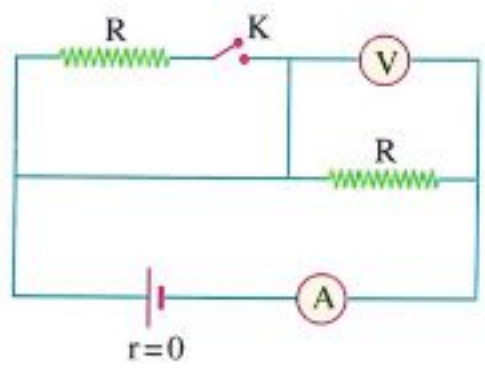
(a) Increases, increases.
(b) Decreases, doesn't change.
(c) Increases, decreases.
(d) Doesn't change, doesn't change.

(iii)



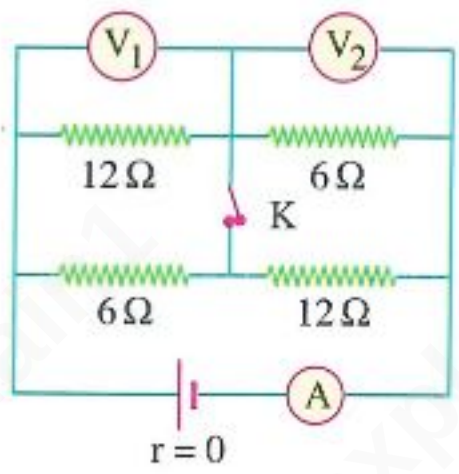
(a) Increases, increases.
(b) Decreases, doesn't change.
(c) Doesn't change, decreases.
(d) Doesn't change, doesn't change.

(iv)



(a) Increases, increases.
(b) Decreases, doesn't change.
(c) Increases, decreases.
(d) Doesn't change, doesn't change.

100 In the opposite electrical circuit, what happens to the reading of each of the ammeter (A) and the voltmeters (V_1) and (V_2) when the switch (K) is opened ?



	Ammeter reading (A)	Voltmeter reading (V_1)	Voltmeter reading (V_2)
(a)	Decreases	Increases	Increases
(b)	Decreases	Increases	Decreases
(c)	Increases	Increases	Increases
(d)	Increases	Decreases	Decreases

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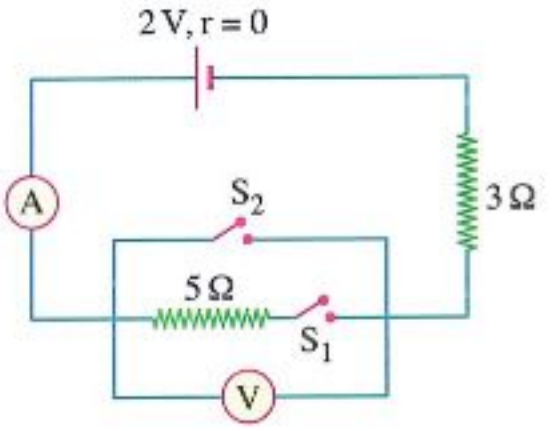
101 In the opposite circuit, the readings of the ammeter and the voltmeter at:



(i) Closing the two switches S_1 and S_2 together equals ..... .

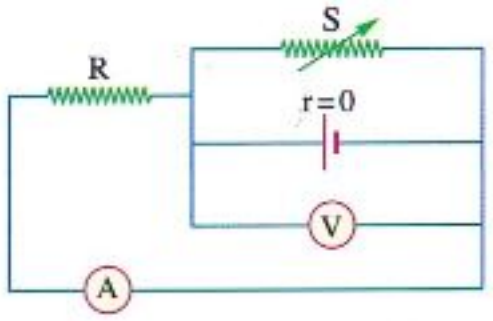
	The ammeter reading	The voltmeter reading
(a)	0.67 A	0.2 V
(b)	0	0.3 V
(c)	0.67 A	0
(d)	0.5 A	0.3 V

(ii) Closing switch S_1 and opening switch S_2 equals ..... .

	The ammeter reading	The voltmeter reading
(a)	3.2 A	1.2 V
(b)	0.25 A	1.25 V
(c)	1.25 A	3.2 V
(d)	0.25 A	2.05 V

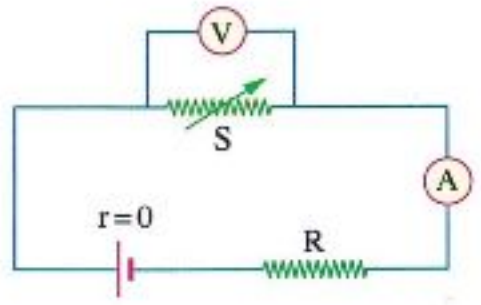
102 What happens to the readings of the ammeter and voltmeter, respectively, when increasing the value of variable resistance S in each of the following cases?

(i)



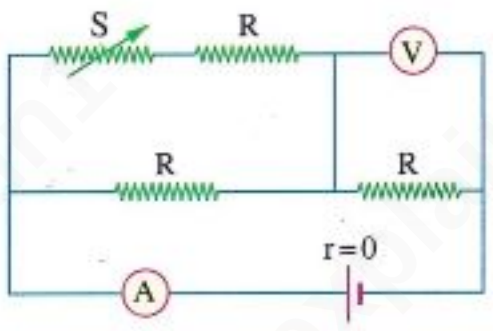
(a) Decreases, decreases.
(b) Decreases, doesn't change.
(c) Doesn't change, increases.
(d) Doesn't change, doesn't change.

(ii)



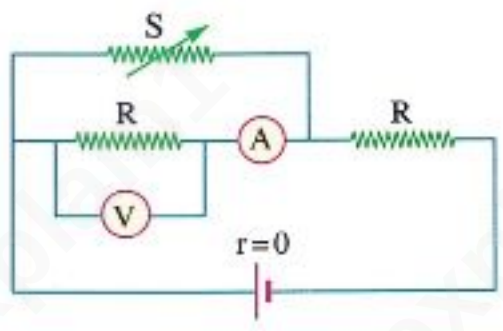
(a) Decreases, decreases.
(b) Decreases, increases.
(c) Increases, decreases.
(d) Increases, increases.

(iii)



(a) Decreases, decreases.
(b) Decreases, increases.
(c) Increases, decreases.
(d) Increases, increases.

(iv)



(a) Decreases, decreases.
(b) Decreases, increases.
(c) Increases, decreases.
(d) Increases, increases.

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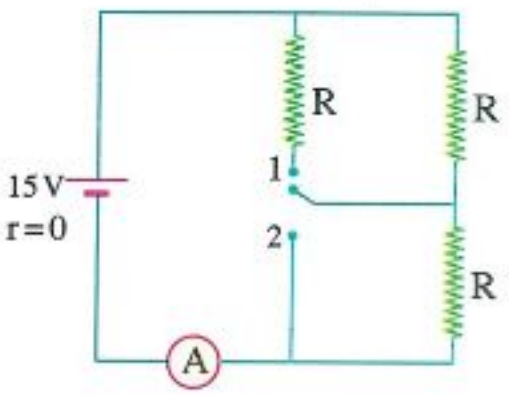
103 In the opposite electric circuit:



(i) When closing the switch in direction (1), a current of intensity 2 A passes in the ammeter, thus the value of the resistance of R is ..... .

(a) 30 Ω (b) 5 Ω

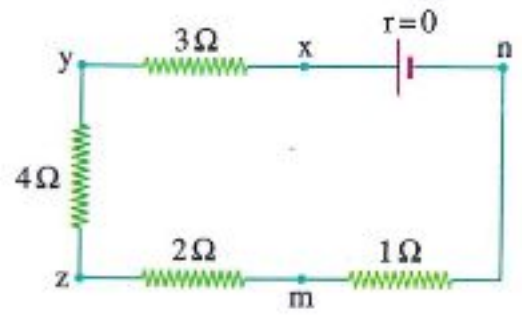
(c) 7.5 Ω (d) 2.5 Ω

(ii) When closing the switch in direction (2), a current of intensity ..... passes in the ammeter.

(a) 1 A (b) 2 A (c) 3 A (d) 4 A

---

104 In the opposite electric circuit, what are the two points between which a free electron requires the greatest amount of work to be moved?

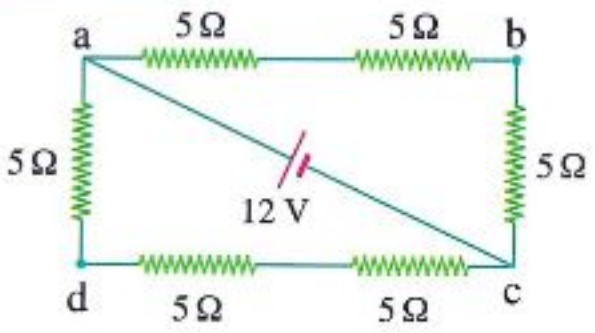


(a) x, y (b) y, z

(c) z, m (d) z, n

---

105 ✱ In the shown electric circuit, the potential difference between the two points b and d equals ..... .



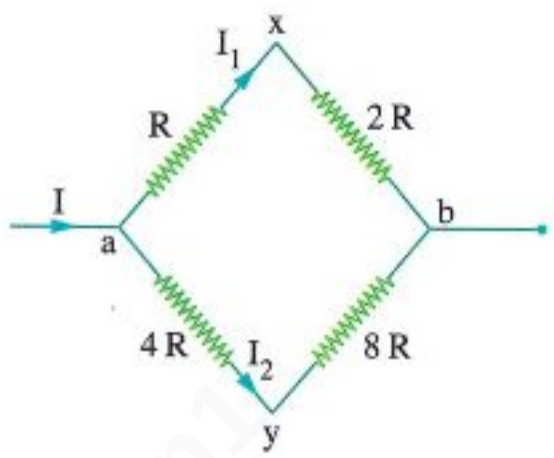
(a) 2 V (b) 4 V

(c) 6 V (d) 8 V

---

106 ✱ In the opposite figure:

The potential difference between x and y equals ..... .



(a) 0

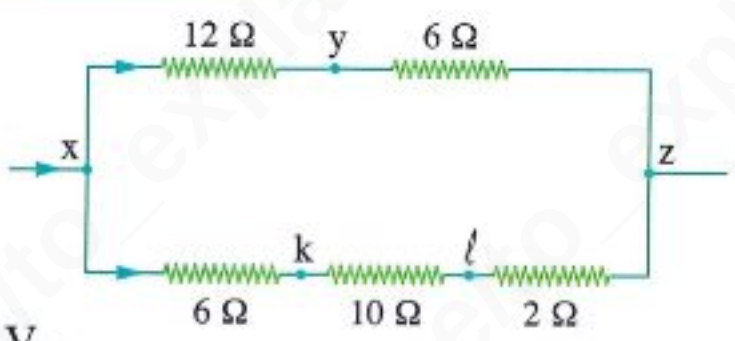
(b) 3 IR

(c) 6 IR

(d) IR

---

107 The opposite figure represents a part of an electric circuit, which of the following is correct regarding the ratio of the potential differences between the shown points?



(a) $V_{k\ell} > V_{xy}$ (b) $V_{yz} > V_{xk}$

(c) $V_{xy} = V_{kz}$ (d) $V_{xz} = 2\,V_{\ell z}$

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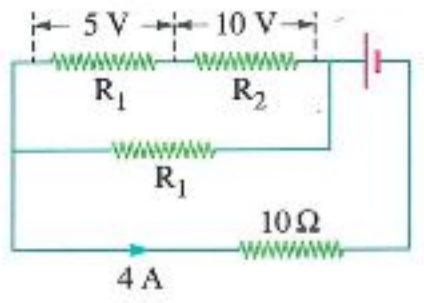
108 In the opposite electrical circuit, the values of R_1 and R_2, respectively, are ..... .

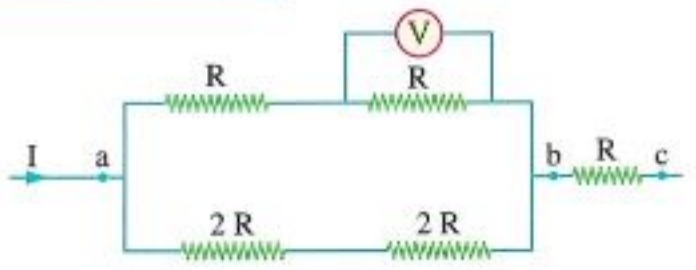


(a) 2.5 Ω, 5 Ω (b) 2.5 Ω, 10 Ω

(c) 5 Ω, 2.5 Ω (d) 5 Ω, 10 Ω

---

109 ✻ In the opposite figure, if the reading of the voltmeter is 4 V:



(i) What will be its reading when it is connected between the two points b and c?

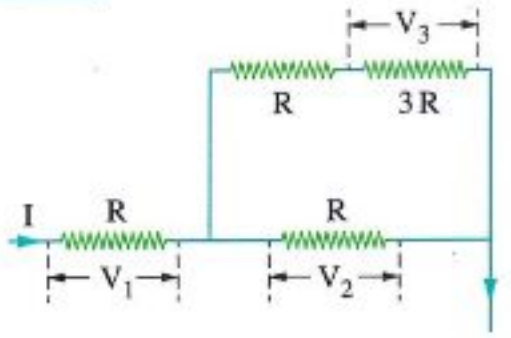
(a) 10 V (b) 8 V (c) 6 V (d) 2 V

(ii) What will be its reading when it is connected between the two points a and c?

(a) 14 V (b) 15 V (c) 16 V (d) 17 V

---

110 The opposite figure shows a section of an electric circuit, so the correct mathematical relationship for the potential differences V_1, V_2, and V_3 is .....

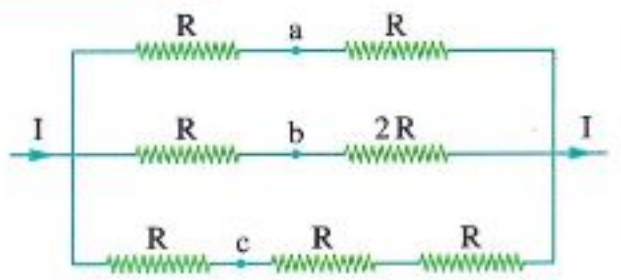


(a) $V_1 = V_2 > V_3$ (b) $V_1 = V_2 < V_3$

(c) $V_1 > V_3 > V_2$ (d) $V_1 > V_2 > V_3$

---

111 The opposite figure represents a section of an electrical circuit. Which of the following mathematical relationships relates the values of electrical potential at points a, b, and c correctly?

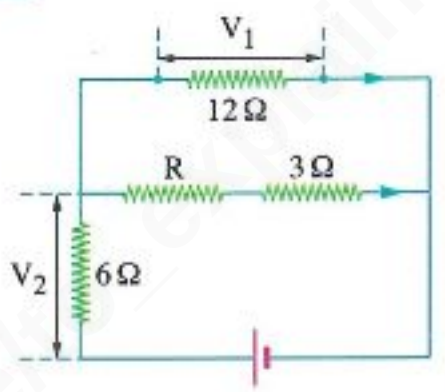


(a) $V_a > V_b > V_c$ (b) $V_a < V_b < V_c$

(c) $V_a > V_b = V_c$ (d) $V_a < V_b = V_c$

---

112 The opposite diagram represents a closed electric circuit, if $V_1 = V_2$, the resistance of resistor R equals ..... .



(a) 3 Ω (b) 9 Ω

(c) 12 Ω (d) 15 Ω

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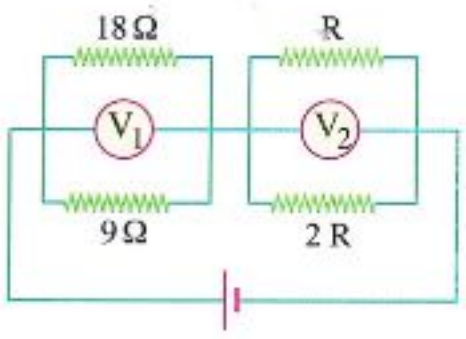
113 In the opposite circuit, if $\frac{V_1}{V_2} = \frac{3}{4}$, the value of the resistor R equals ..... .

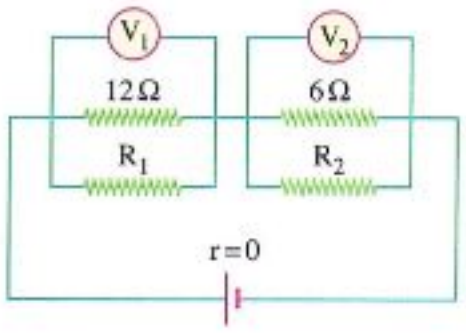


(a) 6 Ω (b) 12 Ω

(c) 18 Ω (d) 24 Ω

---

114 In the opposite electric circuit, the readings of the two voltmeters V_1 and V_2 are equal, so the relation between R_1 and R_2 is ..... .



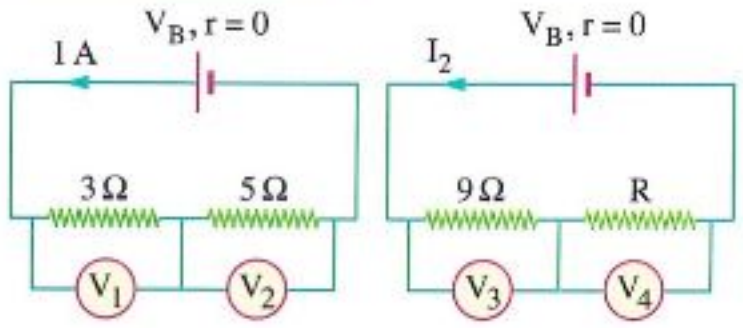
(a) $R_1 = R_2$ (b) $R_1 > R_2$

(c) $R_1 < R_2$ (d) indeterminable

---

115 In the two opposite circuits, if the readings of voltmeters V_1 and V_3 are equal, and the readings of voltmeters V_2 and V_4 are equal, then ..... .

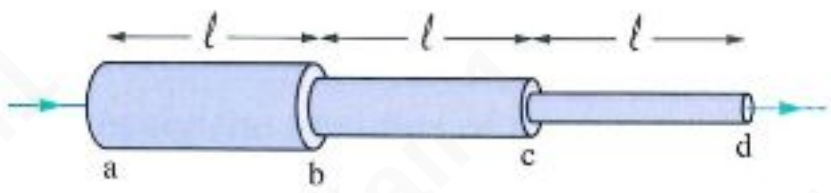
(Assuming that all voltmeters are ideal)



	R	I_2
(a)	6 Ω	$\frac{2}{3}$ A
(b)	6 Ω	$\frac{1}{3}$ A
(c)	15 Ω	$\frac{2}{3}$ A
(d)	15 Ω	$\frac{1}{3}$ A

---

116 Three solid conductors ab, bc and cd are made of the same metal and had the same length (ℓ). Each has a regular circular cross-section with cross-sectional areas 3A, 2A and A respectively, as shown in the opposite figure, then the ratio between:



(i) the potential differences $(\frac{V_{cd}}{V_{bc}})$ equals ..... .

(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{2}{3}$ (d) $\frac{3}{2}$

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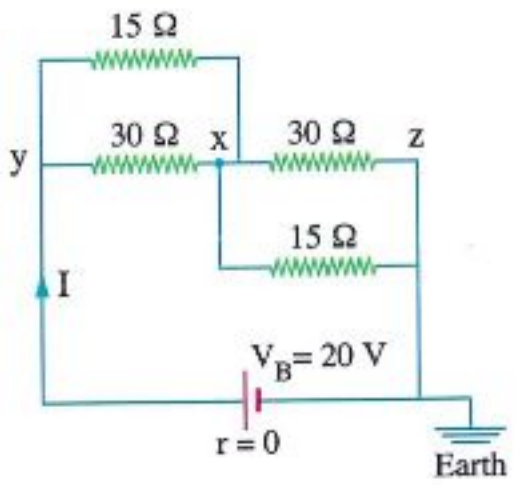
(ii) the potential differences $\left(\frac{V_{bc}}{V_{ad}}\right)$ equals ..... .

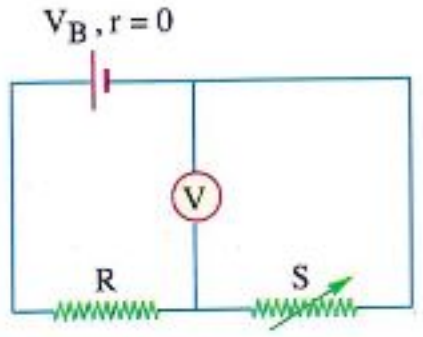
(a) $\frac{11}{3}$ (b) $\frac{3}{11}$ (c) $\frac{5}{22}$ (d) $\frac{22}{5}$

117 In the opposite electric circuit, if you know that the electric potential of the point connected to the Earth is zero, ...



	The value of I	The electric potential of point x
(a)	$\frac{1}{2}$ A	10 V
(b)	$\frac{1}{2}$ A	5 V
(c)	1 A	5 V
(d)	1 A	10 V

118 The opposite diagram represents a closed electric circuit, so when the variable resistance (S) is doubled, the voltmeter reading ..... .



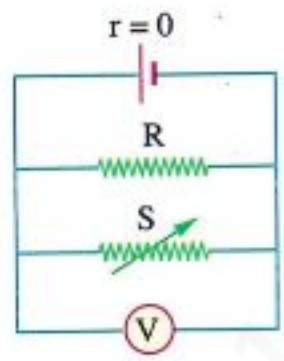
(a) increases but doesn't reach the double of its initial value

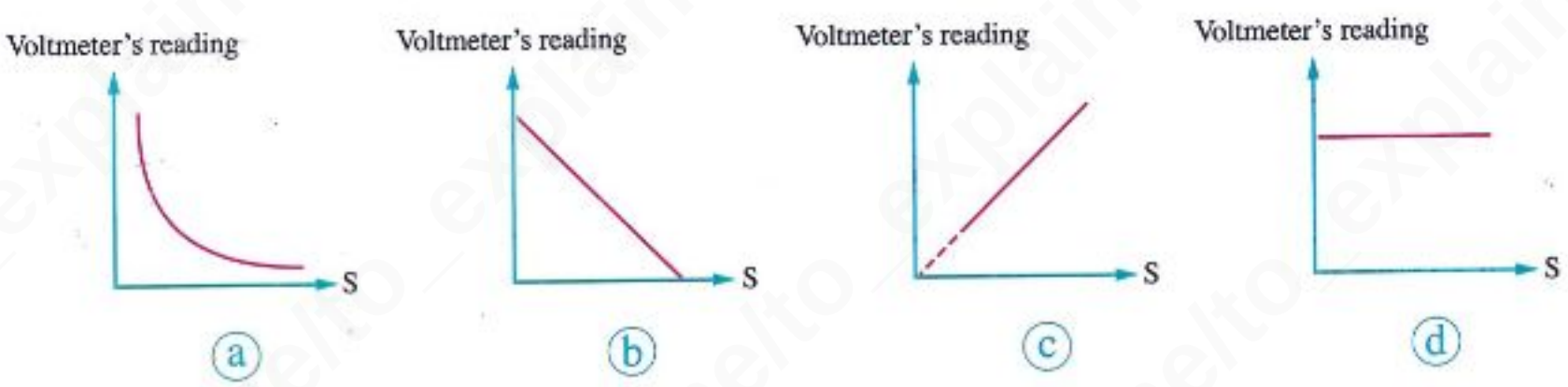
(b) is doubled

(c) decreases but doesn't reach half its initial value

(d) decreases to half its initial value

119 Which of the following graphs represents the relation between the reading of the voltmeter and the variable resistance S?





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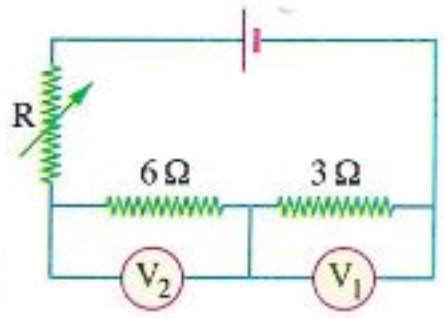
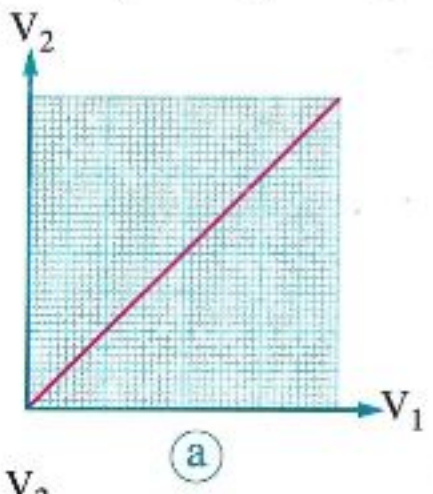
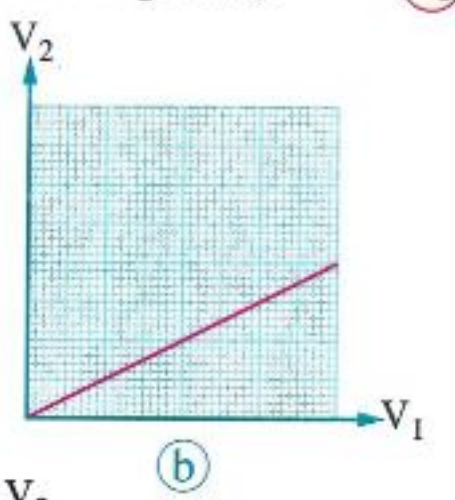
120 Which of the following graphs represents the relation between the reading of the voltmeter V_1 and the reading of the voltmeter V_2 when changing the value of the variable resistance R?

(Noticing that: V_1 and V_2 are represented with the same drawing scale)

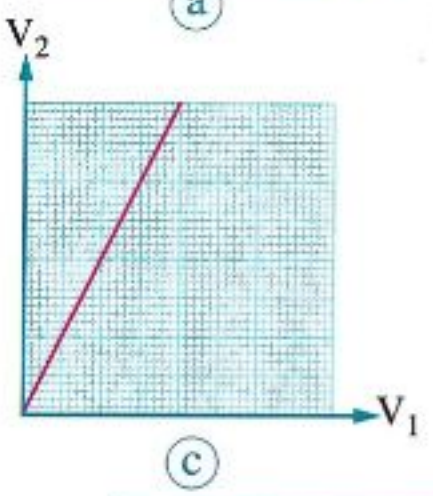




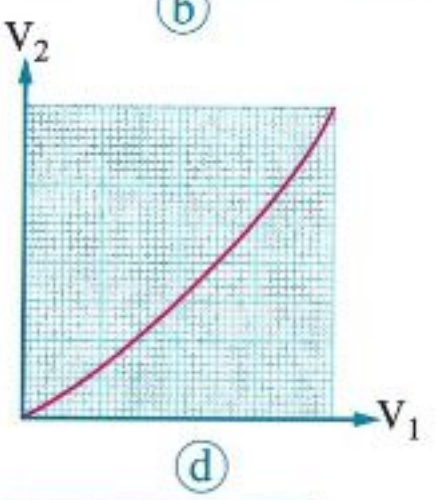
(a)



(b)



(c)



(d)

121 Figure (1) represents the graph of the ammeter reading (A) in the electrical circuit shown in figure (2) versus the reading voltmeter (V_1) in it.

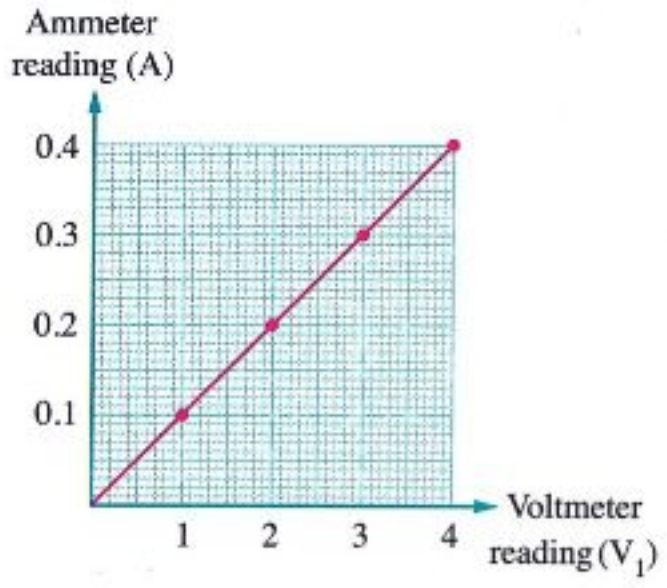


Figure (1)

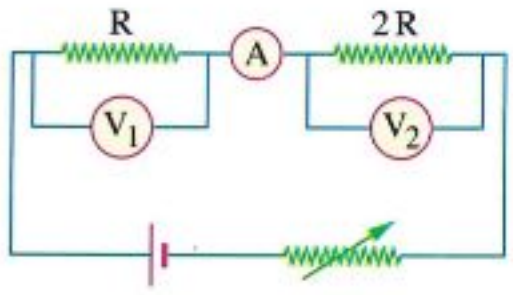


Figure (2)

Which of the following can represent possible values for the readings of the ammeter (A) and the voltmeter (V_2) at different values of the variable resistance?

	Ammeter reading (A)	Voltmeter reading (V_2)
(a)	1 A	2 V
(b)	0.8 A	8 V
(c)	0.6 A	3 V
(d)	0.5 A	10 V

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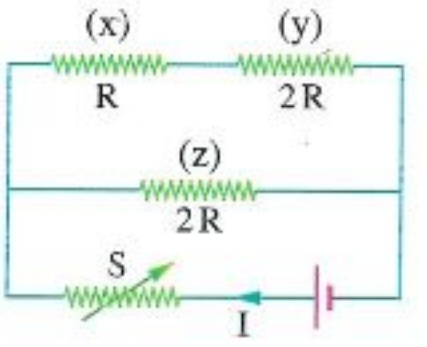
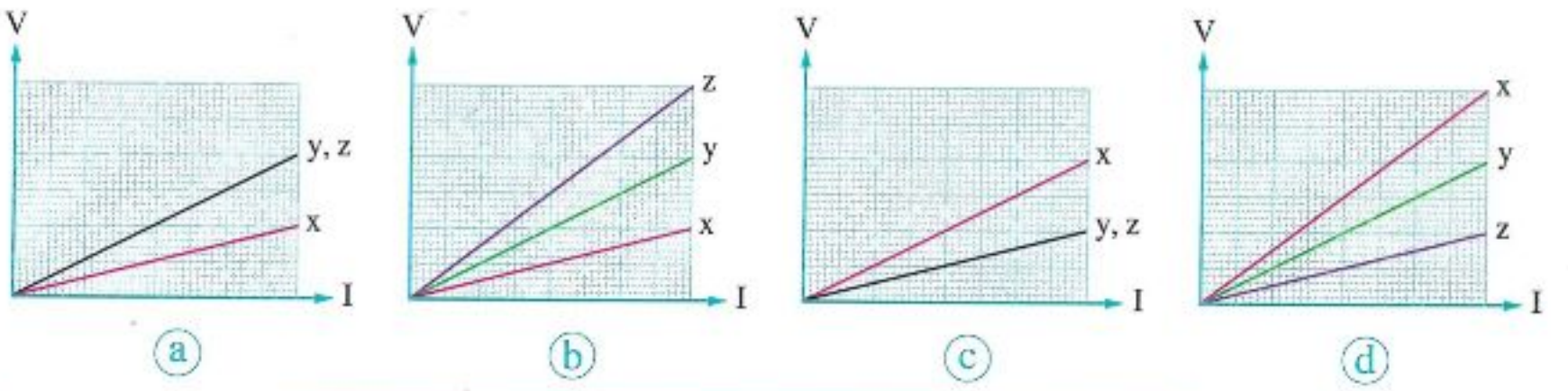
122 ✱ Which of the following graphs represents the relation between the total current (I) through the circuit shown in the opposite figure and the potential difference (V) across each of the three resistors x, y, z?





(a) (b) (c) (d)

123 ✱ Figure (1) shows a graph that represents the potential differences across the parts of the electric circuit in figure (2),

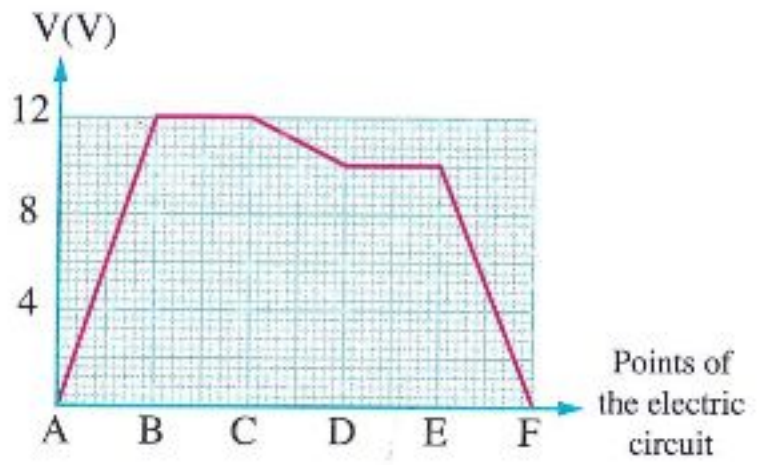


Figure (1)

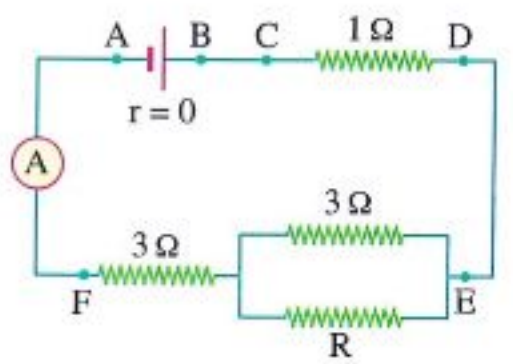


Figure (2)

so, from studying the two figures (1) and (2):

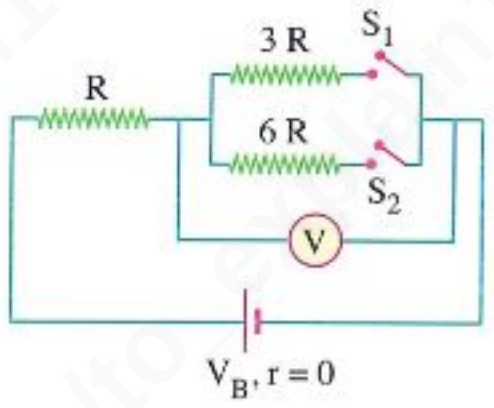
(i) The ammeter reading equals ..... .

(a) 1 A (b) 2 A (c) 3 A (d) 4 A

(ii) The resistance of R is ..... .

(a) 10 Ω (b) 9 Ω (c) 6 Ω (d) 4 Ω

124 ✱ In the opposite electric circuit when switch S_1 only is closed, the reading of the voltmeter becomes V_1, when switch S_2 only is closed, the reading of the voltmeter becomes V_2 and when both switches S_1 and S_2 are closed together, the reading of the voltmeter becomes V_3, then .....



(a) $V_1 < V_2 < V_3$ (b) $V_3 < V_1 < V_2$

(c) $V_2 < V_1 < V_3$ (d) $V_3 < V_2 < V_1$

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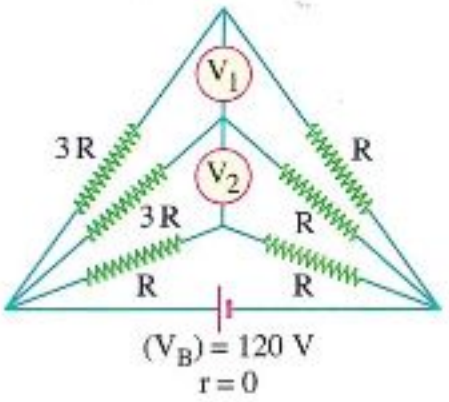
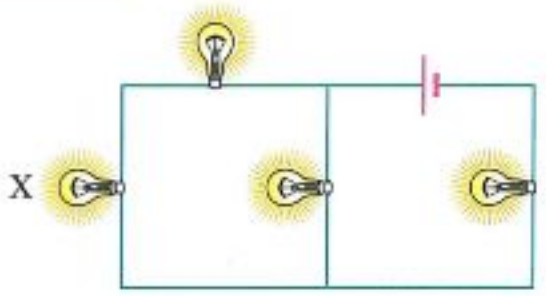
125 ✱ In the opposite electrical circuit, the readings of the voltmeters (V_1) and (V_2) respectively are ..... .



(a) 0, 0 (b) 0, 30 V

(c) 30 V, 30 V (d) 30 V, 60 V

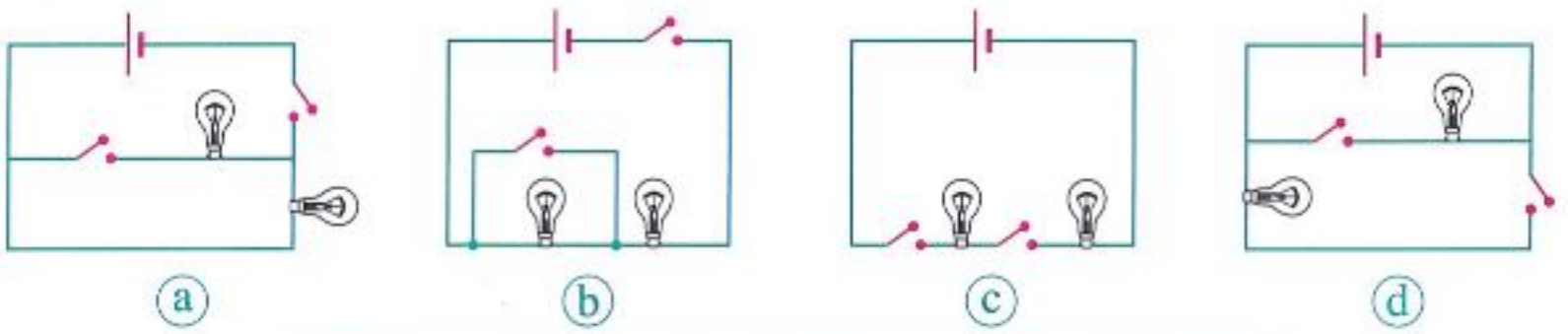
126 The opposite electric circuit shows four lit lamps, if the lamp X is blown up, how many lamps remain lighted?



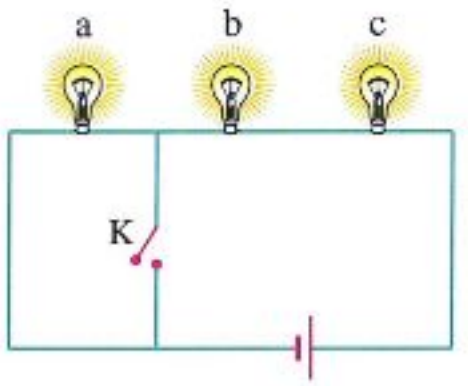
(a) 0 (b) 1

(c) 2 (d) 3

127 In which of the following electric circuits, one of the two bulbs lights up when the two switches are closed?

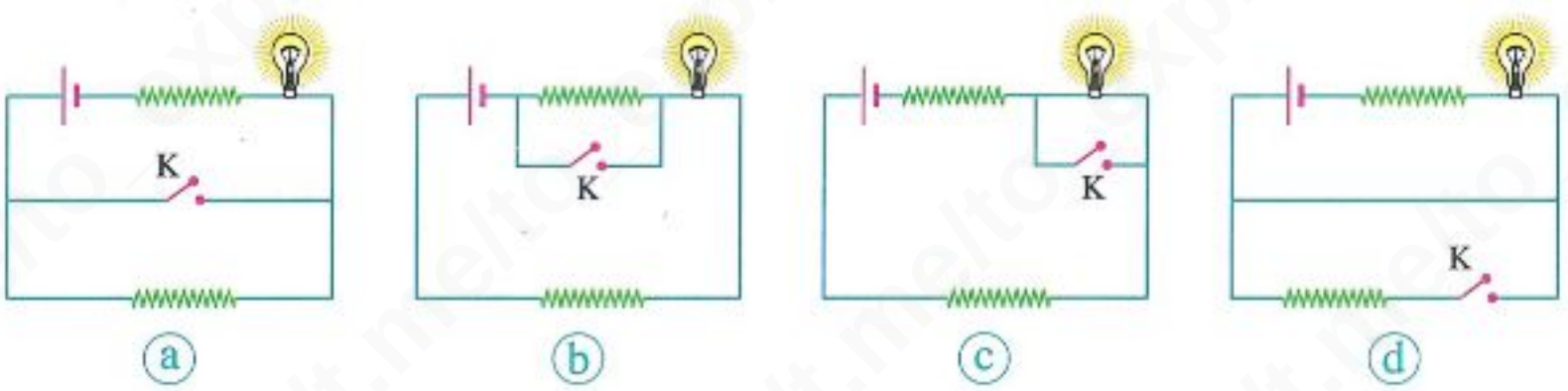


128 ✱ In the opposite electric circuit, when closing the switch K, what will happen to the brightness of the two bulbs a and b ..... .



	Bulb a	Bulb b
(a)	increases	decreases
(b)	vanishes	increases
(c)	increases	increases
(d)	vanishes	decreases

129 In which of the following electric circuits, closing the switch K does not affect the brightness of the lamp?



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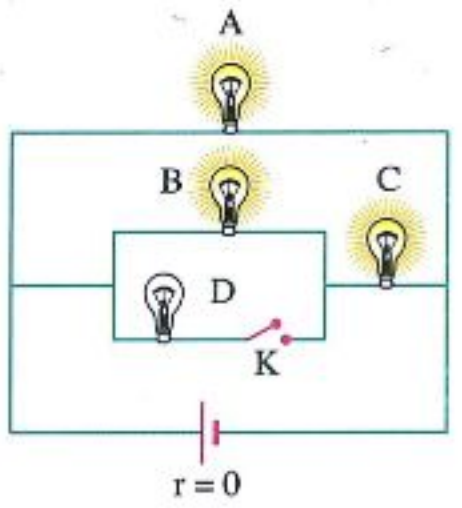
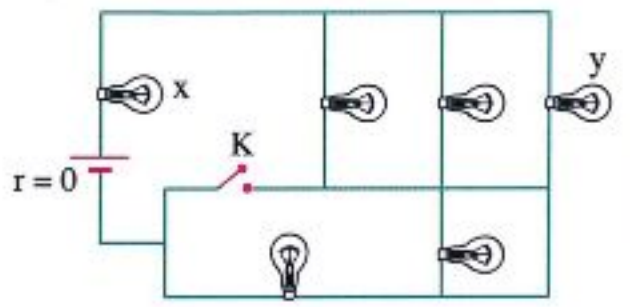
130 ✱ In the opposite circuit, if the four bulbs A, B, C and D are identical, what happens to the illumination intensity of the bulbs A and B when closing the switch K?



	Brightness of bulb A	Brightness of bulb B
(a)	Increases	Decreases
(b)	Remains constant	Increases
(c)	Remains constant	Decreases
(d)	Decreases	Increases

131 Six identical bulbs, a DC source, and a switch (K) are connected as shown in the opposite figure, so:



(i) the number of lighted bulbs when:

1- the switch (K) is open is ..... .

(a) 3 (b) 4 (c) 5 (d) 6

2- the switch (K) is closed is ..... .

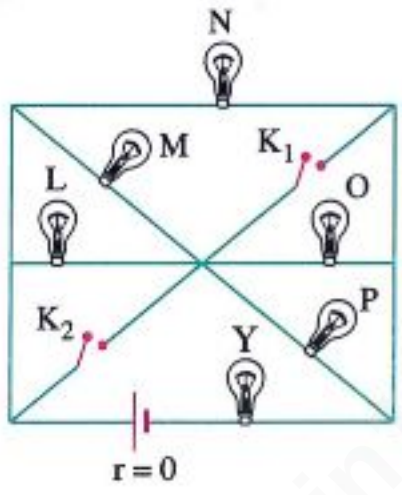
(a) 3 (b) 4 (c) 5 (d) 6

(ii) What happens to the brightness of bulbs x and y, respectively, when the switch (K) is closed?

(a) Increases, does not change. (b) Increases, increases.

(c) Decreases, increases. (d) Does not change, decreases.

132 In the opposite electric circuit, there are six identical bulbs:



(i) How many of these bulbs will remain lit when switches K_1 and K_2 are closed?

(a) 1 (b) 2 (c) 4 (d) 6

(ii) What happens to the brightness of bulbs O and M, respectively, when only switch K_1 is closed?

(a) Increases, decreases. (b) Increases, vanishes.

(c) Vanishes, decreases. (d) Vanishes, increases.

(iii) Which bulb, P or N, will have a higher brightness when only switch K_2 is closed?

(a) Bulb P (b) Bulb N

(c) Both bulbs will have the same brightness.

(d) The answer cannot be determined.

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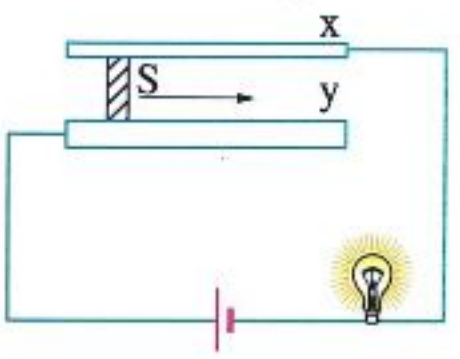
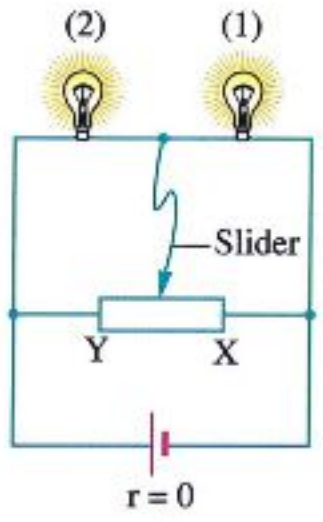
133 In the opposite electric circuit two rods x and y of the same metal have the same length but the cross-sectional area of y is double that of x and they are connected together via a copper slider (S), if the slider is moved in the shown direction, the brightness of the lamp ..... .



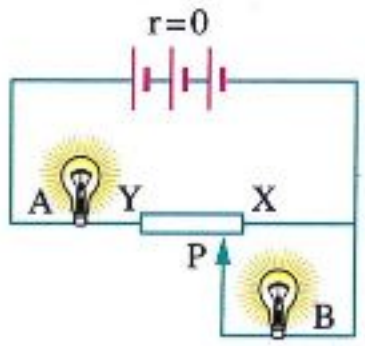
(a) increases.
(b) decreases till it vanishes.
(c) doesn't change.
(d) decreases but doesn't vanish.

134 ✱ In the opposite electric circuit, the two lamps are identical and when the slider is positioned in the middle of the resistance wire XY, the brightness of the two identical lamps (1) and (2) become equal, so if the slider is moved slightly towards X, what will happen to the brightness of the two lamps?



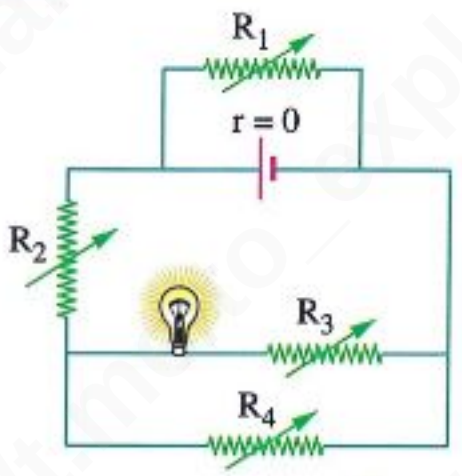
	Brightness of lamp (1)	Brightness of lamp (2)
(a)	Increases	Increases
(b)	Increases	Decreases
(c)	Decreases	Increases
(d)	Decreases	Decreases

135 ✱ In the opposite circuit, rod XY of resistance 10 Ω and two identical lamps A and B each of resistance 10 Ω, what happens to the light of the bulbs A and B when the slider P moves from its position towards point Y?



	Bulb A	Bulb B
(a)	Does not change	Increases
(b)	Increases	Increases
(c)	Decreases	Does not change
(d)	Increases	Decreases

136 In the opposite electrical circuit, which of the shown variable resistors, when its value is increased, leads to an increase in the brightness of the lamp?



(a) Resistor R_1
(b) Resistor R_2
(c) Resistor R_3
(d) Resistor R_4

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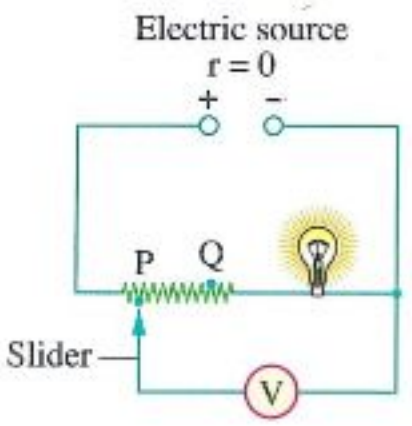
137 ✱ In the opposite electric circuit, what happens to the brightness of the bulb and the reading of the voltmeter when the slider moves from P to Q?



	The brightness of the bulb	The voltmeter reading
(a)	Increases	Decreases
(b)	Increases	Increases
(c)	Does not change	Decreases
(d)	Does not change	Increases

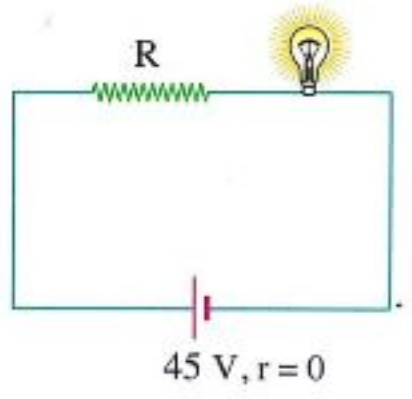
138 Two electric bulbs 1 and 2 of resistances R_1, R_2 respectively are connected in series with an electric source, if $R_1 < R_2$, then ..... .

(a) the brightness of bulb 1 is greater
(b) the brightness of bulb 2 is greater
(c) the two bulbs have the same brightness
(d) the answer is indeterminable

139 Two electric bulbs 1 and 2 of resistances R_1, R_2 respectively are connected in parallel with an electric source, if $R_1 > R_2$, then ..... .

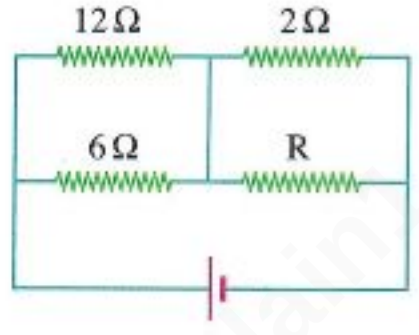
(a) the brightness of bulb 1 is greater
(b) the brightness of bulb 2 is greater
(c) the two bulbs have the same brightness
(d) the answer is indeterminable

140 ✱ In the opposite electric circuit, the electric bulb is labelled with (30 V, 45 W), so the resistance of R that makes the bulb glows according to its labelled specifications of voltage and power equals ..... .



(a) 1.5 Ω
(b) 10 Ω
(c) 15 Ω
(d) 67.5 Ω

141 In the opposite electrical circuit, if the electrical powers consumed in the 12 Ω and 2 Ω resistors are 48 W and 32 W, respectively, then the electrical power consumed in resistor R equals ..... .



(a) 16 W
(b) 64 W
(c) 75 W
(d) 81 W

142 Three resistors x, y and z whose values are R, 2 R and 0.5 R respectively that are connected in series in a closed electric circuit, the ratio of the consumed electric power in each of them is ..... respectively.

(a) 4 : 2 : 1
(b) 2 : 3 : 1
(c) 2 : 4 : 1
(d) 2 : 3 : 4

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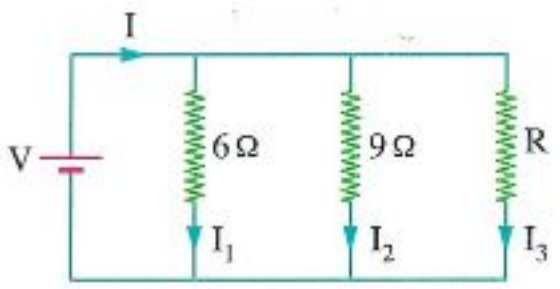
143 ✱ In the opposite electric circuit, if the consumed electric power in resistor R is 12 W and the value of $I_1 = 2$ A, so:



(i) The potential difference between the terminals of the battery equals ..... .

(a) 24 V (b) 12 V (c) 6 V (d) 3 V

(ii) The total current intensity in the circuit equals ..... .

(a) $\frac{4}{3}$ A (b) $\frac{13}{3}$ A (c) $\frac{7}{3}$ A (d) 1 A

(iii) The resistance of R equals ..... .

(a) 24 Ω (b) 18 Ω (c) 12 Ω (d) 9 Ω

---

144 When two resistors R, 4 R are connected in parallel with a battery, then the consumed power in resistor R is ..... the consumed power in resistor 4 R.

(a) four times (b) double (c) equal to (d) quarter

---

145 ✱ Two resistors have resistances of 10 Ω and R, the consumed power through them when they are connected in parallel with a battery of negligible internal resistance is four times the power consumed through them when they are connected in series with the same battery, then the value of R equals ..... .

(a) 10 Ω (b) 7.5 Ω (c) 5 Ω (d) 2.5 Ω

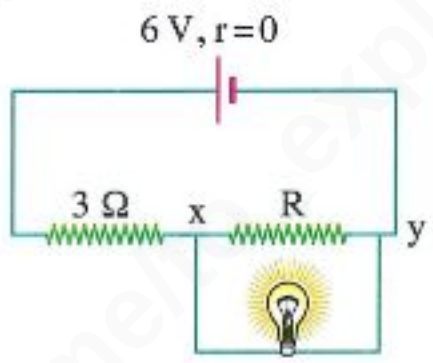
---

146 Two different conductors that are made of the same material are connected together in parallel with a potential difference that equals 220 V. If the length of the first conductor is double that of the second conductor and the diameter of the first conductor is double that of the second conductor, then the ratio between the consumed electric powers in the two conductors $\left(\frac{(P_w)_1}{(P_w)_2}\right)$ equals ..... .

(a) $\frac{4}{1}$ (b) $\frac{2}{1}$ (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

---

147 ✱ In the opposite electric circuit, if the potential difference between the terminals of the bulb is 1.5 V, the equivalent resistance between the two points x and y equals ..... .



(a) 0.45 Ω (b) 1 Ω

(c) 5 Ω (d) 3 Ω

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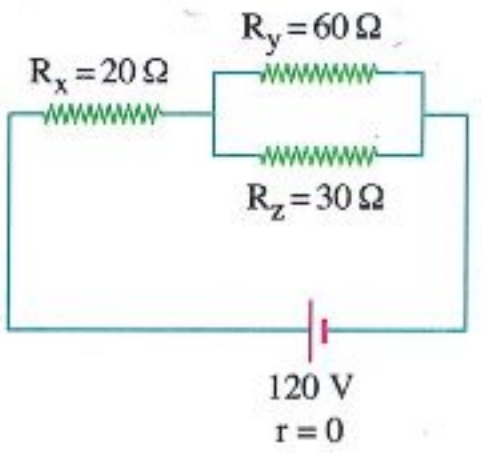
148 From the opposite circuit:



(i) The total consumed power in the circuit equals ..... .

(a) 120 W (b) 240 W

(c) 360 W (d) 480 W

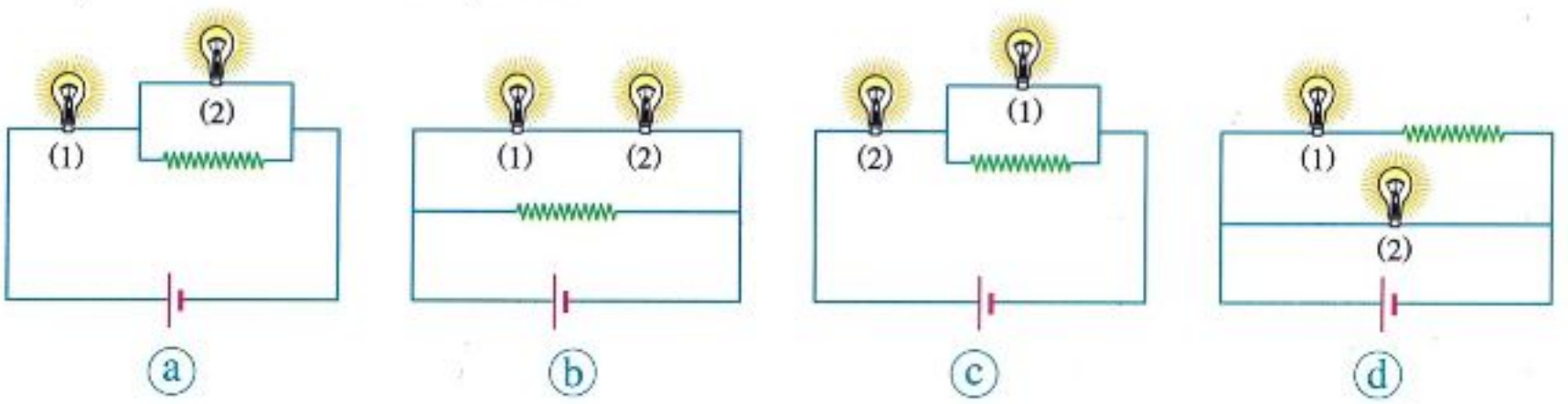
(ii) The ratio of the consumed power in R_y to that in R_x $\left(\frac{(P_w)_y}{(P_w)_x}\right)$ equals ..... .

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{3}{1}$

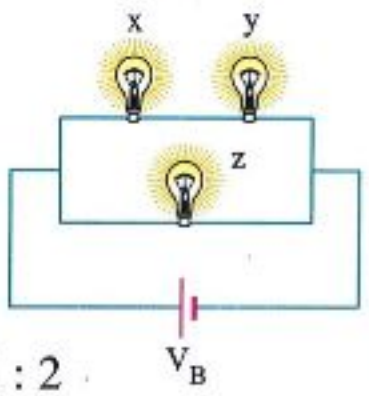
(iii) Which of the following represents the ratios of the consumed power in the three resistors x, y and z respectively?

(a) 3 : 1 : 2 (b) 1 : 1 : 1 (c) 2 : 3 : 1 (d) 3 : 2 : 1

149 Two lamps, (1) and (2), are connected together with a resistor and a battery in several ways as shown in the following electrical circuits. If lamp (1) is labelled (120 V - 60 W) and lamp (2) is labelled (120 V - 120 W), which of the following circuits allows the lamps to operate at their labelled powers?



150 ✱ In the opposite electric circuit, three identical electric bulbs x, y and z are connected together with a battery of negligible internal resistance, then the ratio between the consumed power in the three bulbs $(P_w)_x : (P_w)_y : (P_w)_z$ respectively is .....

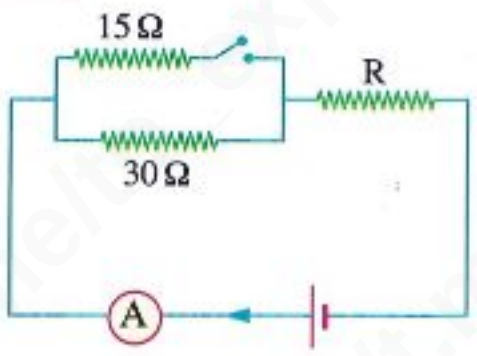


(a) 1 : 1 : 4 (b) 1 : 1 : 1 (c) 4 : 4 : 1 (d) 1 : 1 : 2

151 ✱ Three identical bulbs are connected once in series and another in parallel to the same electric source, so the ratio $\left(\frac{(P_w)_{series}}{(P_w)_{parallel}}\right)$ equals ..... .

(a) $\frac{4}{3}$ (b) $\frac{9}{5}$ (c) $\frac{1}{9}$ (d) $\frac{3}{4}$

152 ✱ In the opposite electric circuit, if you know that when closing the switch, the consumed electric power in the circuit increases to the double, so the resistance of R is ..... .



(a) 3 Ω (b) 6 Ω

(c) 8 Ω (d) 10 Ω

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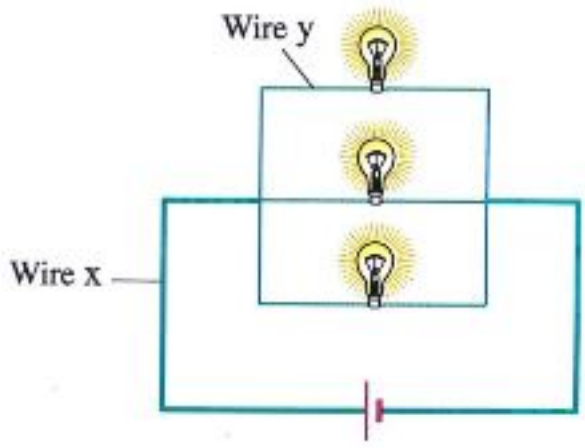
Second Essay questions

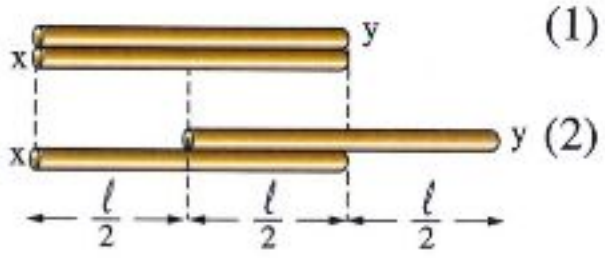
1 The opposite figure shows an electric heater which is equipped with two heating components. **Are** the two components connected in parallel or in series? **And why**?

2 The opposite figure represents an electric circuit. **Explain why** the thickness of wire x is preferable to be greater than that of y.



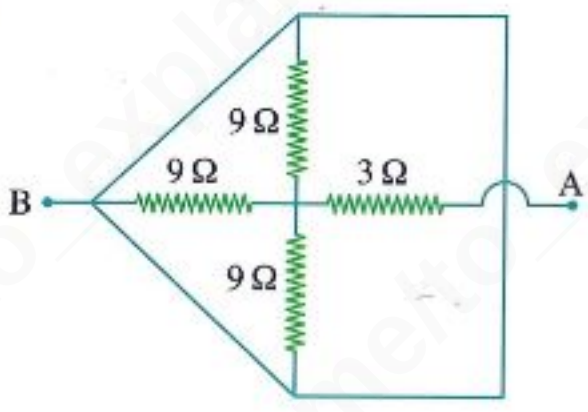
3 A wire of uniform cross-section and resistance R is reshaped in the form of a rectangle abcd that its length ab is double its width bc as shown in the opposite figure, **which** two points are connected to an electrical source to obtain the greatest equivalent resistance?

4 Two non-isolated identical wires, each of uniform cross-sectional areas, length ℓ and electric resistance R, touch each other side by side in ways (1) and (2) as shown in the opposite figure. **What** is the ratio of the equivalent resistance between point x and y in the two cases $\left(\frac{R_1}{R_2}\right)$?

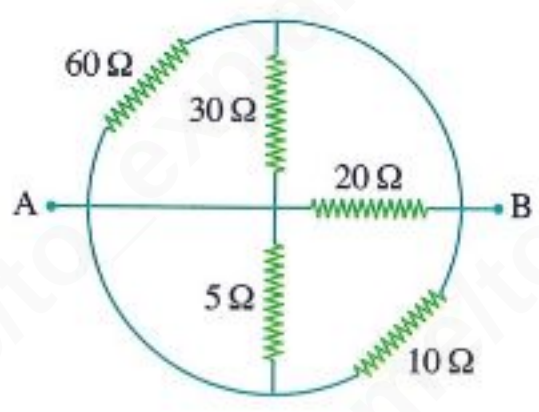


5 **Calculate the equivalent resistance between points A and B in each of the following cases:**

(a)



(b)



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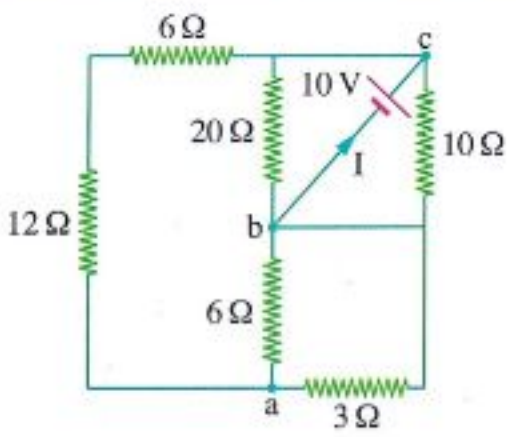
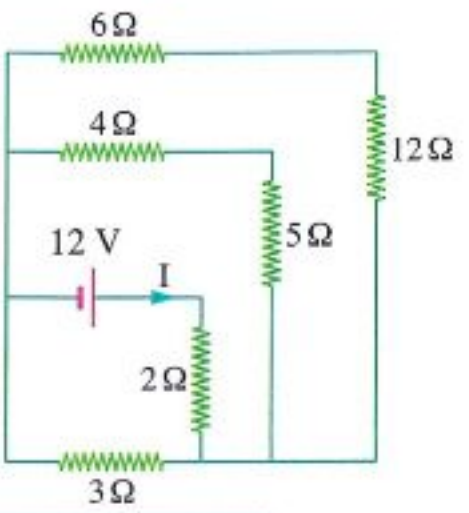
6 **Calculate the intensity of current (I) in each of the following circuits:**

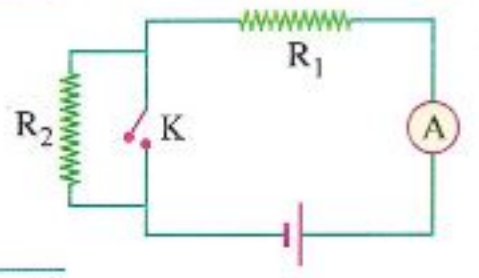
(a)



(b)



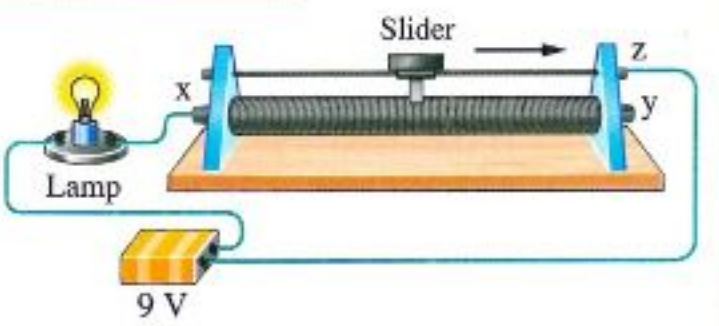
7 In the opposite electric circuit, **explain what happens to** the reading of the ammeter when switch K is closed.



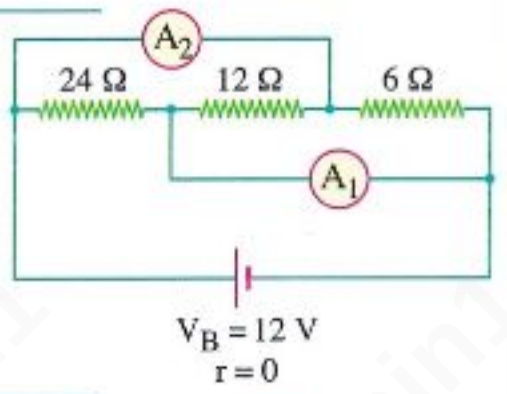
8 An electric circuit consists of a source whose electromotive force is 130 V and its internal resistance is negligible. It is connected to two resistors 300 Ω, 400 Ω in series, **calculate** the reading of the voltmeter whose resistance is 200 Ω if it is connected between the terminals of:

(a) Resistor 300 Ω. **(b)** Resistor 400 Ω.

9 The opposite figure shows a sliding rheostat connected in series to an electric lamp and a battery 9 V of negligible internal resistance, **what happens to** the potential difference between the terminals x and z when the slider moves towards terminal z? **Why**?



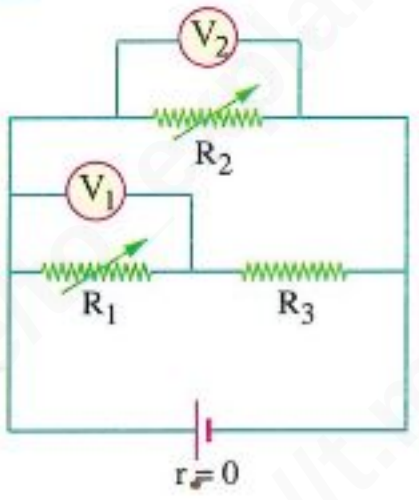
10 In the opposite electric circuit, **calculate** the ratio between the readings of the ammeters $\left(\frac{A_1}{A_2}\right)$.



11 **In the opposite electric circuit, explain what happens when increasing:**

(a) The variable resistance R_1

(b) The variable resistance R_2



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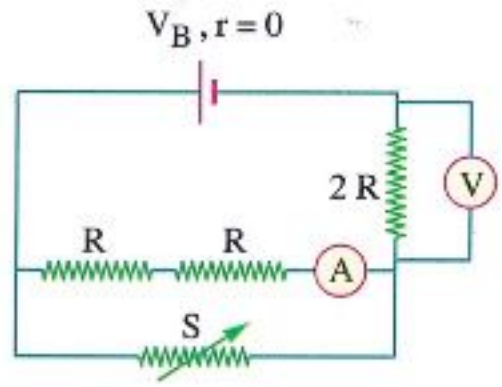
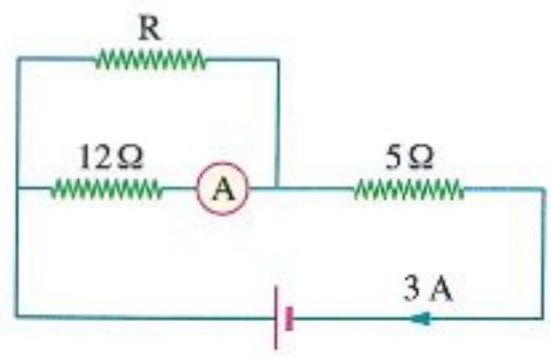
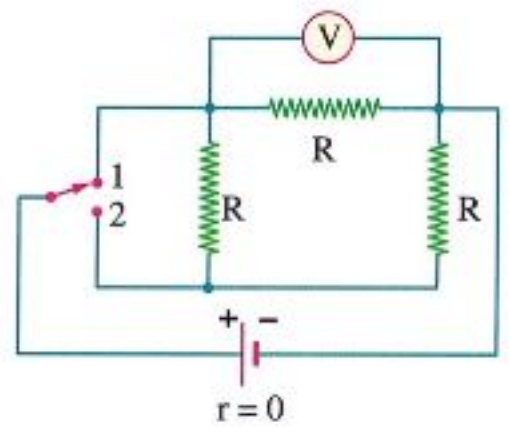
12 The opposite figure represents a closed electric circuit, **explain why** a change in the readings of the ammeter and voltmeter occurs when the resistance of the variable resistor (S) increases.



13 In the opposite circuit, if the ammeter reading is 1 A. **Calculate** the equivalent resistance in the circuit.



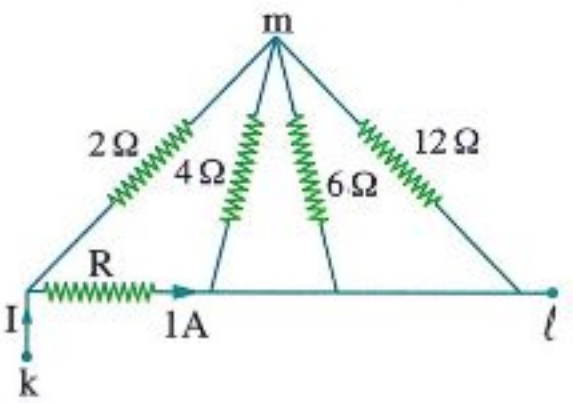
14 In the opposite electric circuit, **explain what happens to** the reading of the voltmeter when changing the switch position from position (1) to position (2).



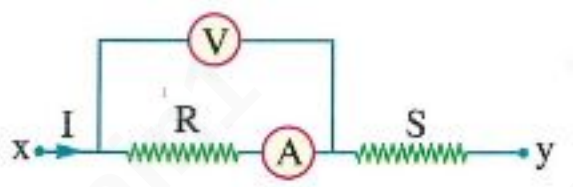
15 The opposite figure represents a part of an electric circuit where the potential difference between the two points k and ℓ equals 50 V and the current intensity passing in the resistor R equals 1 A, **calculate:**

(a) The potential difference between the points k and m.

(b) The resistance of resistor R.



16 In the opposite figure, if the potential difference between the points x and y equals 20 V and the ammeter reading is 1 A while the voltmeter reading is 5 V. **Calculate** the value of each of resistances R and S.



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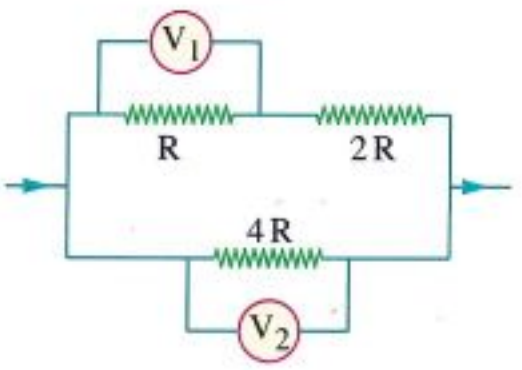
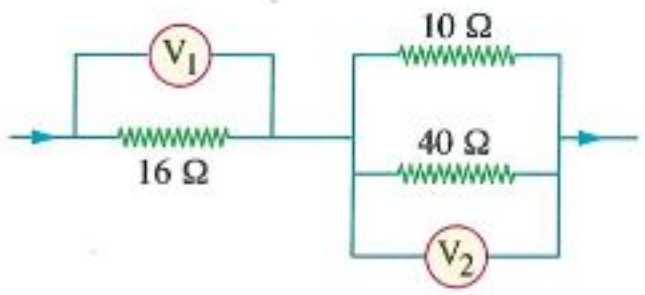
17 **In each figure from the following, if the voltmeter reading V_1 equals 12 V. Calculate the reading of voltmeter V_2:**

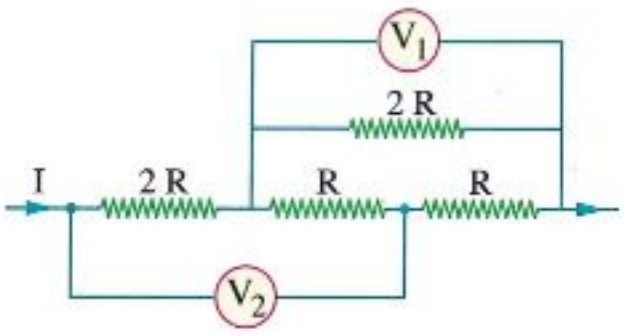
(a)



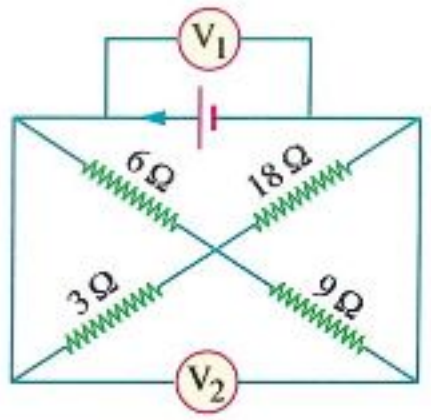
(b)



(c)



(d)



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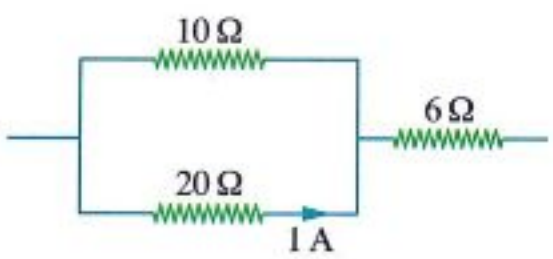
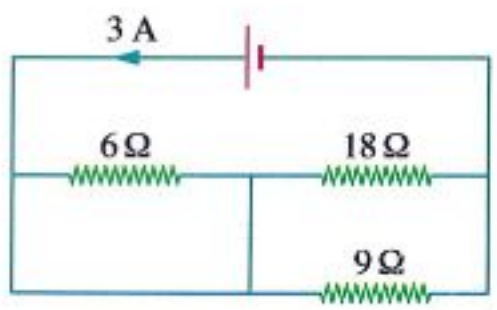
18 **Calculate the electric current intensity (I) passing in the 6 Ω resistance in each of the following:**

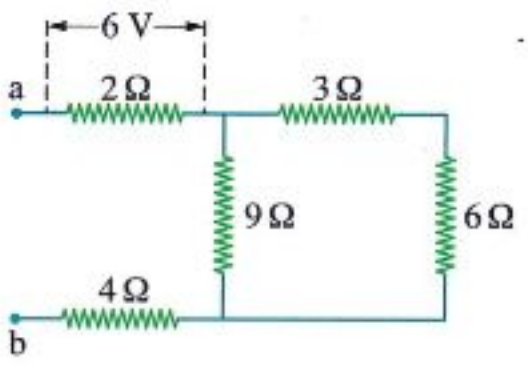
(a)



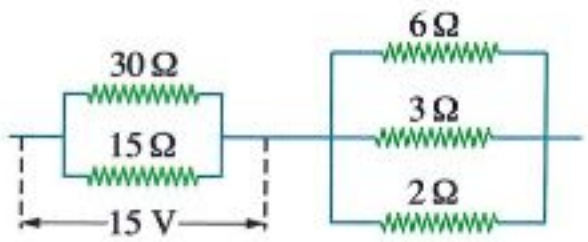
(b)



(c)



(d)



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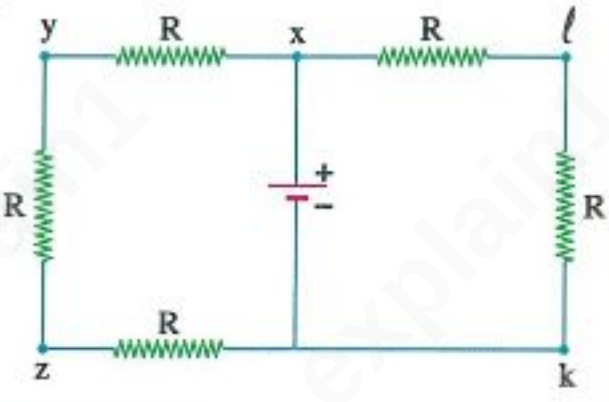
19 In the opposite electric circuit, **arrange** the points x, y, z, k, ℓ descendingly according to the electric potential of each one.



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20 Six identical bulbs, each one works on a maximum potential difference of 100 V. The bulbs were required to be operated on a potential difference of 200 V, **explain how** these bulbs can be connected together such that each of them carries its maximum current?

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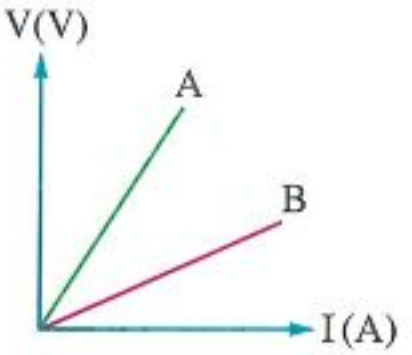
21 Three resistances 10 Ω, 20 Ω and 40 Ω are connected together in a certain method to an electric source, so electric currents of intensities 0.4 A, 0.5 A and 0.1 A pass in these resistances respectively. **What** is its equivalent resistance?

---

22 The opposite graph illustrates the relation between the potential differences (V) across two wires A and B and the electric current (I) which is passing in each of them.



(a) **Which** of the two wires has larger electric resistance? **And why**?

(b) If the two wires are connected together in parallel with an electric source, **which of them** consumes higher electric power? **And why**?

---

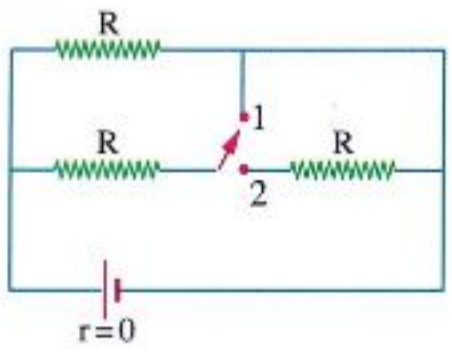
23 Four lamps each of resistance 6 Ω are connected together in parallel. Then the combination is connected to a battery of an emf 12 V and negligible internal resistance, **calculate:**

(a) The total charge which is leaving the battery in 10 s.

(b) The consumed power in each lamp in 10 s.

---

24 In the opposite circuit, **deduce** the ratio between the consumed power in the circuit in the case of closing the switch in position (1) and that in case of closing the switch in position (2).



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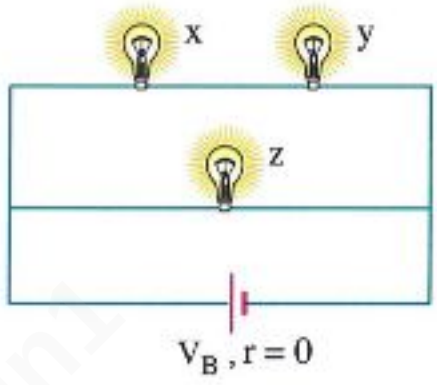
25 Three lamps x, y and z of resistances R, 2 R and 4 R respectively are connected with an electric source V_B of negligible internal resistance as shown in the opposite figure. **Determine with explanation** which of the three lamps consumes larger electric power.



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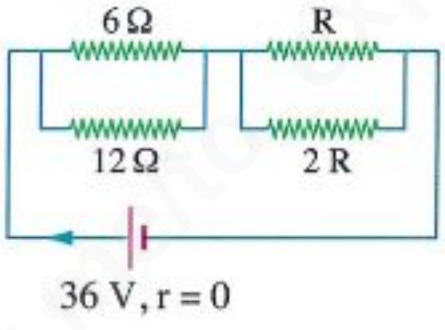
26 In the opposite circuit, if the consumed power in the 6 Ω resistance is 24 W, **calculate** the consumed power in resistance R.



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27 Two students (N) and (M) constructed an electric circuit using three identical lamps, a switch and an electrical source as shown in the following two figures:

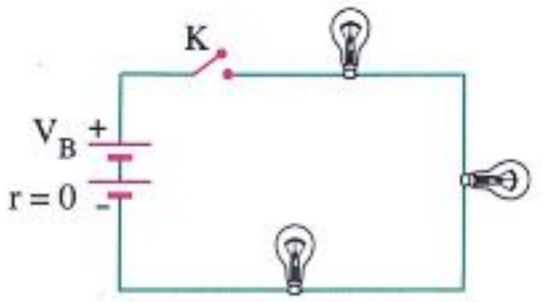


Figure (1)

The circuit of student (M)

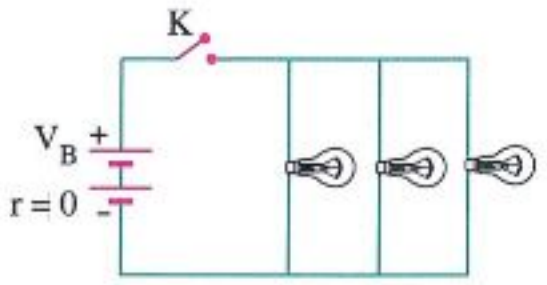


Figure (2)

The circuit of student (N)

(a) **Compare between** the brightness of lamps in each of the two circuits when closing the switch K.

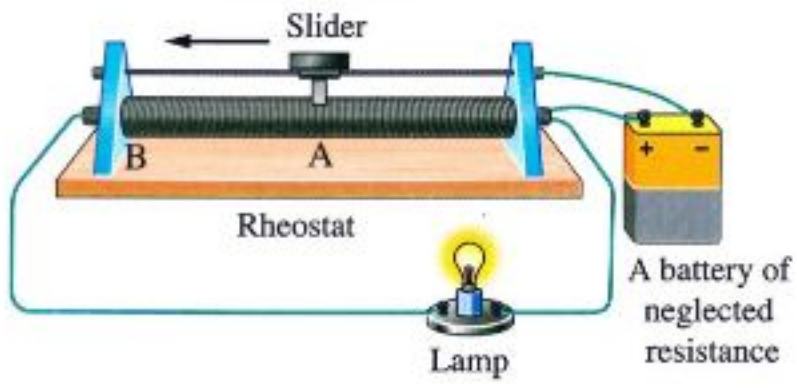
(b) **What happens for** the brightness of lamps in each of the two circuits when one of them is damaged?

---

28 In the opposite electric circuit, **explain what happens to** the brightness of the lamp when:

(a) Moving the slider of rheostat from position A to position B.

(b) Replacing the positions of lamp and battery and moving the slider from A to B.



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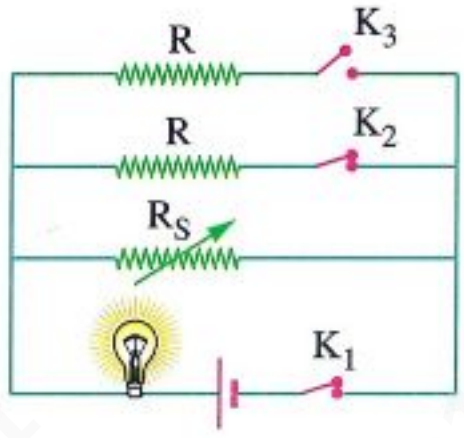
29 In the opposite electric circuit, **how** to increase the brightness of the lamp by two different methods?



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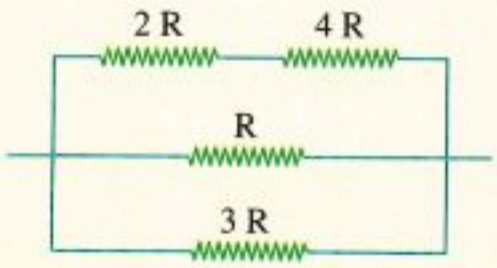
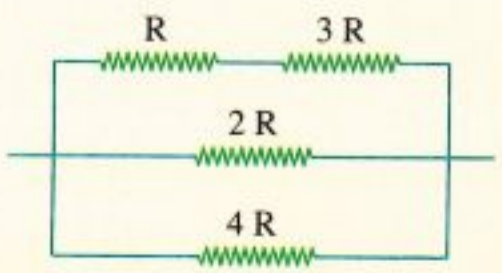
Questions of the Previous Years Exams ? on Lesson 2

1 Which combination of the following resistors gives an equivalent resistance of value R?

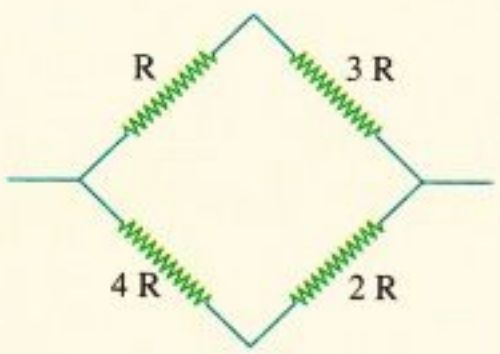
(Exp. May 21)



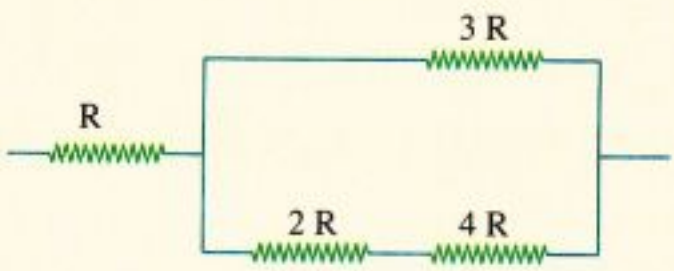
(a)



(b)

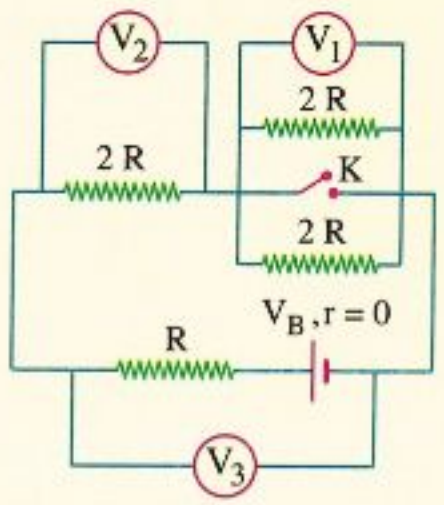


(c)



(d)

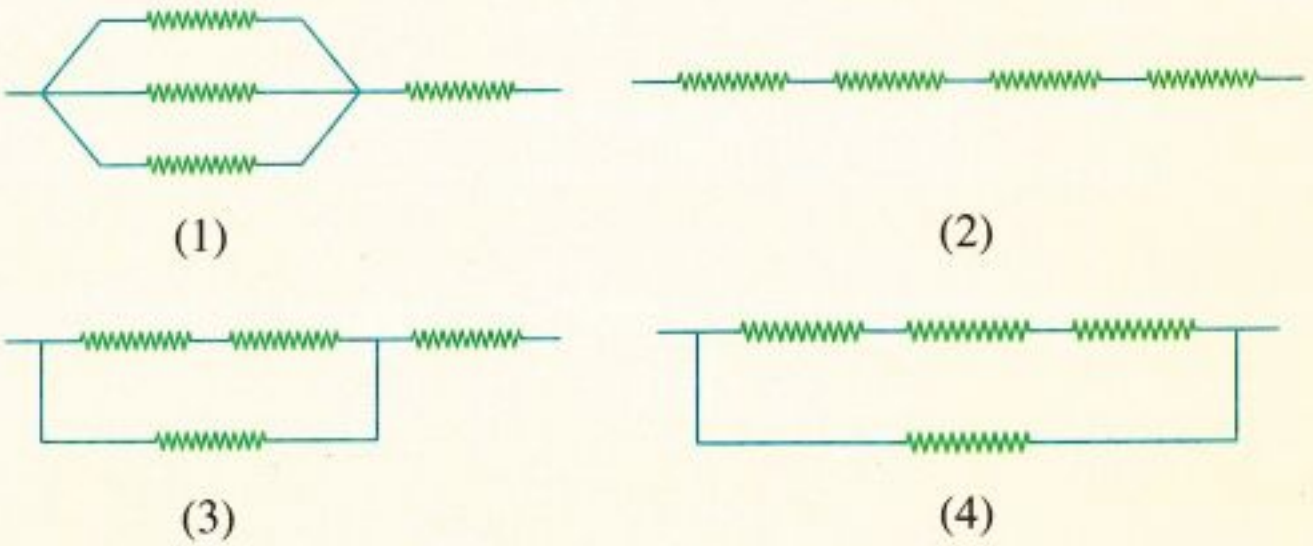
2 In the opposite electric circuit, when closing the switch (K), which of the following rows shows what happens to the readings of the voltmeters V_1, V_2 and V_3 correctly? *(Exp. May 21)*



	V_1	V_2	V_3
(a)	Becomes zero	Increases	Decreases
(b)	Increases	Increases	Decreases
(c)	Becomes zero	Decreases	Increases
(d)	Increases	Increases	Increases

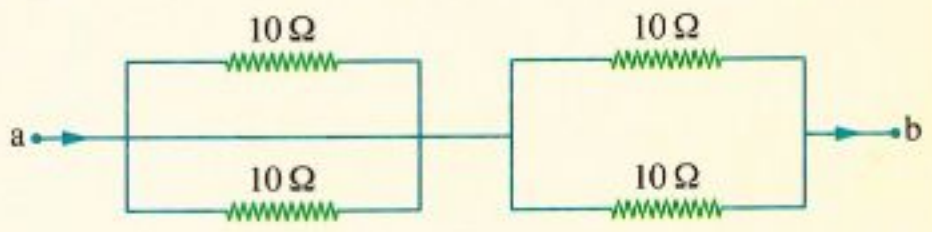
https://t.me/to_explain1

3 Four equal resistors are connected together as in the following figures, so the correct arrangement of the figures from the highest equivalent resistance to the least one is ..... . *(Exp. June 21)*



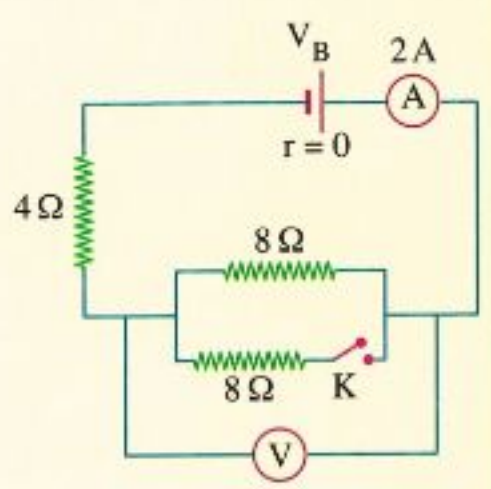
(a) $4 < 3 < 2 < 1$
(b) $1 < 2 < 3 < 4$
(c) $4 < 1 < 3 < 2$
(d) $1 < 4 < 2 < 3$

4 In the opposite electric circuit, the equivalent resistance between points a and b equals ..... . *(Exp. June 21)*



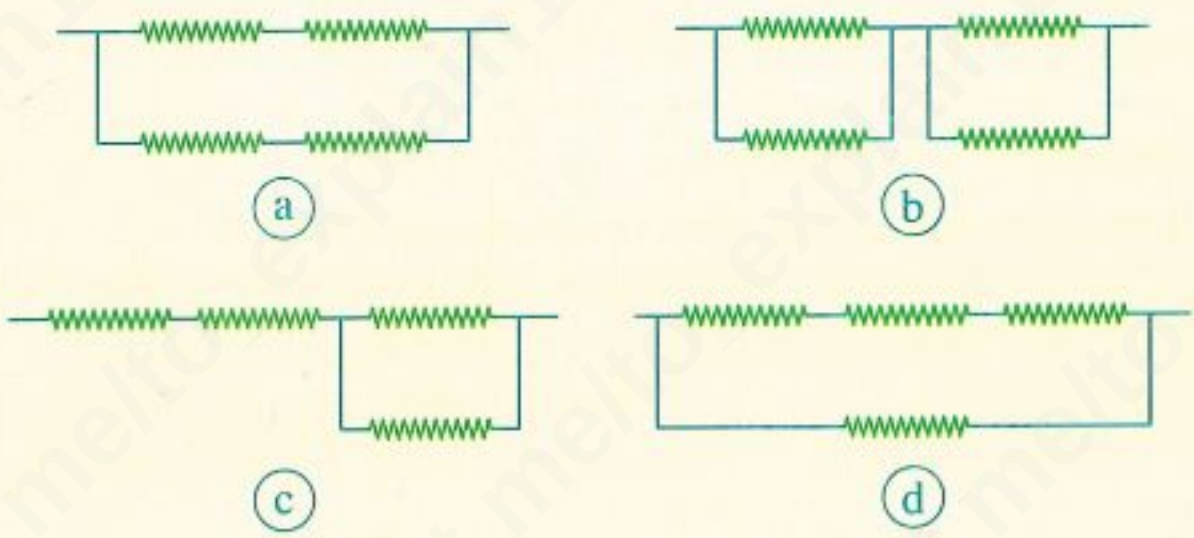
(a) 5 Ω (b) 10 Ω (c) 20 Ω (d) 40 Ω

5 In the opposite electric circuit, when the key (K) is closed, the voltmeter reading equals ..... . *(Exp. June 21)*



(a) 12 V
(b) 8 V
(c) 6 V
(d) 4 V

6 Four equal resistors are connected together as in the following figures, which figure gives the least equivalent resistance? *(1st session 21)*



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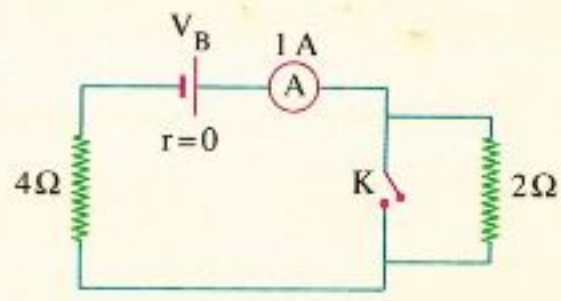
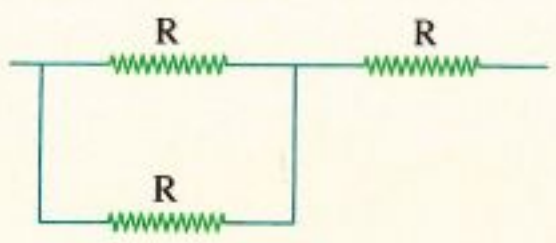
7 In the opposite electric circuit, when the key (K) is closed, the ammeter reading becomes ..... . *(1st session 21)*

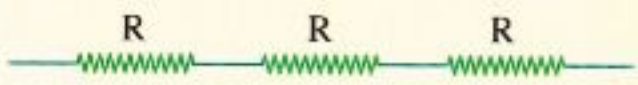


(a) 0.5 A
(b) 1.5 A
(c) 2 A
(d) 0.75 A

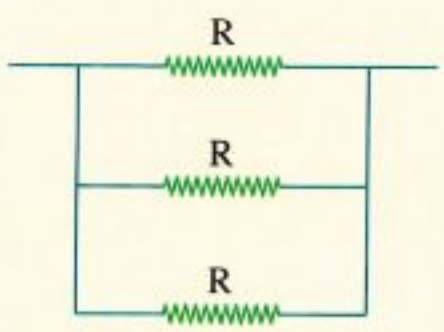
8 Arrange the figures according to their equivalent resistance ascendingly given that the resistors are identical. *(2nd session 21)*



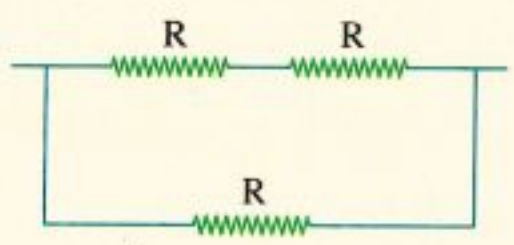
(1)



(2)



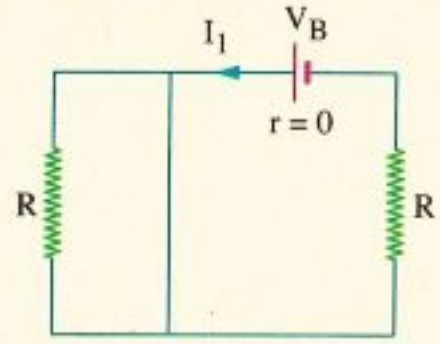
(3)



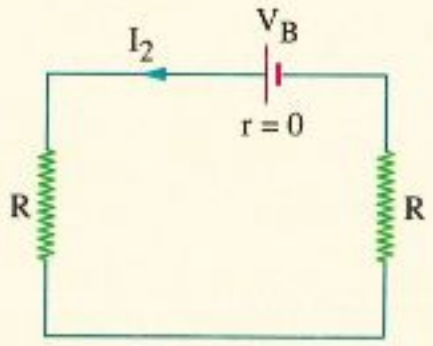
(4)

(a) 3 < 4 < 1 < 2
(b) 2 < 4 < 3 < 1
(c) 1 < 3 < 4 < 2
(d) 4 < 3 < 2 < 1

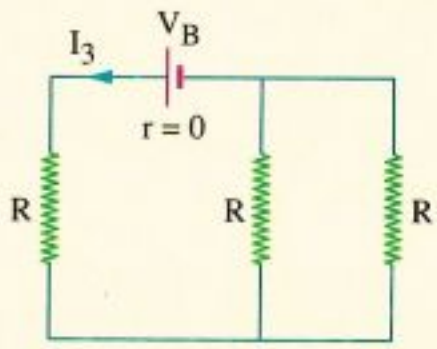
9 In the shown three electric circuits (1), (2) and (3). Which one from the following relations is correct? *(2nd session 21)*



(1)



(2)



(3)

(a) $I_1 = I_2$
(b) $I_1 > I_3$
(c) $I_2 > I_3$
(d) $I_3 > I_1$

10 A uniform cross-sectional copper wire was shaped as a rectangle {kyxm} as in the figure, its length (ky) is double its width (mk), which two terminals should be connected to the electric source to obtain the greatest electric resistance? *(1st session 22)*

(a) m, k
(b) k, y
(c) x, y
(d) k, x

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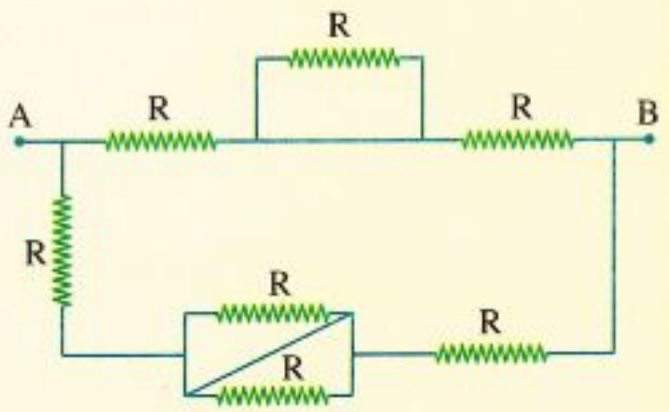
11 Two electric resistors, the resistance of the first is three times as that of the second. When they are connected in parallel, they give an equivalent resistance of 3 Ω, then when they are connected in series gives ..... . *(1st session 22)*

(a) 12 Ω (b) 16 Ω (c) 8 Ω (d) 4 Ω

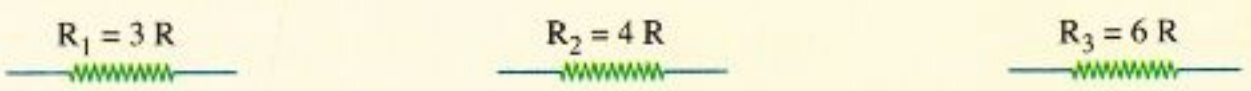
12 The figure shows a part of a closed electric circuit that contains a group of identical resistors. The equivalent resistance between the two points (A) and (B) equals ..... . *(2nd session 22)*



(a) $\frac{6\,R}{5}$ (b) $\frac{5\,R}{4}$

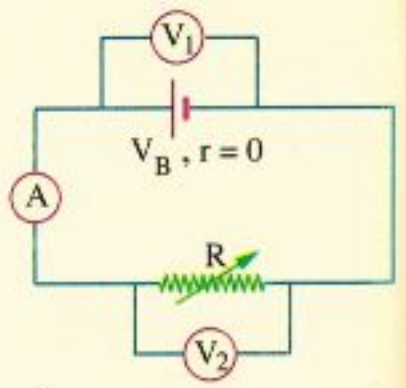
(c) $\frac{3\,R}{2}$ (d) R

13 You have three resistors R_1, R_2 and R_3 as shown in the figure. When they are connected in parallel, they give an equivalent resistance 4 Ω, then when they are connected in series, they give an equivalent resistance ..... . *(2nd session 22)*



(a) 9 Ω (b) 27 Ω (c) 13 Ω (d) 39 Ω

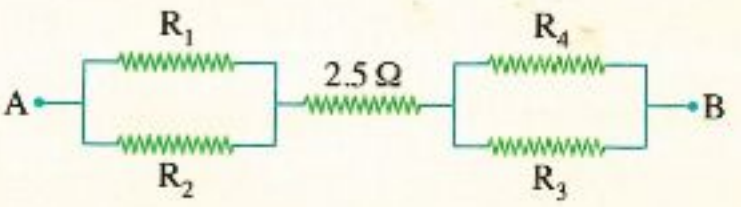
14 In the electrical circuit in front of you, when the value of resistance (R) increases. Then, the reading of V_1 ..... and the reading of V_2 ..... . *(1st session 22)*



	V_1	V_2
(a)	does not change	does not change
(b)	increases	increases
(c)	increases	does not change
(d)	does not change	increases

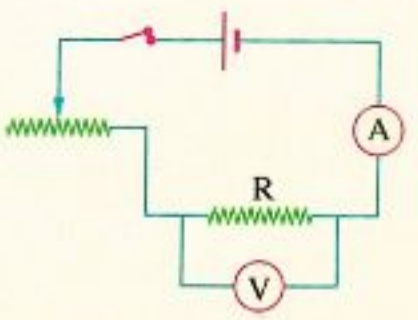
https://t.me/to_explain1

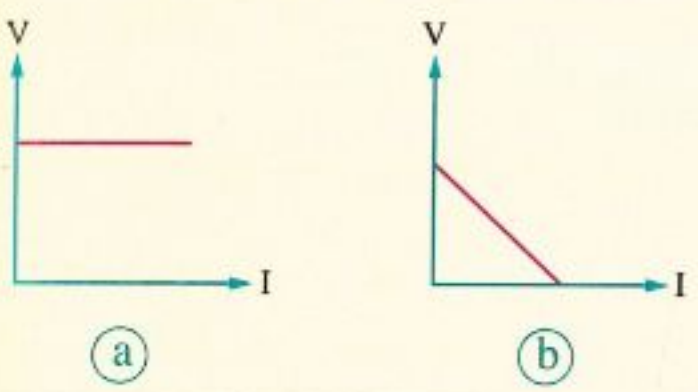
15 In the opposite figure, which of the following choices makes the resistance between A and B equals 5 Ω? *(Exp. 23)*



	R_1 (Ω)	R_2 (Ω)	R_3 (Ω)	R_4 (Ω)
(a)	2	9	8	2.5
(b)	1	9	2	8
(c)	1	2	8	9
(d)	8	1	9	5

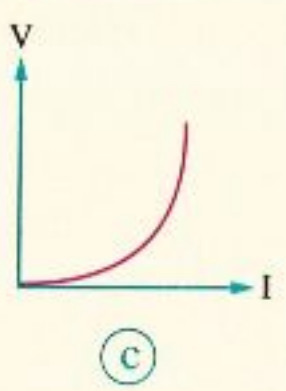
16 Which graph represents the correct relation between the electric potential difference (V) across the two terminals of the fixed resistance (R) and the ammeter reading (I) at the same temperature? *(1st session 23)*



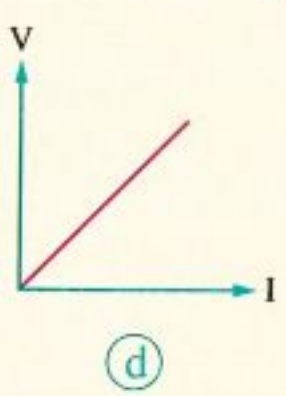


(a)

(b)

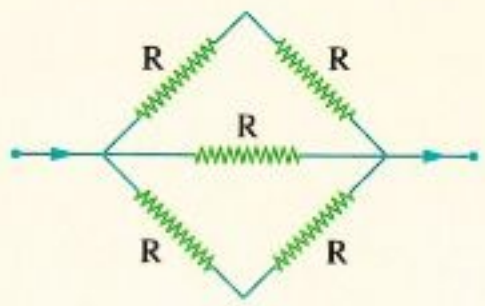


(c)



(d)

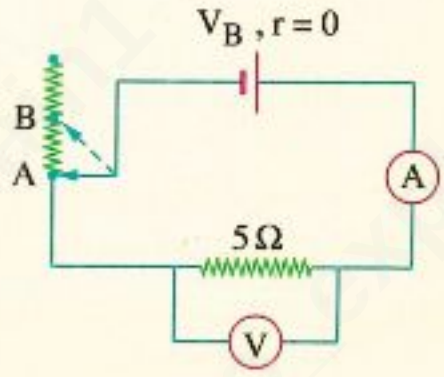
17 The figure represents a part from a closed electric circuit. The equivalent resistance of the shown combination equals ..... . *(1st session 23)*



(a) R (b) 2 R

(c) $\frac{R}{2}$ (d) $\frac{3R}{5}$

18 In the electric circuit, if the voltmeter reading when the slider of the rheostat is at (A) was 12 V and when the slider is moved to point (B), the voltmeter reading was 3 V. The value of the resistance taken from the rheostat at (B) is ..... . *(1st session 23)*



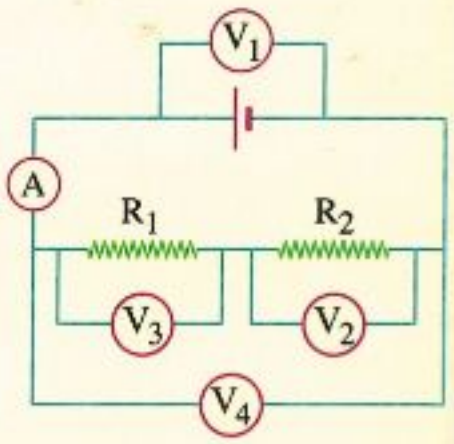
(a) 25 Ω (b) 30 Ω

(c) 15 Ω (d) 20 Ω

https://t.me/to_explain1

19 In the shown electric circuit:

Which readings of those voltmeters are equal? *(2nd session 23)*



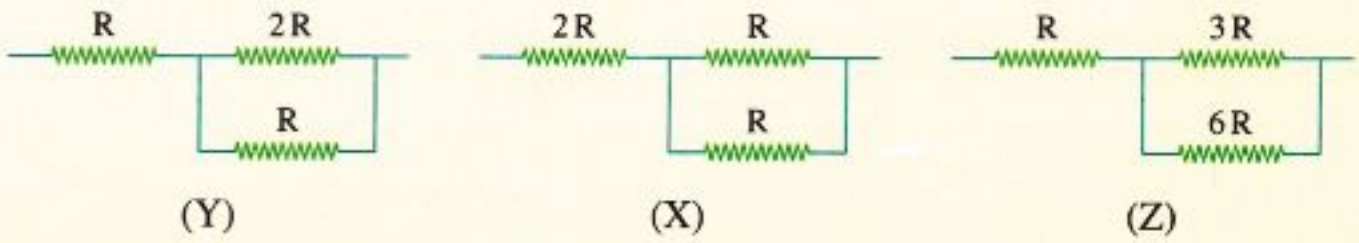
(a) V_2, V_3

(b) V_2, V_4

(c) V_2, V_1

(d) V_1, V_4

20 The figures show a number of resistors connected to each other.



(Y) (X) (Z)

Which of the following expressions is correct concerning the equivalent resistance of each combination? *(1st session 24)*

(a) The equivalent resistance of combination (X) equals that of combination (Y).

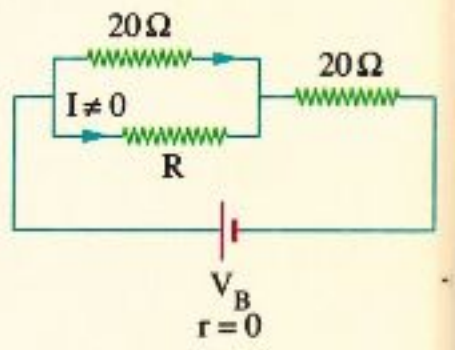
(b) The equivalent resistance of combination (X) is less than that of combination (Y).

(c) The equivalent resistance of combination (Z) is less than that of combination (X).

(d) The equivalent resistance of combination (Z) is more than that of combination (Y).

21 From the opposite electric circuit:

Which choice is possible to express the total resistance of the circuit? *(2nd session 24)*



(a) 19 Ω (b) 25 Ω

(c) 15 Ω (d) 40 Ω

22 When two different resistors are connected together in parallel, their equivalent resistance will ..... . *(Exp. 25)*

(a) be equal to the sum of the resistors

(b) have an average value between the values of the two resistors

(c) be less than the smaller resistance

(d) be greater than the larger resistance

23 A uniform wire of resistance 120 Ω is cut into a number of equal segments and when these wire segments are connected together in parallel, their total resistance becomes 1.2 Ω, so the number of these segments of the wire equals ..... . *(Exp. 25)*

(a) 6 (b) 10 (c) 12 (d) 24

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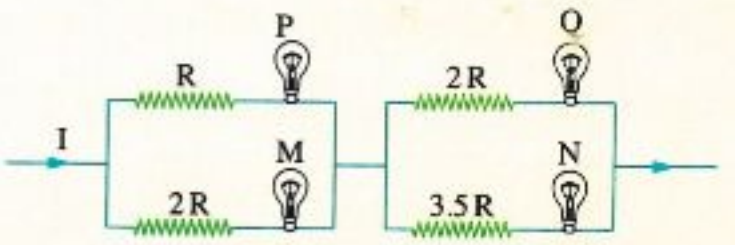
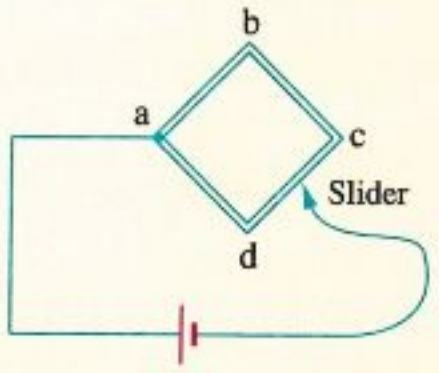
24 Four identical bulbs N, M, P and Q, the resistance of the filament of each is R, are connected to different resistors as shown in the opposite figure, then the brightness is the same for ..... . *(Exp. 25)*



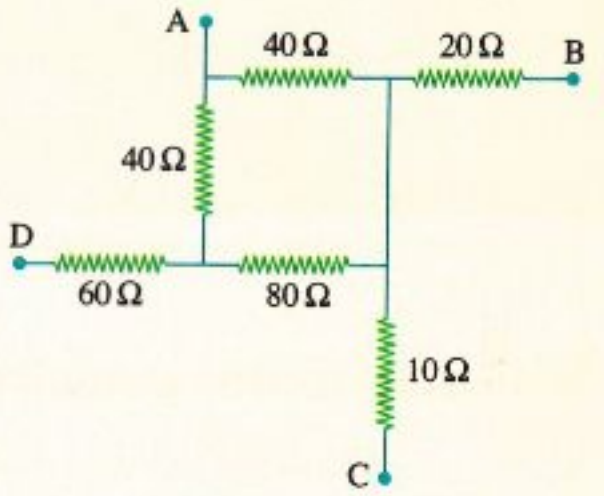
(a) both bulbs Q and M
(b) both bulbs M and N
(c) both bulbs P and N
(d) all the bulbs

25 A wire of uniform cross-section is bent to form a square abcd, of which each side has a resistance R, one of the poles of a battery is connected to point a on the frame. Then the point at which the other pole of the battery is connected so that the lowest current intensity passes in the circuit is ..... . *(Exp. 25)*



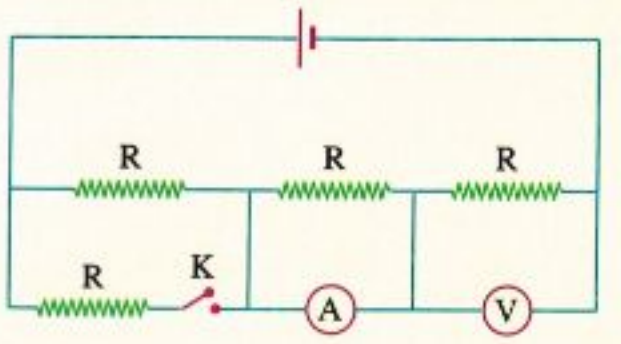
(a) a
(b) b
(c) c
(d) d

26 Resistors are connected as shown in the opposite figure. To which two points of the following should a battery terminals be connected in order to get the lowest equivalent resistance ? *(Exp. 25)*



(a) B, C
(b) A, B
(c) C, D
(d) A, D

27 In the opposite electrical circuit, if the voltmeter resistance is infinite and the ammeter resistance is negligible, what happens to the reading of each of the ammeter and the voltmeter respectively when switch (K) is closed? *(Exp. 25)*



(a) Increases, increases.
(b) Decreases, decreases.
(c) Decreases, increases.
(d) Increases, decreases.

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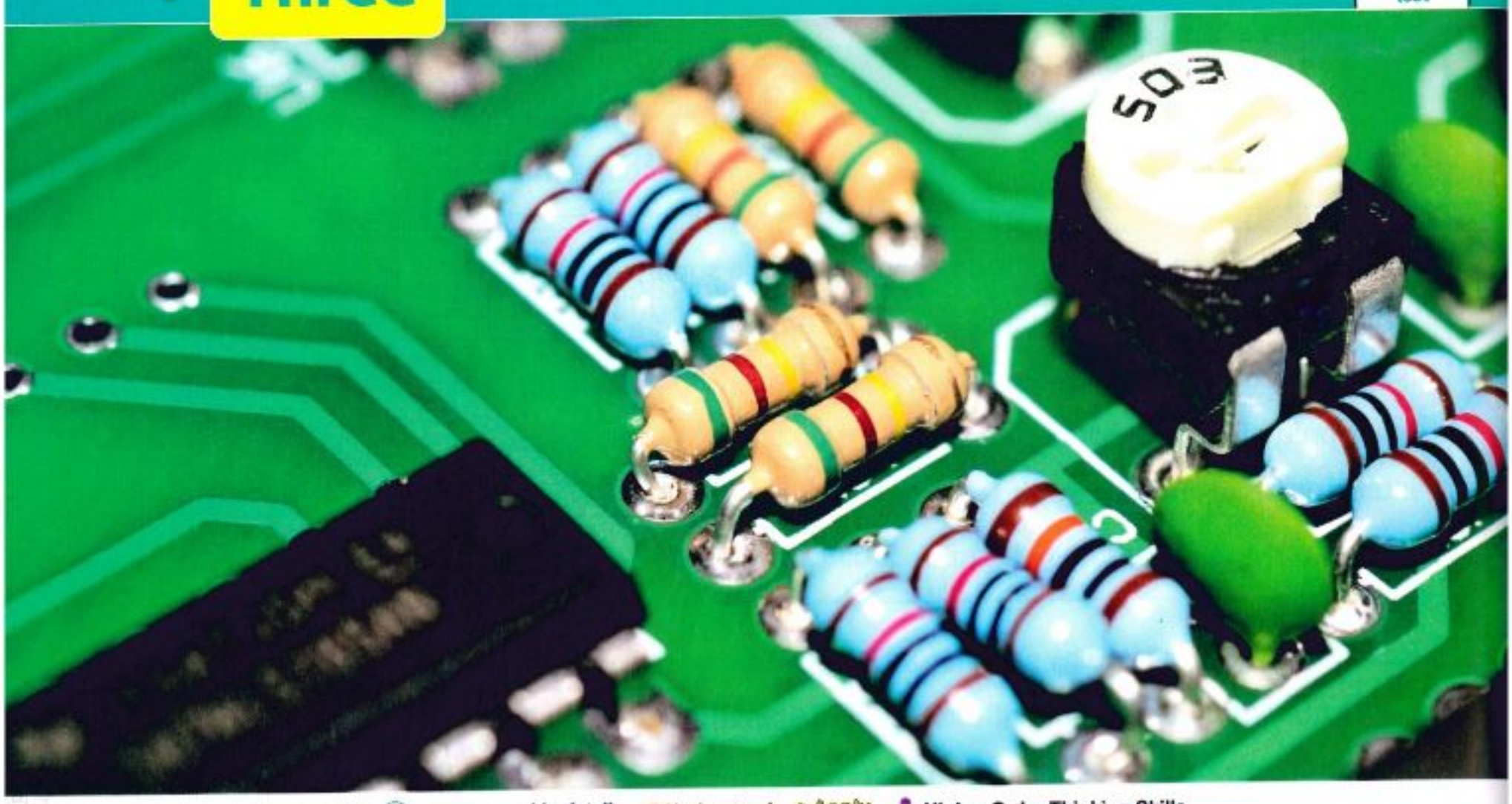
Chapter 1

Questions on Lesson Three

Ohm's Law for the Closed Circuit

Interactive test



The questions signed by ✳ are answered in detail. ● Understand ○ Apply ∴ Higher Order Thinking Skills

Important guidelines

Ohm's law for the closed circuit

$$V_B = V + Ir = IR + Ir = I(R + r)$$

To determine the electric current intensity (I) in a closed electric circuit:

$$I = \frac{V_B}{R + r} = \frac{V_B - V}{r}$$

- In the case of the absence of electric current ($I = 0$) then: $V = V_B$

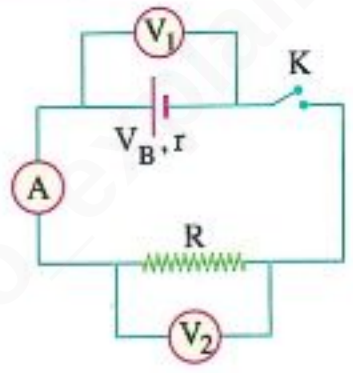
(1) In the following electric circuit if switch K is:

Opened

$I = 0$

$V_2 = 0$

$V_1 = V_B$



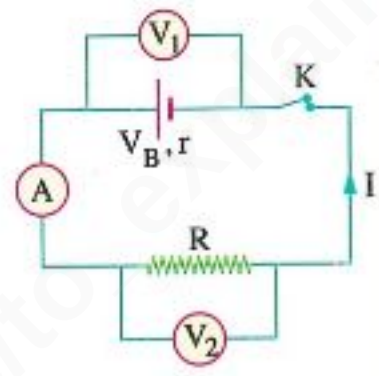
Closed

$$I = \frac{V_B}{R + r}$$

$$= \frac{V_B - V_1}{r} = \frac{V_2}{R}$$

$V_2 = IR$

$V_1 = V_B - Ir$



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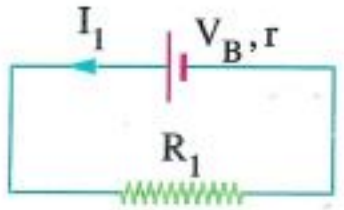
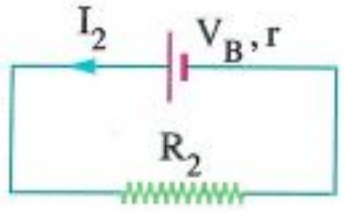
(2) When the external resistor R_1, which carries electric current of intensity I_1 is replaced by another R_2, the passing electric current intensity in the circuit changes to I_2 when using the same battery:



$$V_B = I_1 (R_1 + r)$$

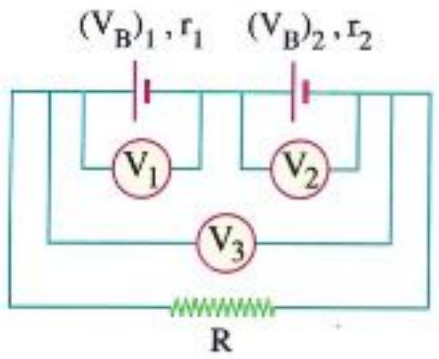


$$V_B = I_2 (R_2 + r)$$

Thus the two equations are solved algebraically to find the unknown values.

(3) When two electric cells are connected as follows:

①



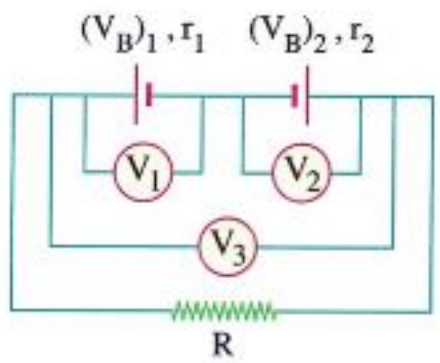
$$I = \frac{(V_B)_1 + (V_B)_2}{R + r_1 + r_2}$$

$V_1 = (V_B)_1 - Ir_1$ (Discharging)

$V_2 = (V_B)_2 - Ir_2$ (Discharging)

$V_3 = V_1 + V_2 = IR$

②



$(V_B)_1 > (V_B)_2$

$$I = \frac{(V_B)_1 - (V_B)_2}{R + r_1 + r_2}$$

$V_1 = (V_B)_1 - Ir_1$ (Discharging)

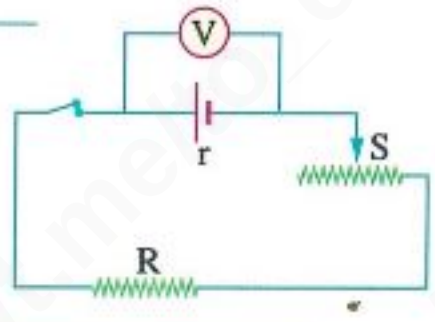
$V_2 = (V_B)_2 + Ir_2$ (Charging)

$V_3 = V_1 - V_2 = IR$

First Multiple choice questions

1. If the emf of an electric source whose internal resistance is r equals 8 V, the potential difference between its terminals during the flow of electric current in its circuit ..... .
   - (a) equals 8 V
   - (b) is less than 8 V
   - (c) is more than 8 V
   - (d) the answer can't be determined without knowing the value of r

2. In the opposite electric circuit, when the variable resistor (S) increases, the reading of the voltmeter ..... .
   - (a) increases
   - (b) decreases until it vanishes
   - (c) remains constant
   - (d) decreases but doesn't vanish



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3 ✱ If a battery of emf 6 V is connected to a 10 Ω resistor, an electric current of intensity 0.5 A passes in the circuit, so the internal resistance of the battery equals ..... .

(a) 0.5 Ω (b) 1 Ω (c) 1.5 Ω (d) 2 Ω

4 ✱ Three resistors 3 Ω, 6 Ω and 4 Ω are connected in series to a battery of emf 30 V and internal resistance 2 Ω, so:

(i) The total resistance of the circuit equals ..... .

(a) 11 Ω (b) 13 Ω (c) 15 Ω (d) 19 Ω

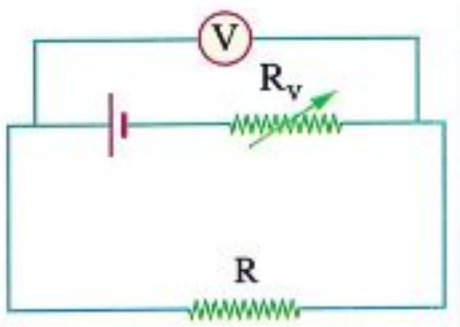
(ii) The intensity of the electric current in the circuit equals ..... .

(a) 0.5 A (b) 1 A (c) 1.5 A (d) 2 A

(iii) The potential difference across the terminals of the 6 Ω resistor equals ..... .

(a) 6 V (b) 8 V (c) 12 V (d) 18 V

5 In the opposite electric circuit, when R_v decreases, the voltmeter reading (V) ..... .

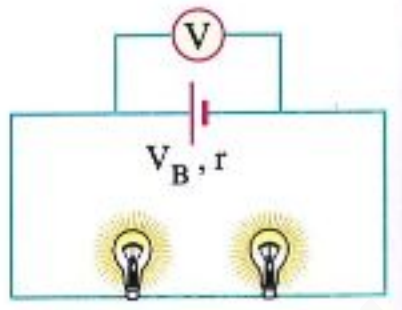


(a) increases
(b) decreases till it vanishes
(c) remains constant
(d) decreases but doesn't vanish

6 The intensity of the current that flows through a battery after closing its external circuit is inversely proportional to ..... .

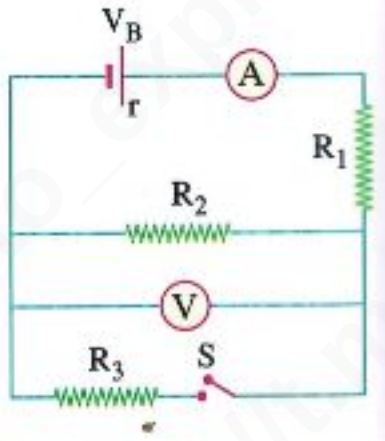
(a) the emf of the battery
(b) the internal resistance of the battery
(c) the external equivalent resistance
(d) the total resistance of the circuit

7 In the opposite electric circuit, if the filament of one of the lightbulbs is blown up, the voltmeter reading ..... .



(a) increases
(b) decreases but does not equal zero
(c) remains constant
(d) becomes zero

8 In the opposite electric circuit when switch S is closed, then the readings of the voltmeter and the ammeter ..... , ... respectively.



(a) decreases, decreases
(b) decreases, increases
(c) increases, decreases
(d) increases, increases

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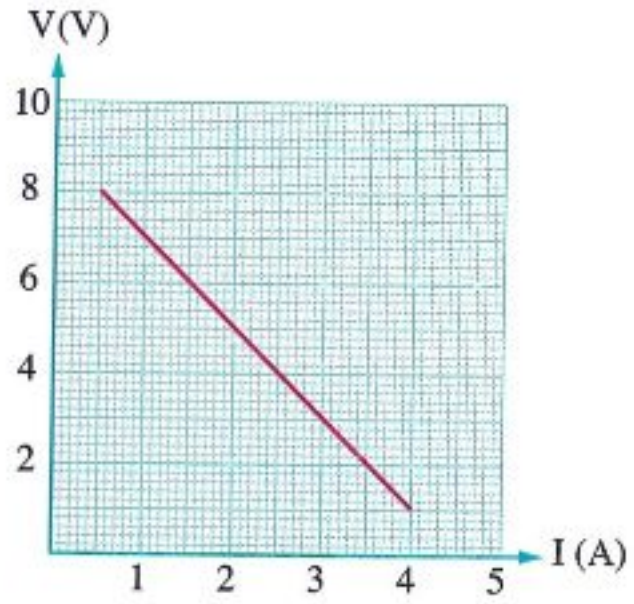
9 ✱ The opposite graph represents the relation between the potential difference across the terminals of a battery (V) and the current intensity (I) that passes through it, then:



(i) The internal resistance of the battery is ..... .

(a) 1 Ω (b) 2 Ω

(c) 0.45 Ω (d) 0.9 Ω

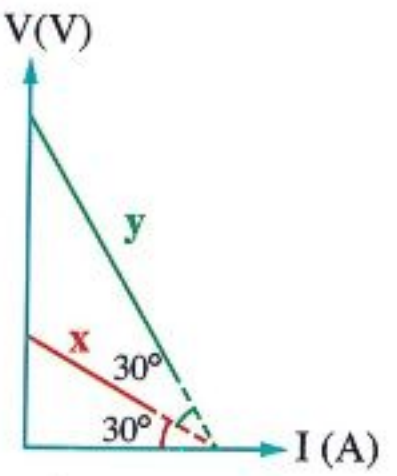
(ii) The emf of the battery is ..... .

(a) 7 V (b) 7.5 V

(c) 8 V (d) 9 V

---

10 The opposite graph represents the variation of the potential difference between the two poles of two electric cells (x), (y) with respect to the electric current intensity that passes in the circuit of each of them, then the ratio between their internal resistances $\left(\frac{r_x}{r_y}\right)$ is ..... .



(a) $\frac{1}{2}$ (b) $\frac{1}{3}$

(c) $\frac{\sqrt{3}}{2}$ (d) $\sqrt{\frac{3}{2}}$

---

11 Figure (1) represents the graph of voltmeter reading (V) versus ammeter reading (A) when changing the value of the variable resistor (R) in the electrical circuit shown in figure (2):

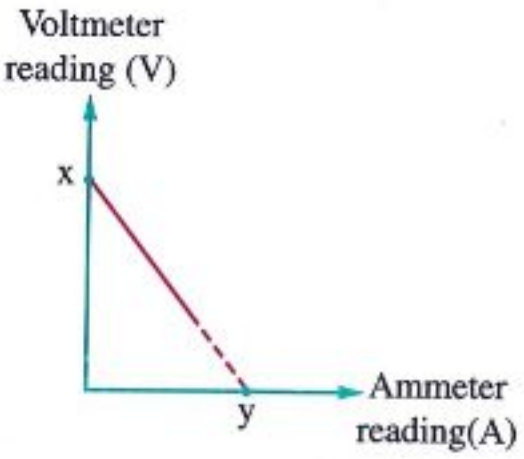


Figure (1)

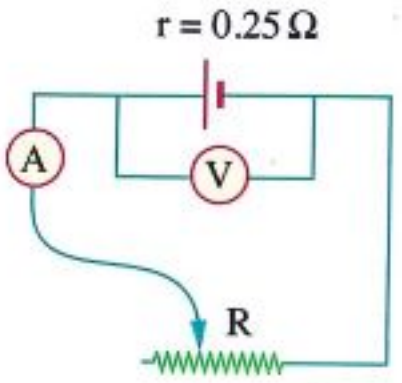


Figure (2)

If the internal resistance of the battery is 0.25 Ω, which of the following values represent two possible values for the two points (x) and (y) on the graph in figure (1)?

	x	y
(a)	8 V	8 A
(b)	8 V	2 A
(c)	2 V	8 A
(d)	2 V	4 A

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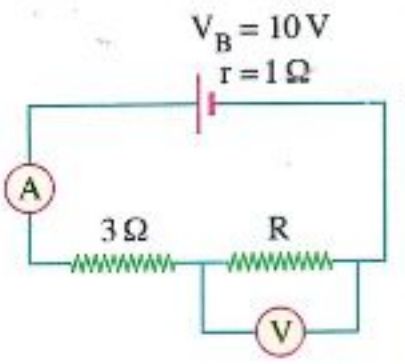
12 In the electric circuit shown in the figure, if the reading of the ammeter is 1 A, the reading of the voltmeter is ..... .



(a) 3 V (b) 6 V
(c) 7 V (d) 9 V

---

13 ✱ A metal wire of length of 30 m, cross-sectional area 0.3 cm^2 and material resistivity 5×10^{-7} Ω.m is connected in series to a resistor of 8.5 Ω and a battery whose emf is 18 V and its internal resistance is 1 Ω. So, the electric current intensity passing in the circuit equals ..... .

(a) 0.9 A (b) 1.8 A (c) 3.6 A (d) 4.2 A

---

14 ✱ A battery that has emf of 6 V and internal resistance of 1 Ω is connected with an ammeter of negligible resistance, a constant resistance R and a rheostat together in series and when the slider is adjusted at the beginning of the rheostat, an electric current of 0.6 A passes in the circuit and when the slider is moved to the end of the rheostat, the current that passes in the circuit becomes 0.1 A, so:

(i) The resistance of R equals ..... .

(a) 3 Ω (b) 6 Ω (c) 9 Ω (d) 12 Ω

(ii) The maximum resistance of the rheostat equals ..... .

(a) 15 Ω (b) 27 Ω (c) 38 Ω (d) 50 Ω

---

15 ✱ Two resistors, $R_1 = 6$ Ω and $R_2 = 4$ Ω, are connected together in parallel between the terminals of an electric source that has emf of 6 V and internal resistance of 0.1 Ω, so:

(i) The intensity of the passing electric current in the circuit equals ..... .

(a) 1.3 A (b) 2.4 A (c) 3.6 A (d) 4 A

(ii) The consumed electric power in the circuit (inside and outside the source) equals ..... .

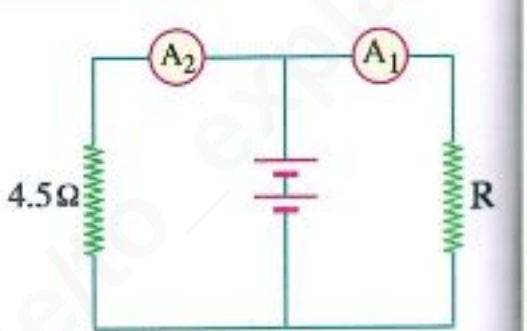
(a) 14.4 W (b) 15 W (c) 18.3 W (d) 21.9 W

(iii) The electric power that is consumed in R_1 equals ..... .

(a) 12.2 W (b) 9.3 W (c) 6.1 W (d) 5.53 W

---

16 ✱ In the opposite circuit: If the reading of ammeter $A_1 = 1$ A while the reading of ammeter $A_2 = 2$ A and the internal resistance of the battery (r) = 1 Ω, so:



(i) The resistance R equals ..... .

(a) 2 Ω (b) 4.5 Ω
(c) 9 Ω (d) 13 Ω

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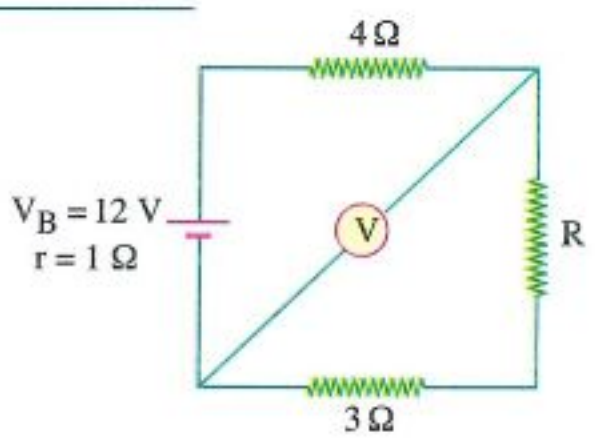
(ii) The emf of the battery equals ..... .

(a) 14 V (b) 12 V (c) 9 V (d) 8 V

---

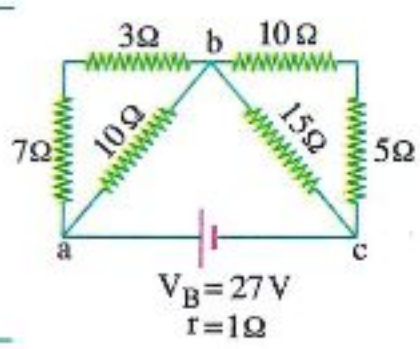
17 In the opposite electric circuit, if the voltmeter reading is 6 V, the resistance R equals ..... .



(a) 2 Ω
(b) 3 Ω
(c) 4.8 Ω
(d) 6 Ω

---

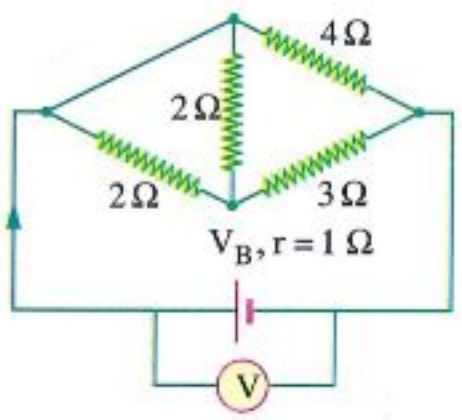
18 * In the circuit shown in the figure, the potential difference between b and c equals ..... .



(a) 5 V (b) 10 V
(c) 15 V (d) 20 V

---

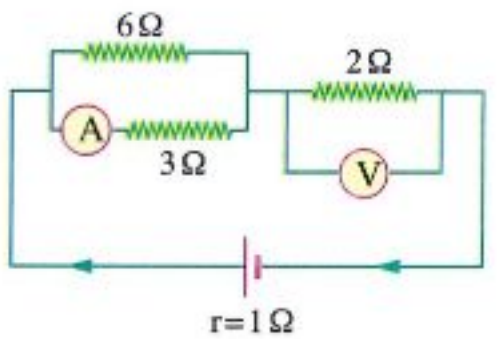
19 In the opposite electrical circuit, if the voltmeter reading is 8 V, then the electromotive force (V_B) of the battery equals ..... .



(a) 8 V
(b) 10 V
(c) 12 V
(d) 14 V

---

20 In the opposite electric circuit, if the current that passes in the 6 Ω resistor equals 1 A, then:



(i) The reading of the ammeter (A) equals ..... .

(a) 3.4 A (b) 3 A
(c) 2.8 A (d) 2 A

(ii) The reading of the voltmeter (V) equals ..... .

(a) 1 V (b) 3 V (c) 6 V (d) 9 V

(iii) The emf of the battery equals ..... .

(a) 11 V (b) 13 V (c) 15 V (d) 19 V

---

21 * Three resistors of 8 Ω, 6 Ω and 16 Ω are connected together in a definite way and with an electric source of internal resistance 1.2 Ω. When the circuit is closed, the potential differences across the resistors become 2 V, 6 V and 4 V respectively, so the emf of the source equals ..... .

(a) 6 V (b) 7.5 V (c) 9 V (d) 12 V

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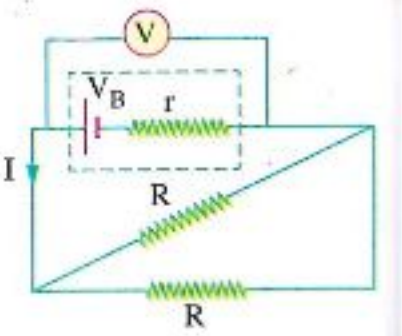
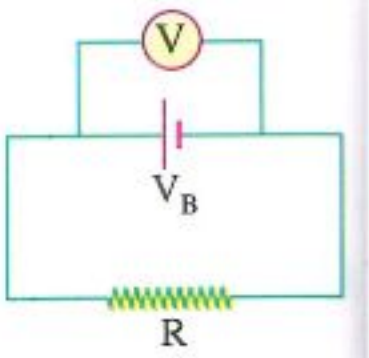
22 In the opposite electric circuit, the reading of the voltmeter equals .....



(a) $V_B - 2\,Ir$ (b) $V_B + Ir$

(c) $\frac{IR}{2}$ (d) $2\,IR$

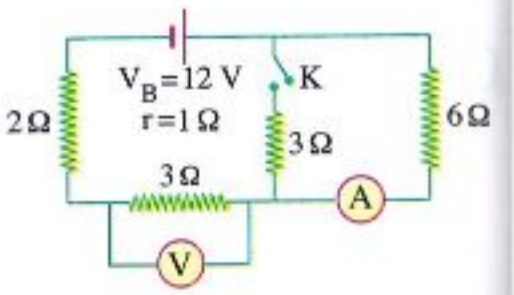
23 In the opposite circuit, if the internal resistance of the battery is $\frac{1}{4}$ R, then the voltmeter reading equals ..... .



(a) $\frac{2}{3}\,V_B$ (b) $\frac{5}{4}\,V_B$

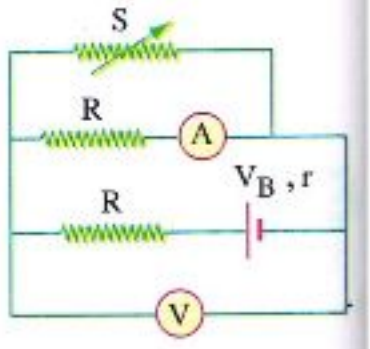
(c) $\frac{1}{5}\,V_B$ (d) $\frac{4}{5}\,V_B$

24 In the shown electric circuit, when the switch K is closed, then the ammeter (A) and voltmeter (V) readings are ....., ...



	The ammeter reading (A)	The voltmeter reading (V)
(a)	increases	decreases
(b)	decreases	increases
(c)	increases	increases
(d)	decreases	decreases

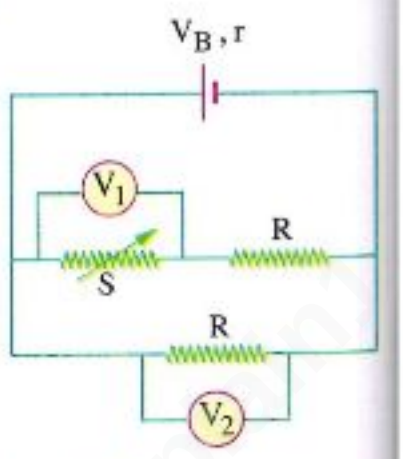
25 What happens to the readings of both ammeter and voltmeter respectively when increasing the variable resistance (S) in the opposite electrical circuit?



(a) Increases, increases. (b) Increases, decreases.

(c) Decreases, increases. (d) Decreases, decreases.

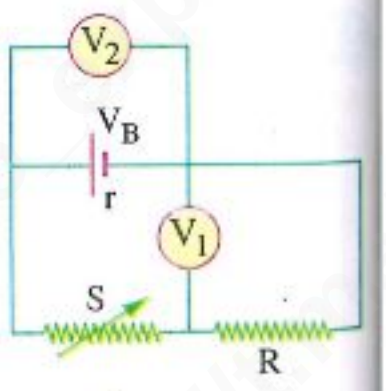
26 The opposite diagram represents a closed electric circuit, so when the variable resistance (S) is increased, the readings of the two voltmeters V_1 and V_2 are ....., ... respectively.



(a) increases, increases (b) decreases, decreases

(c) increases, decreases (d) decreases, increases

27 In the shown electric circuit, if the value of the variable resistance (S) is decreased, which of the following ratios decreases?



(a) $\frac{V_1}{V_B}$ (b) $\frac{V_2}{V_1}$ (c) $\frac{V_B}{V_2}$ (d) $\frac{V_1}{V_2}$

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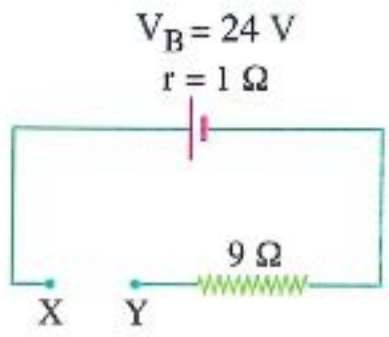
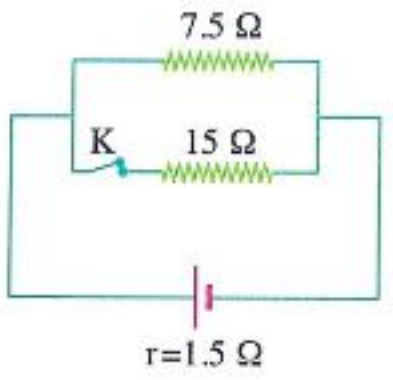
28 If you have a group of resistors each of value 8 Ω, what is the number of these resistors and how can you connect them with each other between the two points X and Y in order to get a current intensity of 2 A passing in the circuit?



(a) 2 resistors, in series. (b) 3 resistors, in series.
(c) 4 resistors, in parallel. (d) 6 resistors, in parallel.

---

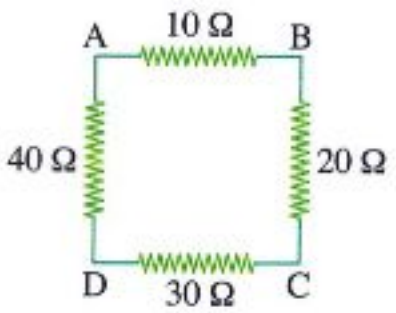
29 In the opposite electric circuit the current intensity that passes in the circuit in the case of closing the switch K is greater than the current intensity that passes in the case of opening the switch K by 0.5 A. So, the emf of the battery equals ..... .



(a) 8.2 V (b) 9.4 V
(c) 10.3 V (d) 11.7 V

---

30 ✱ The opposite figure shows four resistors which are connected in the form of a square ABCD:



(i) So, the two points which have to be connected to a battery whose internal resistance is 1 Ω to let a current of 0.25 A pass in all resistors are ..... .

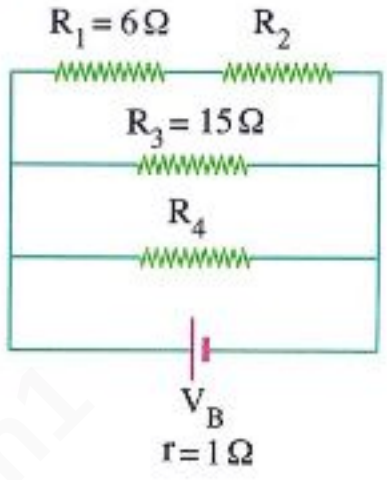
(a) A, B (b) B, D (c) C, D (d) A, C

(ii) The emf of the battery which is connected in (i) equals ..... .

(a) 13 V (b) 26 V (c) 35 V (d) 40 V

---

31 In the opposite figure an electric circuit consists of a battery V_B whose internal resistance is 1 Ω. The battery is connected to four resistors R_1, R_2, R_3 and R_4 that are carrying 0.3 A, 0.3 A, 0.4 A and 0.2 A respectively, so:



(i) The emf of the source V_B equals ..... .

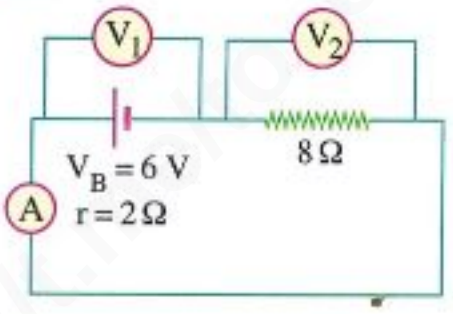
(a) 5.4 V (b) 6.9 V (c) 7.13 V (d) 9.51 V

(ii) The total resistance of the circuit equals ..... .

(a) 30 Ω (b) 14 Ω (c) 7.67 Ω (d) 13.34 Ω

---

32 ✱ In the opposite electric circuit, the readings of the voltmeters V_1 and V_2 are ..... , ... respectively.



(a) 2.25 V, 5.5 V (b) 4.8 V, 4.8 V
(c) 2.25 V, 2.25 V (d) 4.8 V, 2.4 V

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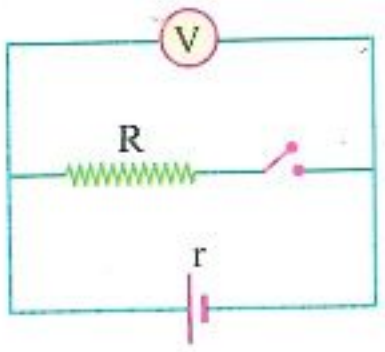
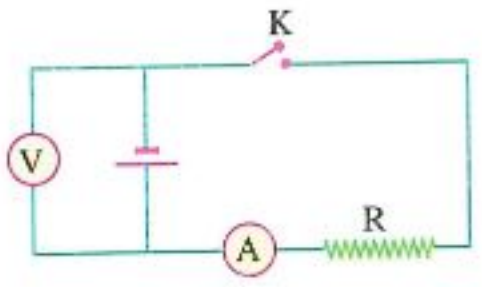
33 A resistor (R) is connected to a battery of internal resistance r and a switch, as shown in the opposite electrical circuit. If the voltmeter reading is V_o when the switch is open, and $0.8\ V_o$ when the switch is closed, then the ratio $\left(\frac{R}{r}\right)$ equals ..... .



(a) 1 (b) 2 (c) 4 (d) 8

---

34 ✱ In the opposite electric circuit, the reading of the voltmeter is 12 V when the switch K is opened and when the switch K is closed, its reading becomes 9 V where the reading of the ammeter is 1.5 A, so:



(i) The internal resistance of the battery equals ..... .

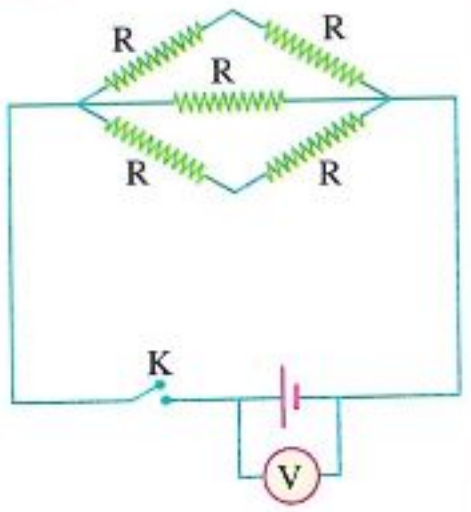
(a) 0.5 Ω (b) 1 Ω (c) 1.5 Ω (d) 2 Ω

(ii) The resistance of R equals ..... .

(a) 2 Ω (b) 4 Ω (c) 6 Ω (d) 8 Ω

---

35 ✱ In the opposite electric circuit, if the internal resistance of the battery is 2 Ω and the reading of the voltmeter is 12 V when the switch (K) is opened and it becomes 10 V when the switch (K) is closed, so:



(i) The electric current intensity that passes in the circuit when the switch (K) is closed equals ..... .

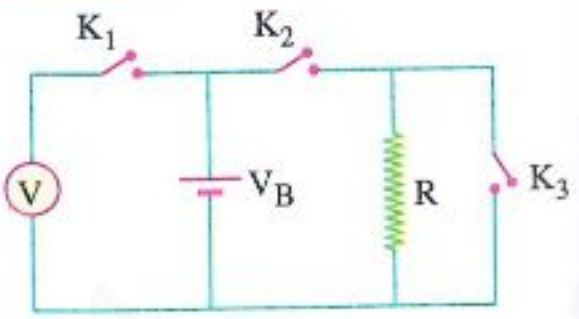
(a) 4 A (b) 3 A (c) 2 A (d) 1 A

(ii) The resistance of R equals ..... .

(a) 5 Ω (b) 10 Ω (c) 15 Ω (d) 20 Ω

---

36 In the opposite electric circuit, a voltmeter is connected across a battery of emf (V_B) that has an internal resistance r, so the voltmeter gives a reading equal to zero at closing ..... .

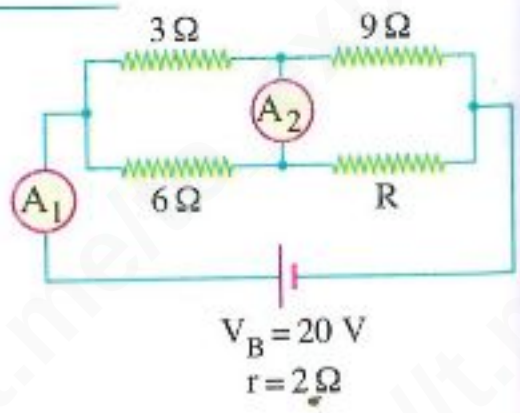


(a) switch K_1 only (b) both switches K_1 and K_2 only

(c) both switches K_1 and K_3 only (d) all three switches K_1, K_2 and K_3

---

37 ✱ In the opposite electric circuit, if the pointer of the ammeter (A_2) is at zero, then the reading of the ammeter (A_1) is ..... .



(a) 3.5 A (b) 2.5 A

(c) 2 A (d) 1.5 A

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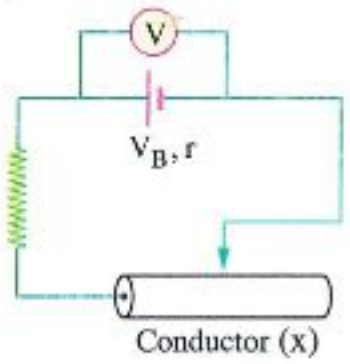
38 An electric source is connected to a conductor (x) of uniform cross-section using a slider as shown in the opposite circuit, so what happens to the voltmeter reading (V) when increasing the segment length of conductor (x) that carries electric current?

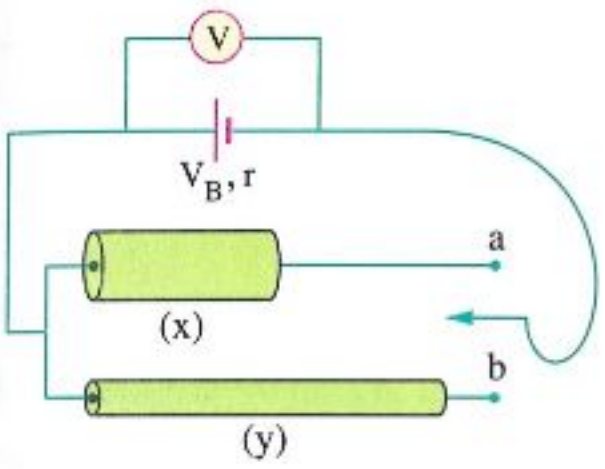


(a) Increases. (b) Decreases.

(c) Doesn't change. (d) The answer is indeterminable.

---

39 In the following figure, two conductors (x) and (y) of the same metal and uniform cross-sections have lengths (ℓ) and (2ℓ) and diameters (d) and $\left(\frac{d}{2}\right)$ respectively. They can be connected through a lead to a battery of internal resistance (r). And the following table records the voltmeter reading (V) as the lead changes its position of contact,



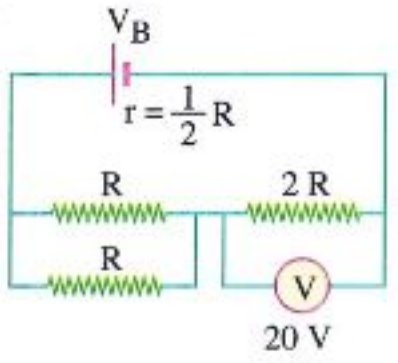
Case	Voltmeter reading
Not connecting the lead to either point (a) or (b)	V_1
Connecting the lead to point (a)	V_2
Connecting the lead to point (b)	V_3

Then, the correct order of the voltmeter readings V_1, V_2, V_3 is .....

(a) $V_1 = V_2 = V_3$ (b) $V_1 > V_2 > V_3$ (c) $V_1 > V_3 > V_2$ (d) $V_3 > V_2 > V_1$

---

40 In the opposite electric circuit, the magnitude of the electromotive force of the battery is ..... .

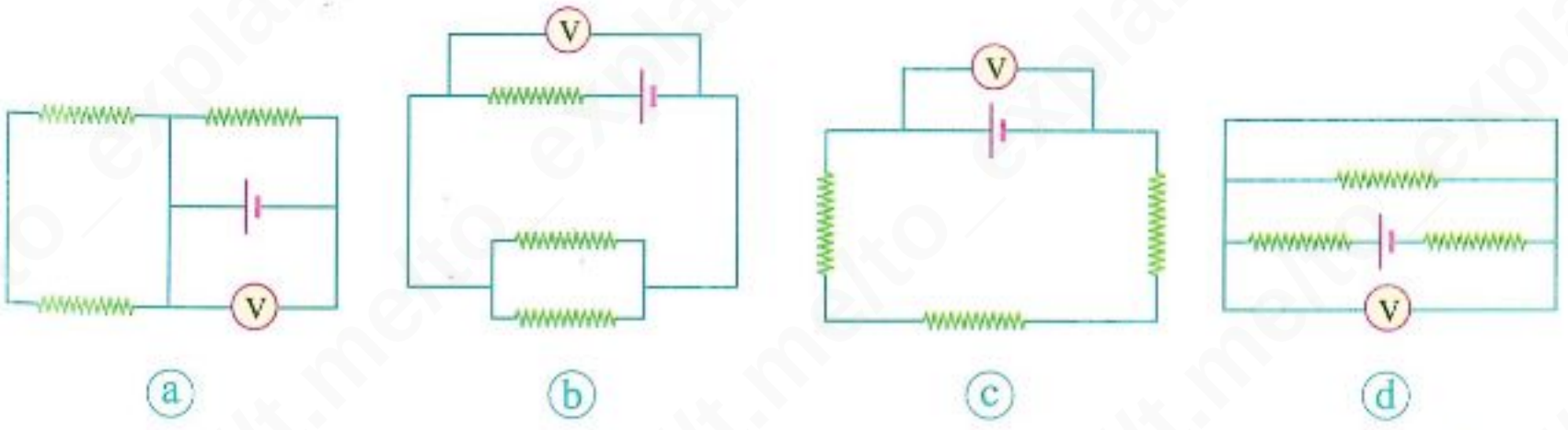


(a) 25 V (b) 30 V

(c) 35 V (d) 45 V

---

41 Three identical resistors are connected to a battery with internal resistance (r) in four different ways as shown in the following circuits. In which of these circuits will the voltmeter reading be the largest?



(a) (b) (c) (d)

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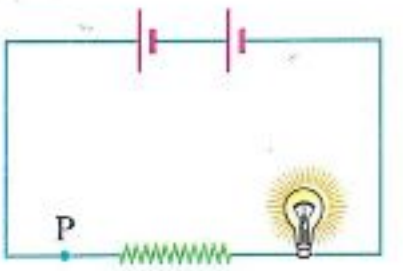
42 What is the change that could be done in the opposite circuit to increase the intensity of the passing electric current in the electric bulb?



(a) Adding a resistor in parallel with the resistor which is in the circuit.

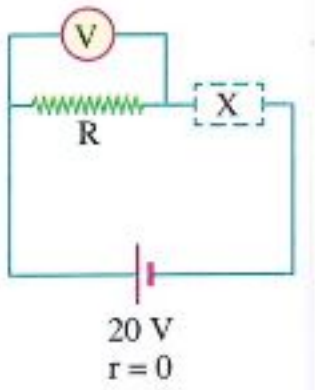
(b) Adding a resistor in series with the resistor which is in the circuit.

(c) Removing one of the two batteries.

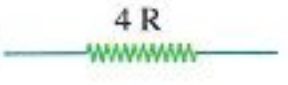
(d) Moving the bulb to point P.

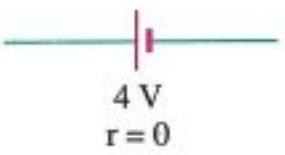
---

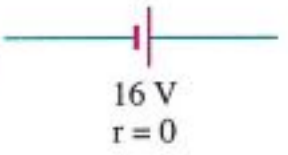
43 The opposite diagram represents a closed electric circuit, so which of the following figures represents the component X that makes the pointer of the voltmeter deflect to 4 V?



(a)

(b) 

(c) 

(d) 

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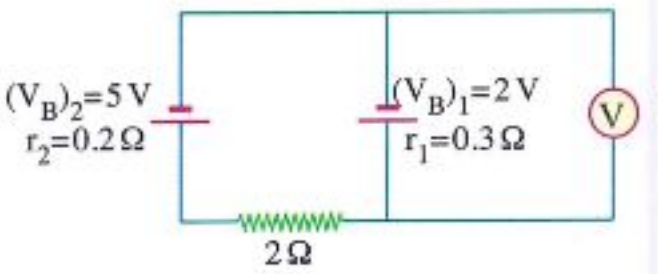
44 In the opposite electric circuit, the voltmeter reading is ..... .



(a) 7.64 V

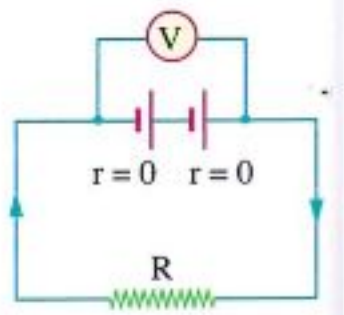
(b) 2.36 V

(c) 2 V

(d) 1.64 V

---

45 In the opposite electric circuit, if we remove one of the battery cells and connect another resistance in series to resistor R, the reading of the voltmeter ..... .



(a) increases

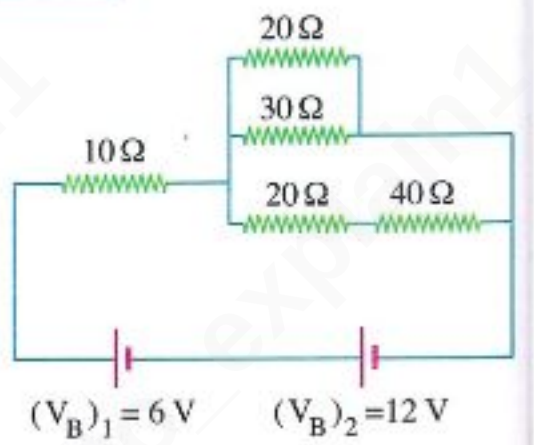
(b) decreases

(c) remains unchanged

(d) cannot be determined

---

46 ✱ In the opposite electric circuit, if the internal resistance of each electric cell is 2 Ω, then:



(i) The total external resistance of the circuit equals ..... .

(a) 5 Ω

(b) 10 Ω

(c) 20 Ω

(d) 25 Ω

(ii) The total current intensity in the circuit equals ..... .

(a) 0.25 A

(b) 0.5 A

(c) 0.75 A

(d) 1 A

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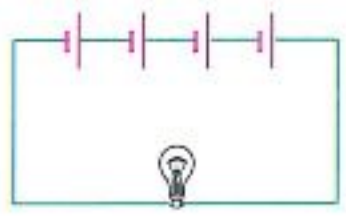
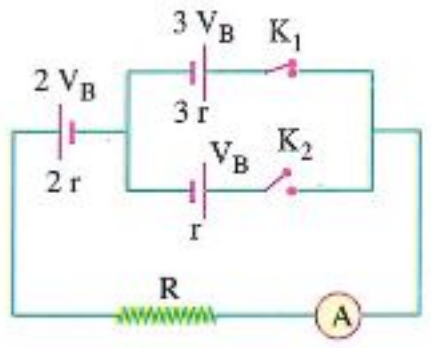
47 ✱ The opposite figure shows four identical electric cells, each of emf 12 V, where they are connected with an electric bulb, when the intensity of the electric current that passes in the circuit was 0.5 A, the consumed electric power in the bulb was 23 W, so the internal resistance of each cell equals ..... .



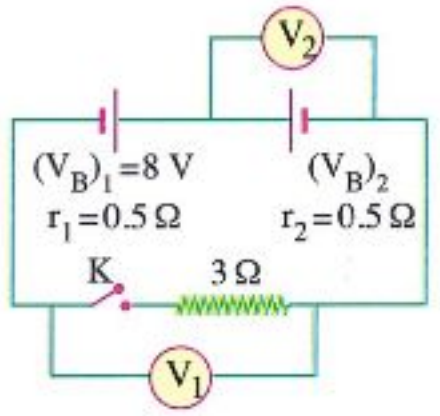
(a) 0.5 Ω (b) 1 Ω (c) 1.5 Ω (d) 2 Ω

48 ✱ In the shown electric circuit, when opening switch K_1 and closing switch K_2, which of the following choices shows what happen to the direction of the current in resistor R and the reading of the ammeter?



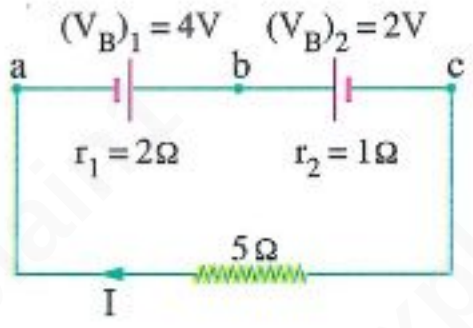
	Current direction	Ammeter reading
(a)	Remains unchanged	Increases
(b)	Gets reversed	Decreases
(c)	Remains unchanged	Decreases
(d)	Gets reversed	Increases

49 ✱ In the opposite electric circuit, if the reading of the voltmeter V_1 when the switch K is opened is 4 V, so if you know that $(V_B)_2 > (V_B)_1$, then the readings of each of the two voltmeters V_1 and V_2 after closing the switch K are ..... .



	The reading of V_1	The reading of V_2
(a)	3 V	11.5 V
(b)	3 V	8 V
(c)	4.5 V	11.5 V
(d)	4.5 V	8 V

50 ✱ In the opposite electric circuit:



(i) The current intensity passing in the circuit equals ..... .

(a) $\frac{2}{3}$ A (b) $\frac{3}{2}$ A

(c) $\frac{1}{2}$ A (d) $\frac{1}{4}$ A

(ii) The potential difference between the points a and b equals ..... .

(a) $\frac{7}{2}$ V (b) $\frac{5}{3}$ V (c) $\frac{4}{9}$ V (d) $\frac{2}{3}$ V

(iii) The potential difference between the points b and c equals ..... .

(a) 0.4 V (b) 2.25 V (c) 0.625 V (d) 1.6 V

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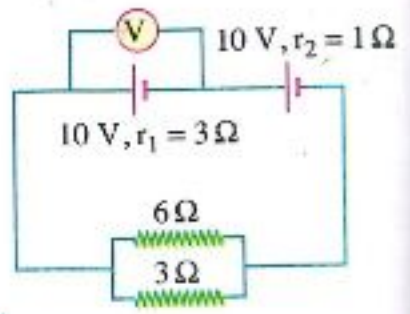
51 In the opposite electric circuit, the voltmeter reading is ..... .



(a) 20 V (b) 10 V
(c) 5 V (d) 0

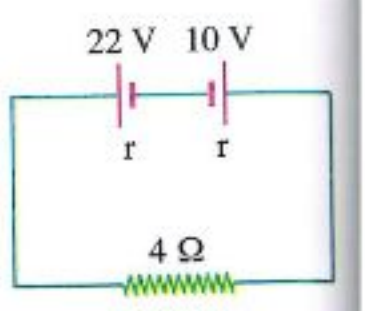
---

52 A rechargeable battery of electromotive force 8 V and internal resistance 0.4 Ω is connected to a source of internal resistance 0.4 Ω, so a current of intensity 2.5 A passes in the circuit. By ignoring the resistance of the wires in the circuit, the electromotive force of the source that is used to charge the battery is ..... .

(a) 12 V (b) 11 V (c) 10 V (d) 6 V

---

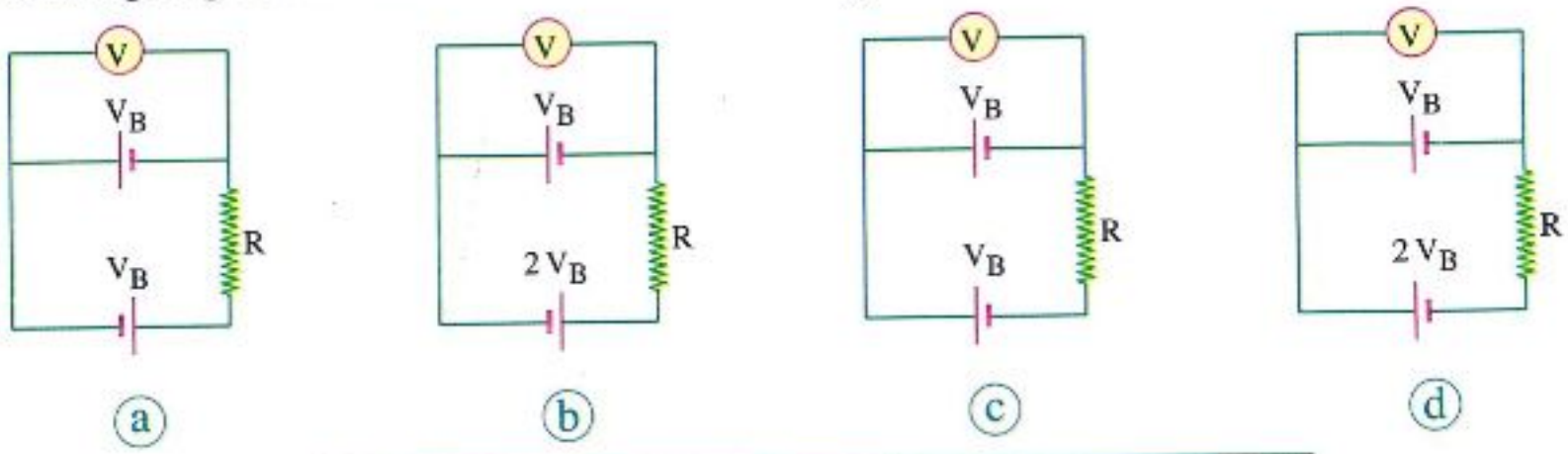
53 In the opposite electric circuit, if the consumed power in the 4 Ω resistor is 16 W, then the value of r equals ..... .



(a) 0.25 Ω (b) 0.5 Ω
(c) 1 Ω (d) 2 Ω

---

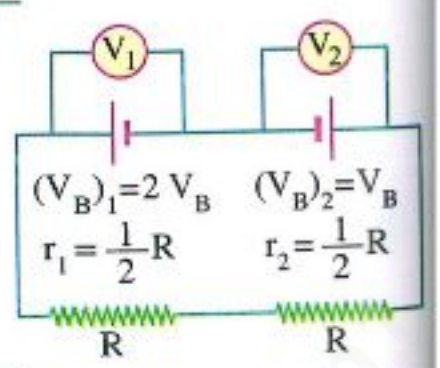
54 Each of the following electric circuits consists of a voltmeter, an ohmic resistance (R) and two batteries of the same internal resistance (r), so in which of these circuits the voltmeter reading is greater than electromotive force V_B?



(a) (b) (c) (d)

---

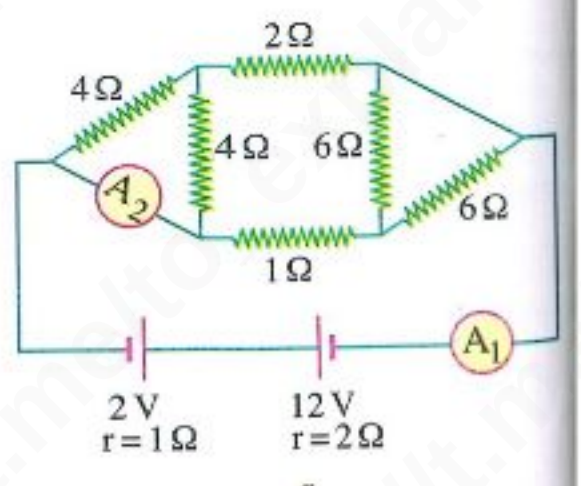
55 ✱ In the opposite circuit, the ratio $\frac{V_2}{V_1}$ = ...



(a) $\frac{5}{11}$ (b) $\frac{2}{3}$
(c) $\frac{7}{11}$ (d) $\frac{1}{1}$

---

56 In the opposite electric circuit:



(i) The ammeter reading (A_1) equals ..... .

(a) 2 A (b) 5 A
(c) 7 A (d) 10 A

(ii) The ammeter reading (A_2) equals ..... .

(a) 0.5 A (b) 1 A
(c) 1.5 A (d) 2 A

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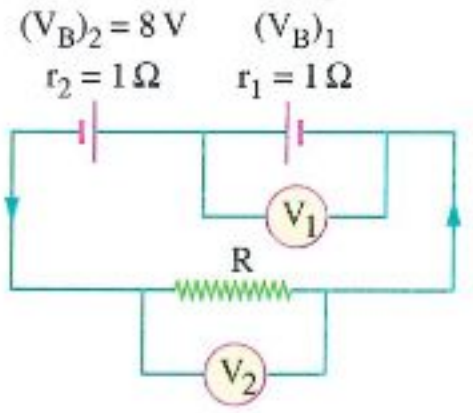
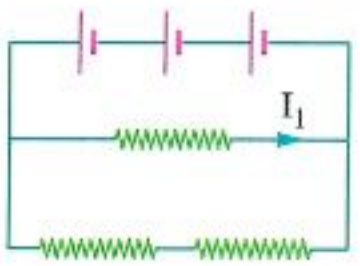
57 In the opposite electrical circuit, if the voltmeter readings (V_1) and (V_2) are 16 V and 6 V respectively, then the value of resistance R and the electromotive force $(V_B)_1$ are respectively ....., ...



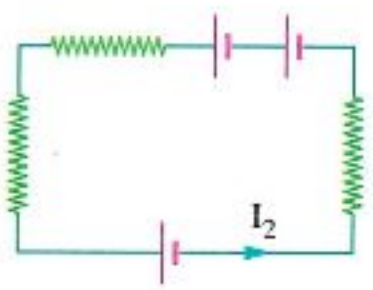
(a) 3 Ω, 16 V (b) 4 Ω, 10 V
(c) 3 Ω, 18 V (d) 4 Ω, 18 V

---

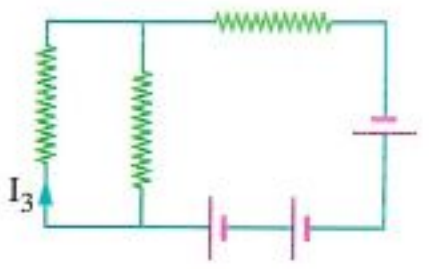
58 Three identical resistors are connected with three identical electric cells of negligible internal resistances in three different methods as follows:



(1)



(2)



(3)

So, the ratio of electric intensities $I_1 : I_2 : I_3$ is .....

(a) 9 : 1 : 3 (b) 2 : 3 : 1 (c) 3 : 6 : 2 (d) 1 : 4 : 9

---

59 ✱ An electric cell was connected to a 1.9 Ω resistor, so an electric current of intensity 0.5 A passed in the circuit and when this resistor was replaced by another of 10.6 Ω, the current intensity decreased to 0.125 A, hence the emf of the cell equals ..... .

(a) 5.3 V (b) 3.31 V (c) 2.7 V (d) 1.45 V

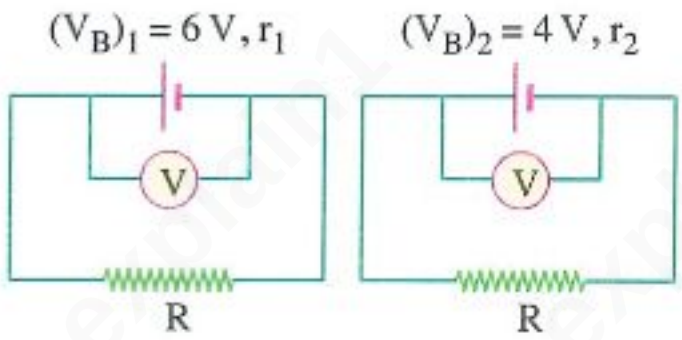
---

60 ✱ An electric cell was connected to a resistor of resistance R, so the resistor R carried a current of intensity I and when another resistor of resistance $\frac{R}{2}$ was connected with the first resistor in parallel, the current intensity passing in the circuit was doubled, hence the internal resistance of the electric cell equals ..... .

(a) 3 R (b) $\frac{R}{3}$ (c) 6 R (d) $\frac{R}{6}$

---

61 A resistor of ohmic resistance R is connected to two different batteries, one at a time, as shown in the two opposite circuits. If the voltmeter readings in the two circuits are equal and equal to 3 V, then the ratio of the internal resistances of the two batteries $\left(\frac{r_1}{r_2}\right)$ equals ..... .



(a) $\frac{2}{3}$ (b) $\frac{3}{2}$
(c) $\frac{1}{3}$ (d) 3

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62 ✱ Two identical wires are made of the same material, each of 50 cm long and cross-sectional area of 2 mm^2. They are connected together in series with an electric cell of internal resistance 0.5 Ω to form an electric circuit, so the intensity of the passing current was 2 A and when the same two wires were connected in parallel with the same electric cell, the total electric current intensity became 6 A, so:

(i) The emf of the used electric cell equals ..... .

(a) 3 V (b) 6 V (c) 9 V (d) 12 V

(ii) The conductivity of the wire's material equals ..... .

(a) $125 \times 10^3\ \Omega^{-1}.m^{-1}$ (b) $250 \times 10^4\ \Omega^{-1}.m^{-1}$

(c) $396 \times 10^6\ \Omega^{-1}.m^{-1}$ (d) $431 \times 10^8\ \Omega^{-1}.m^{-1}$

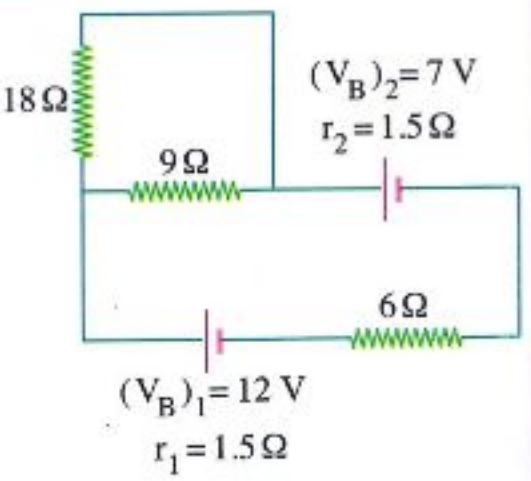
---

63 ✱ A battery of emf 12 V is connected to two identical bulbs which are connected in parallel, so the potential difference between the terminals of the battery becomes 10.8 V. If each of the bulbs consumes an electric power of 12 W, then the internal resistance of the battery equals ..... .

(a) 0.25 Ω (b) 0.54 Ω (c) 0.72 Ω (d) 1 Ω

---

64 ✱ From the opposite circuit:



(i) The current intensity passing through the 12 V battery equals ..... .

(a) $\frac{3}{5}$ A (b) $\frac{1}{3}$ A

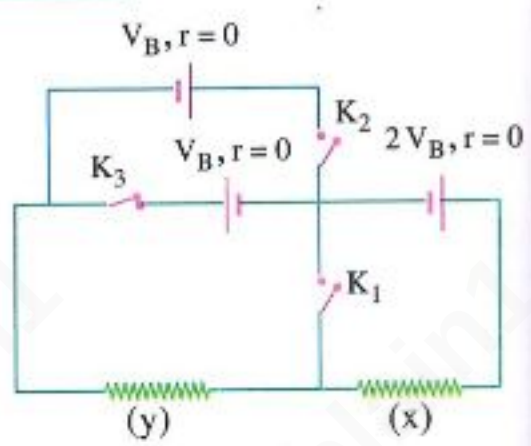
(c) $\frac{4}{9}$ A (d) $\frac{7}{8}$ A

(ii) The consumed power in the 9 Ω resistor equals ..... .

(a) $\frac{5}{4}$ W (b) $\frac{3}{7}$ W (c) $\frac{6}{5}$ W (d) $\frac{4}{9}$ W

---

65 Two identical resistors x and y are connected as shown in the opposite electric circuit, hence the electric power consumed in each of them is P_w, so what are the electric powers consumed in the two resistors x and y respectively when:



(i) closing switch K_1?

(a) $4\ P_w, 2\ P_w$ (b) $16\ P_w, 4\ P_w$

(c) $\frac{P_w}{4}, \frac{P_w}{2}$ (d) $\frac{P_w}{16}, \frac{P_w}{4}$

(ii) opening switch K_3 and closing switch K_2?

(a) $\frac{3}{2}\ P_w, 2\ P_w$ (b) $\frac{P_w}{4}, \frac{P_w}{8}$ (c) $9\ P_w, 9\ P_w$ (d) $\frac{2\ P_w}{3}, \frac{2\ P_w}{3}$

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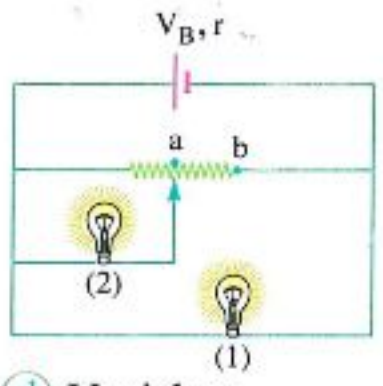
66 The opposite electric circuit contains two identical lightbulbs (1) and (2), so when moving the slider from position a to position b, what happens to the brightness of:



(i) bulb (1)?

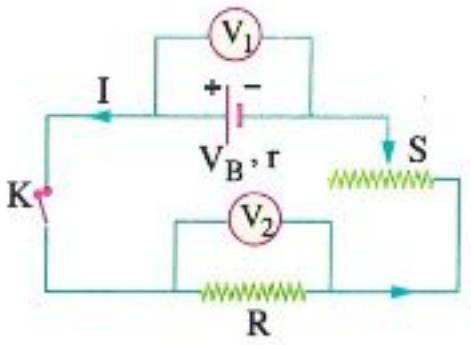
(a) Decreases (b) Increases (c) Doesn't change (d) Vanishes

(ii) bulb (2)?

(a) Decreases (b) Increases (c) Doesn't change (d) Vanishes

Second Essay questions

1 In the electric circuit shown in the figure:



(a) **Write the relation between** the electric current intensity I passing in the circuit and the readings of V_1 and V_2

(b) **Deduce what happens to** the readings of each of V_1 and V_2 when the value of the rheostat resistance S increases.

(c) **What** is the reading of each of V_1 and V_2 when the switch K is opened?

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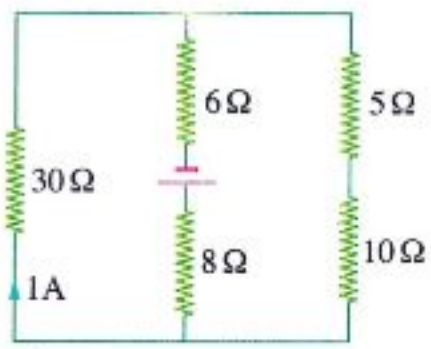
2 From the opposite electric circuit, **calculate** the electromotive force of the source if its internal resistance equals 2 Ω.



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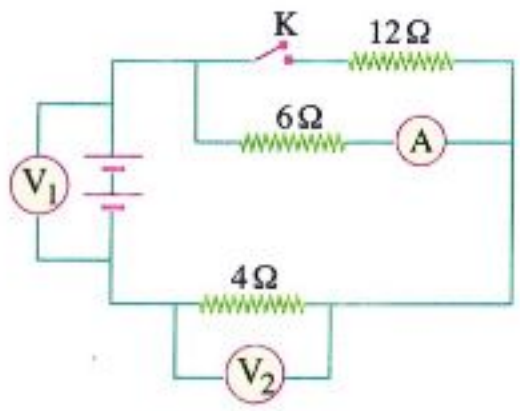
3 In the opposite electric circuit, if the emf of the battery is 12 V and its internal resistance is 2 Ω, **find** the reading of each of the ammeter (A), the voltmeter (V_1), the voltmeter (V_2) when the switch K is:



(a) opened. (b) closed.

---

4 In the two opposite figures (1) and (2), a variable resistance R is connected once to an electric source of an electromotive force V_B and neglected internal resistance and again connected to a source of electromotive force V_B and internal resistance r, when the resistance R increases in the two circuits the voltmeter reading V_1 remains constant, while the voltmeter reading V_2 increases. **Explain**.

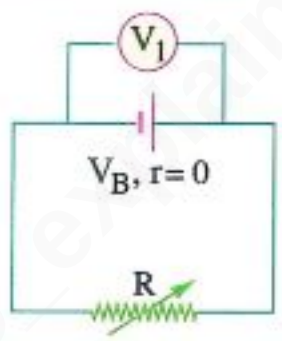


Figure (1)

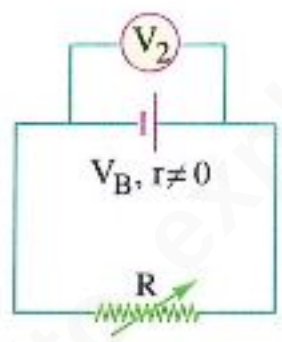


Figure (2)

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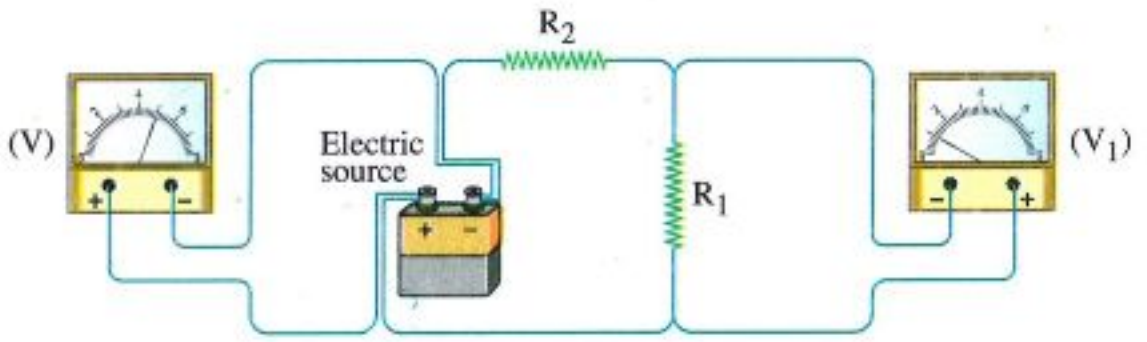
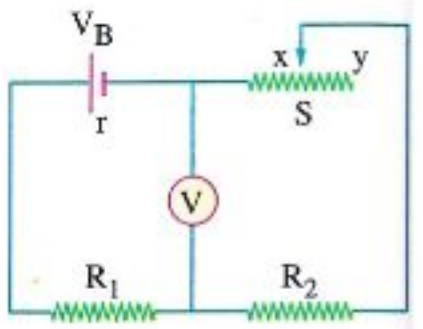
5 In the following electric circuit, if resistor R_1 is equivalent to double the internal resistance (r) of the source and the reading of the voltmeter (V) across the source is five times as the reading of the voltmeter (V_1) across R_1,



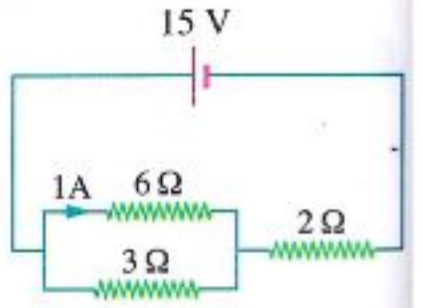
find the resistance of R_2 in terms of the internal resistance of the source (r).

6 In the opposite circuit, **what happens to** the voltmeter reading when the slider moves from point x to point y?

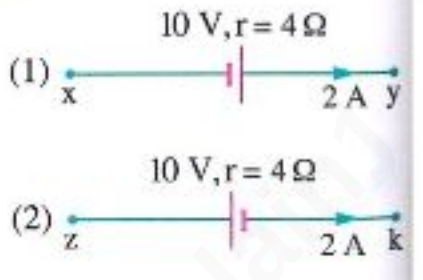


7 An electric circuit consists of a battery whose electromotive force is V_B, internal resistance r, variable resistance R and an ammeter, when the resistance R is doubled, the reading of the ammeter doesn't decrease to its half. **Does this agree with Ohm's law? Explain.**

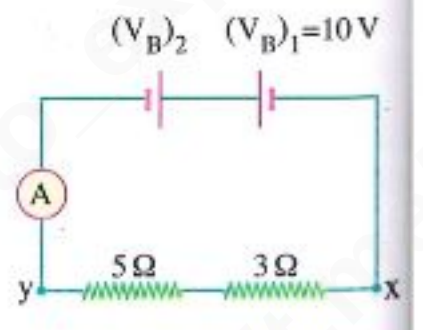
8 In the opposite circuit, **is** the internal resistance of the battery considered or neglected ? **Explain your answer.**



9 The two figures (1) and (2), each one represents a part of a closed electric circuit, **find** the ratio between the potential differences $\left(\frac{V_{xy}}{V_{zk}}\right)$.



10 In the opposite electric circuit, if the potential difference of point x is greater than the potential difference of point y and the ammeter reading is 2 A and the internal resistance of each battery is 1 Ω. **Calculate** the electromotive force of the battery $(V_B)_2$



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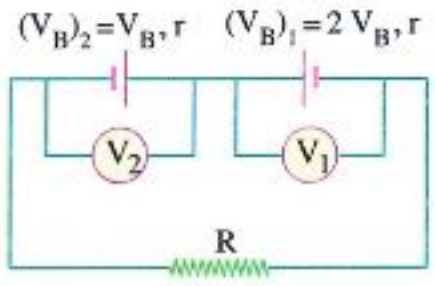
11 **From the opposite figure, which is greater with an explanation:**

(a) $(V_B)_1, V_1$?

(b) $(V_B)_2, V_2$?



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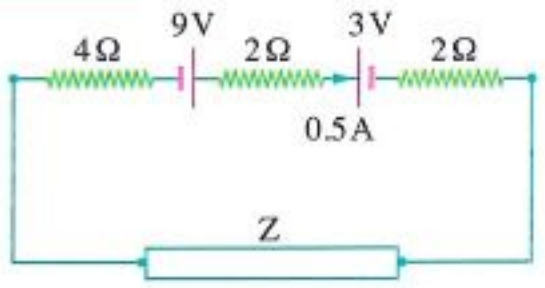
12 The opposite figure shows a closed electric circuit containing an unknown component Z. Considering the internal resistances of the electric sources are negligible, **present two assumptions** for the unknown component Z.



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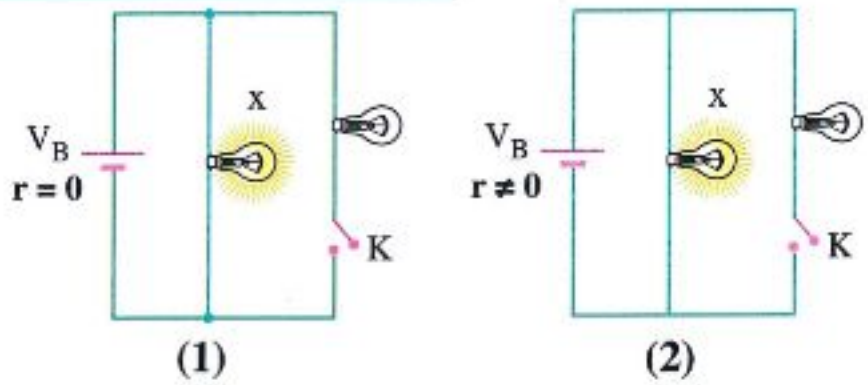
13 From the opposite two circuits (1) and (2), **what is the effect of** closing the switch on the brightness of lamp x in each of the two circuits?



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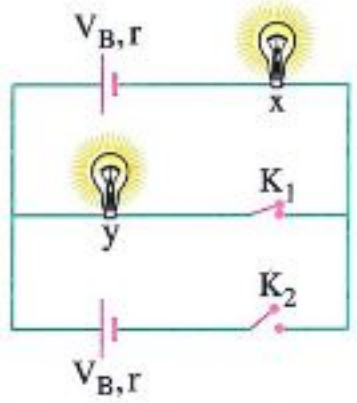
14 In the opposite electric circuit, **what happens to** the brightness of lamp x when the switch K_1 is opened and switch K_2 is closed?



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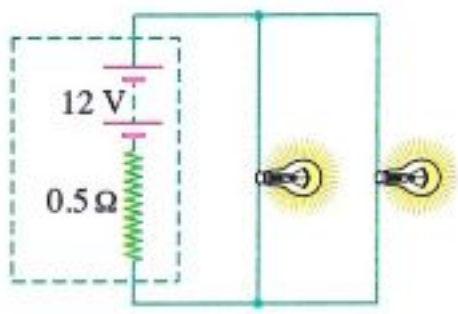
15 Two identical electric lamps taped on each of them (12 V, 60 W) connected to a battery whose electromotive force is 12 V and internal resistance is 0.5 Ω as shown in the opposite figure, **why** is the power consumed by each lamp not 60 W?



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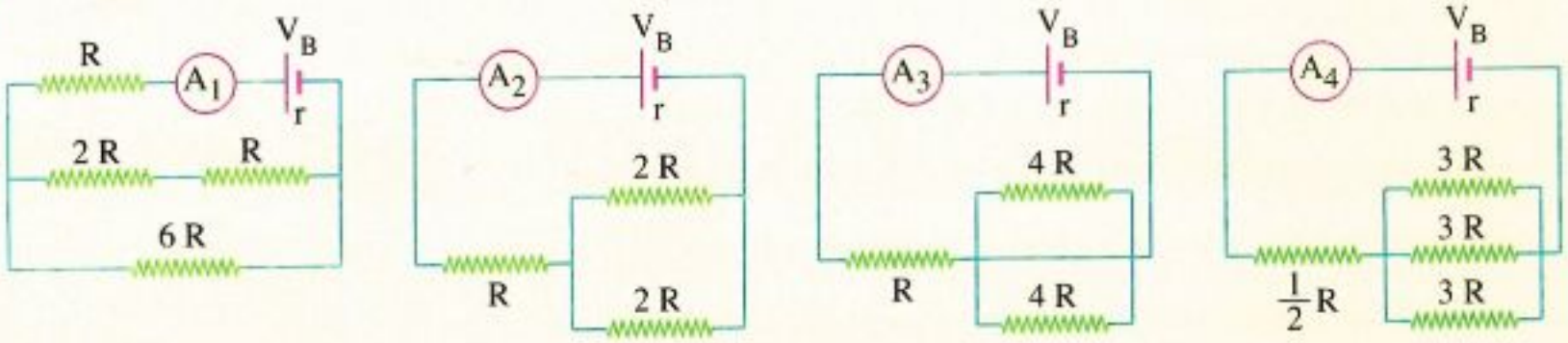
Questions of the Previous Years Exams on Lesson 3

1



Each of the four electric circuits contains an ammeter. What is the correct arrangement of the readings A_1, A_2, A_3 and A_4 of the four ammeters? *(Exp. May 21)*

(a) $A_4 < A_2 < A_1 < A_3$ (b) $A_4 < A_3 < A_1 < A_2$

(c) $A_3 < A_4 < A_2 < A_1$ (d) $A_1 < A_2 < A_4 < A_3$

2 An electric cell of unknown emf is connected to resistance R_1, hence the intensity of the passing current through the cell equals 0.5 A as in figure (1) and when replacing resistance R_1 by another resistance R_2, the intensity of the passing current through the cell becomes 0.3 A as in figure (2), so the emf of the cell equals ..... . *(Exp. May 21)*

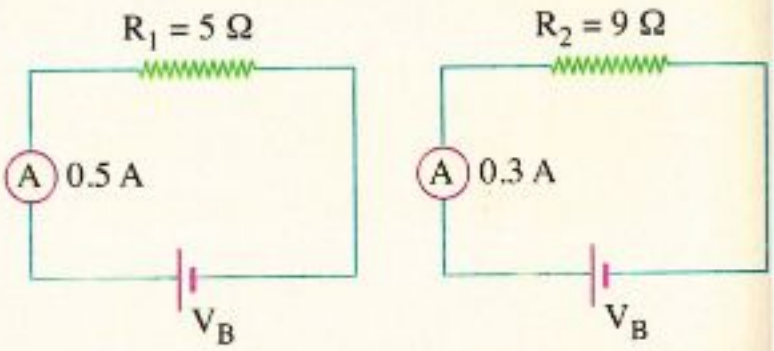
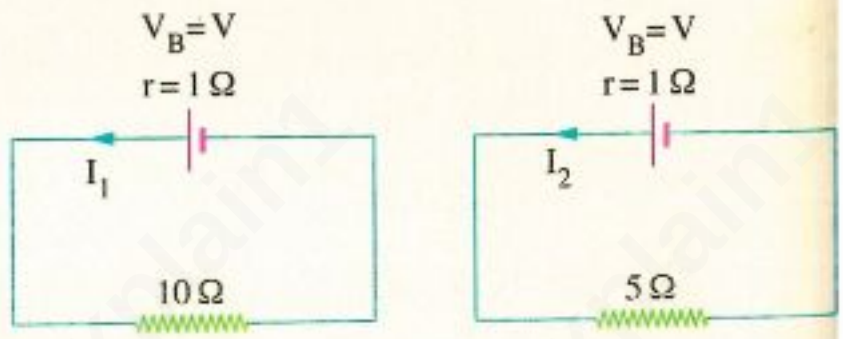


Figure (1) **Figure (2)**

(a) 1.2 V (b) 1.5 V (c) 2 V (d) 3 V

3 In the opposite figure, the ratio $\left(\frac{I_1}{I_2}\right)$ equals ..... . *(Exp. June 21)*



Circuit (1) **Circuit (2)**

(a) $\frac{6}{11}$

(b) $\frac{11}{6}$

(c) $\frac{1}{2}$

(d) $\frac{1}{1}$

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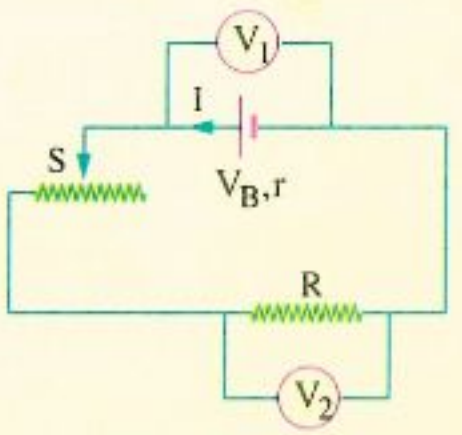
4 In the opposite closed electric circuit, the ratio

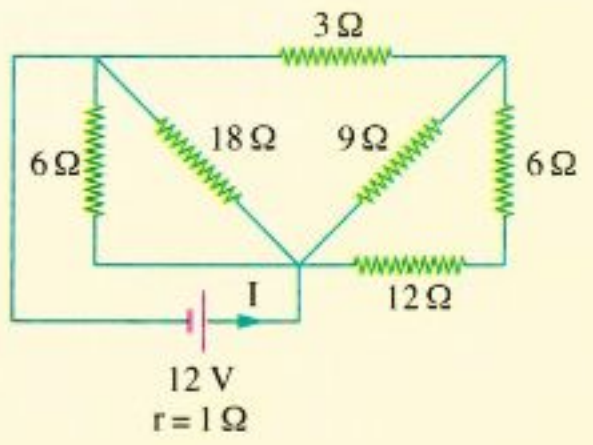
of $\frac{\text{the reading of voltmeter } V_1}{\text{the reading of voltmeter } V_2}$ = ... *(1st session 21)*



(a) $\frac{IR}{V_B + V_2}$ (b) $\frac{IR - Ir}{V_2 - V_B}$

(c) $\frac{V_B - Ir}{IR}$ (d) $\frac{V_B + Ir}{IR}$

5 In the shown electric circuit, the electric current intensity (I) equals ..... . *(1st session 21)*



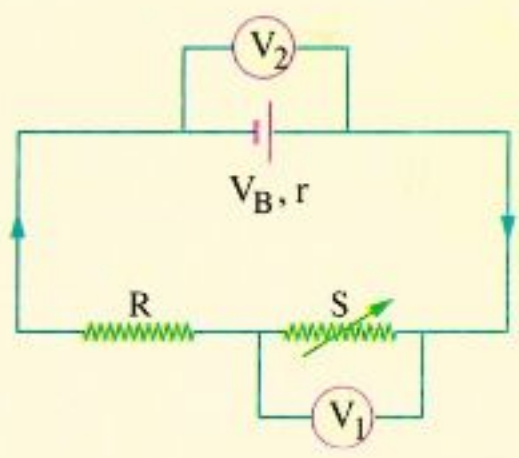
(a) 4 A

(b) 0.76 A

(c) 0.83 A

(d) 3 A

6 In the opposite closed electric circuit, when the value of resistance S is increased, ... *(2nd session 21)*



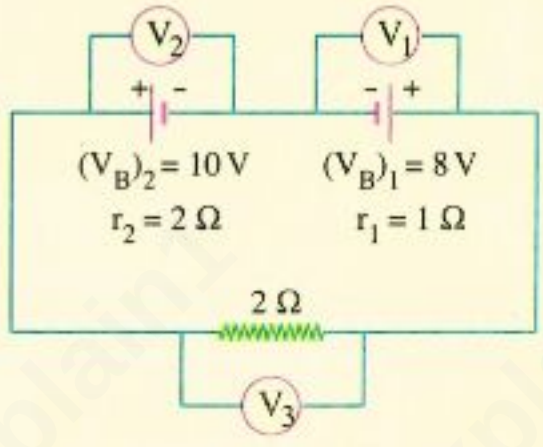
(a) the readings of both (V_1) and (V_2) increase

(b) the reading of (V_1) increases while of (V_2) decreases

(c) the reading of (V_1) decreases while of (V_2) increases

(d) the readings of both (V_1) and (V_2) decrease

7 In the opposite electric circuit: If the reading of voltmeter V_3 equals 0.8 V. Which choice correctly represents the readings of V_1 and V_2? *(2nd session 21)*



	V_1	V_2
(a)	10 V	6 V
(b)	8.4 V	9.2 V
(c)	7.6 V	9.2 V
(d)	4 V	8 V

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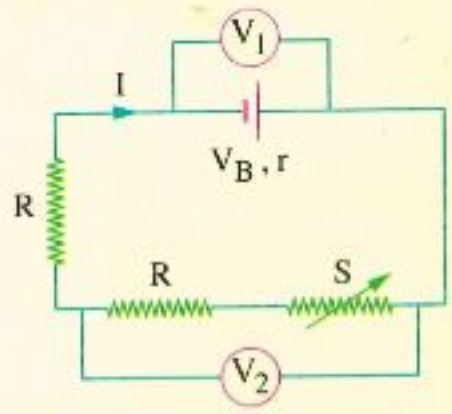
8 In the shown electric circuit:

On increasing the value of the variable resistance (S).

Which choice correctly represents the change in the readings of voltmeters (V_1) and (V_2)? *(1st session 22)*

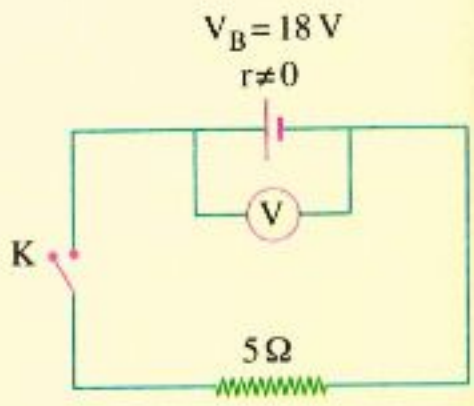


	V_1	V_2
(a)	Increases	Increases
(b)	Remains constant	Increases
(c)	Decreases	Remains constant
(d)	Decreases	Decreases

9 If the voltmeter reads 18 V when the switch (K) is opened, but reads 15 V when the switch is closed, so the internal resistance of the cell = ... *(1st session 22)*

(a) 3 Ω (b) 2 Ω

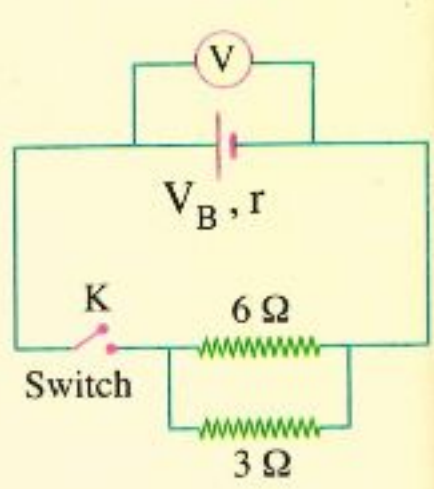
(c) 4 Ω (d) 1 Ω



10 In the electric circuit shown, the voltmeter reads 14 V when the switch (K) is opened, but reads 8 V when the switch (K) is closed. Then the internal resistance of the battery = ... *(2nd session 22)*

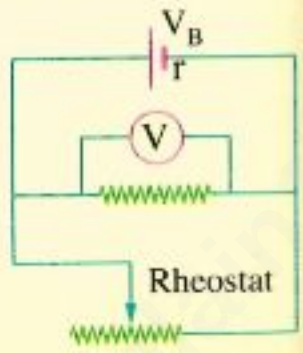
(a) 1.25 Ω (b) 0.5 Ω

(c) 1.5 Ω (d) 0.25 Ω



11 According to the opposite circuit, which of the following represents what will happen to the reading of the voltmeter by changing the value of resistance which is taken from rheostat? *(Exp. 23)*

	The value of the resistance taken from the rheostat	**The reading of the voltmeter**
(a)	Decreases	Decreases
(b)	Decreases	Increases
(c)	Increases	Decreases
(d)	Increases	Doesn't change



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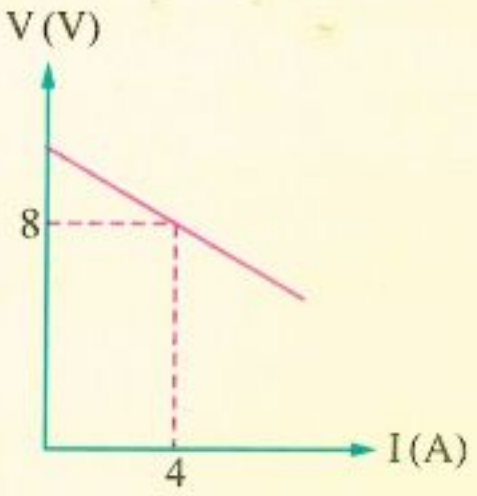
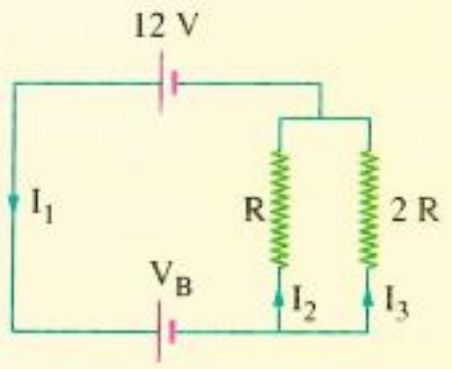
12 The opposite graph shows the relation between the terminal voltage of a battery (V) that has an internal resistance 0.5 Ω connected with a closed electric circuit and the current intensity (I) that passes through it, then the value of the electromotive force of the battery is ..... . *(Exp. 23)*



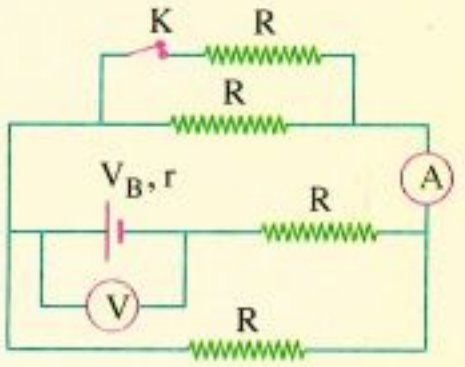
(a) 8 V (b) 10 V
(c) 9 V (d) 12 V

13 As in the shown circuit, which of the following is correct with respect to the value of V_B, I_1 and I_2? *(Exp. 23)*



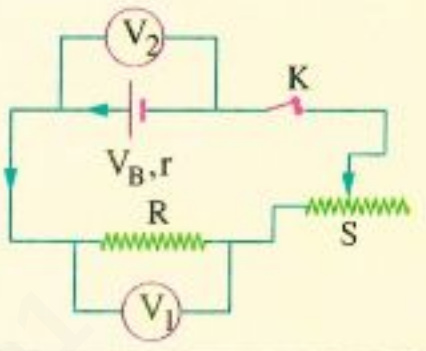
	V_B	I_1	I_2
(a)	6 V	2 A	1 A
(b)	18 V	3 A	1 A
(c)	18 V	1 A	2 A
(d)	6 V	3 A	2 A

14 The figure illustrates a closed electric circuit. So, when the switch (K) is opened, ... *(1st session 23)*



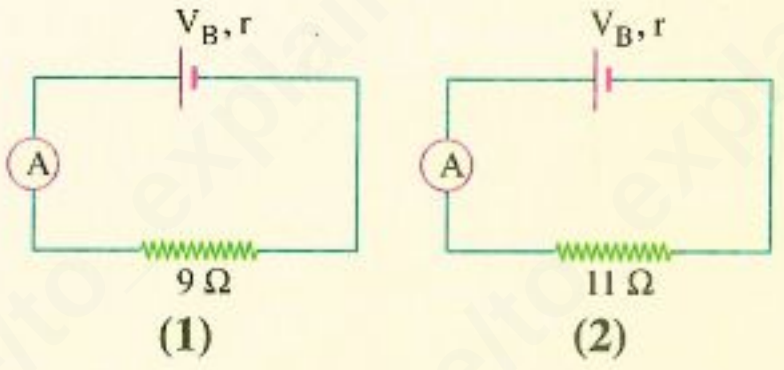
(a) the ammeter reading decreases, while the voltmeter reading increases
(b) the ammeter reading increases, while the voltmeter reading decreases
(c) the reading of both ammeter and voltmeter decreases
(d) the reading of both ammeter and voltmeter increases

15 In the shown closed electric circuit:
We can conclude that ..... . *(2nd session 23)*



(a) $V_2 < V_B$ (b) $V_1 > V_B$
(c) $V_2 = V_B$ (d) $V_1 = V_2$

16 The figure illustrates a cell with internal resistance (r), when it is connected to 2 different circuits (each individually), the ammeter reading is (1.2 A) in the first circuit and (1 A) in the second circuit. So the value of the internal resistance of the cell = ... *(2nd session 23)*

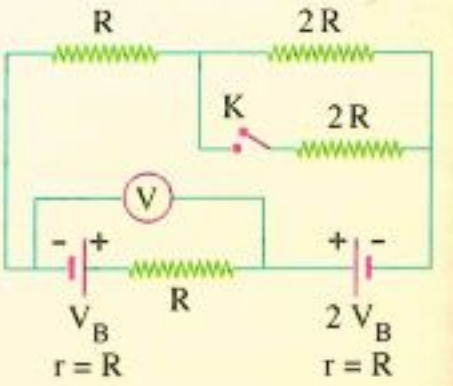


(a) 1.5 Ω (b) 2 Ω (c) 0.5 Ω (d) 1 Ω

https://t.me/to_explain1

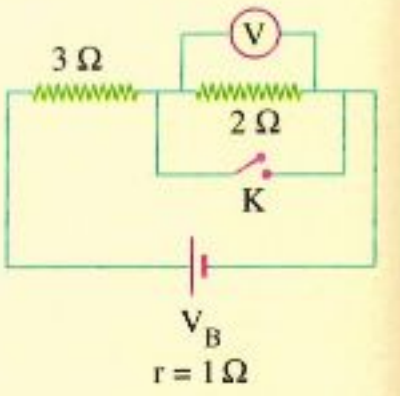
17 In the shown electric circuit, which choice is correct?

	Reading of voltmeter when K is opened	Reading of voltmeter when K is closed
(a)	$\frac{4}{3}V_B$	$\frac{6}{5}V_B$
(b)	$\frac{4}{3}V_B$	$\frac{7}{5}V_B$
(c)	$\frac{7}{6}V_B$	$\frac{6}{5}V_B$
(d)	$\frac{7}{6}V_B$	$\frac{7}{5}V_B$



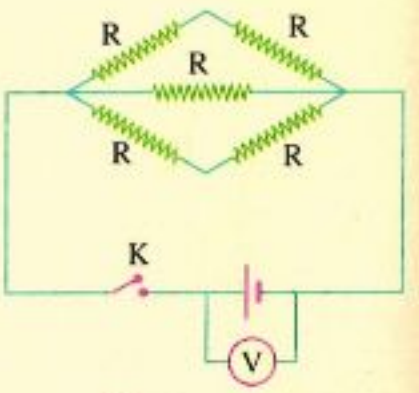
(1st session 24)

18 The opposite figure represents an electric circuit, if the reading of the voltmeter, when the key is open = 4 V
Then the potential difference between the terminals of the 3 Ω resistor when the key is closed = ... *(2nd session 24)*



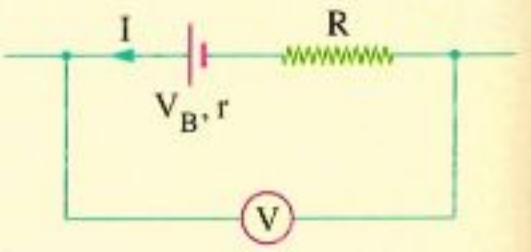
(a) 4 V (b) 8 V
(c) 6 V (d) 9 V

19 In the opposite electric circuit, if the internal resistance of the battery is 0.5 Ω and the reading of the voltmeter when switch K is open is 21 V and when it is closed, is 19.5 V, then the intensity of the electric current in the circuit and the value of resistance R respectively are ....., ... *(Exp. 25)*



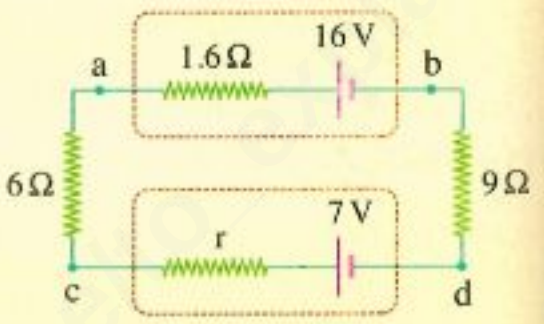
(a) 2 A, 10 Ω (b) 2 A, 13 Ω (c) 3 A, 10 Ω (d) 3 A, 13 Ω

20 The opposite figure represents section of electric circuit, so the reading of the voltmeter (V) can be calculated from the relation; ..... *(Exp. 25)*



(a) $V = V_B - I(R + r)$ (b) $V = V_B - I(R - r)$
(c) $V = V_B + I(R + r)$ (d) $V = V_B + I(R - r)$

21 In the electrical circuit shown in the opposite figure, if the potential difference between points a and b is 15.2 V, then the value of r and the potential difference between points c and d respectively are ....., ... *(Exp. 25)*



(a) 1.4 Ω , 7.7 V (b) 1.4 Ω, 7.8 V (c) 0.7 Ω, 7.7 V (d) 2.8 Ω, 8.4 V

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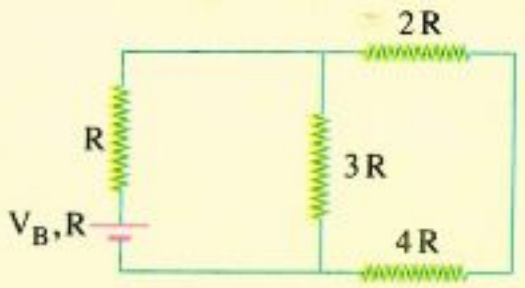
22 In the opposite electrical circuit, a group of different resistors are connected together with a battery of internal resistance R. Which of the following relationships for the potential differences across the external resistors is correct ? *(Exp. 25)*



(a) $V_{3R} = 3\ V_R = 3\ V_{2R} = 1.5\ V_{4R}$

(b) $V_{3R} = 3\ V_R = 1.5\ V_{2R} = 0.75\ V_{4R}$

(c) $V_{3R} = 2\ V_R = V_{2R} = V_{4R}$

(d) $V_{3R} = 2\ V_R = 3\ V_{2R} = 1.5\ V_{4R}$

23 If the total work done to transfer a quantity of charge of 2 C inside a battery and outside it is 12 J, then this means that ..... . *(Exp. 25)*

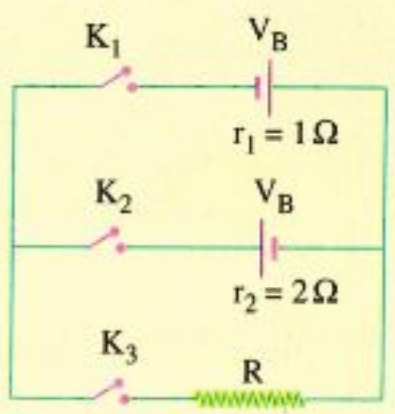
(a) the intensity of the current in the battery is 6 A

(b) the electrical power produced by the battery is 6 W

(c) the internal resistance of the battery is 6 Ω

(d) the electromotive force of the battery is 6 V

24 In the shown electric circuit when closing K_1 and K_3 only, a current of 0.8 A passes. And when closing K_2 and K_3 only, a current of 0.6 A passes, **calculate** the value of V_B *(1st session 24)*



.....

.....

.....

25 A battery of electromotive force 18 V and internal resistance 2 ohms is connected with resistance R, if the potential difference between the two terminals of the battery is 12 V. **Calculate** the electric current intensity in the circuit if a resistance of 12 ohms is connected in parallel with the resistance R? *(2nd session 24)*

.....

.....

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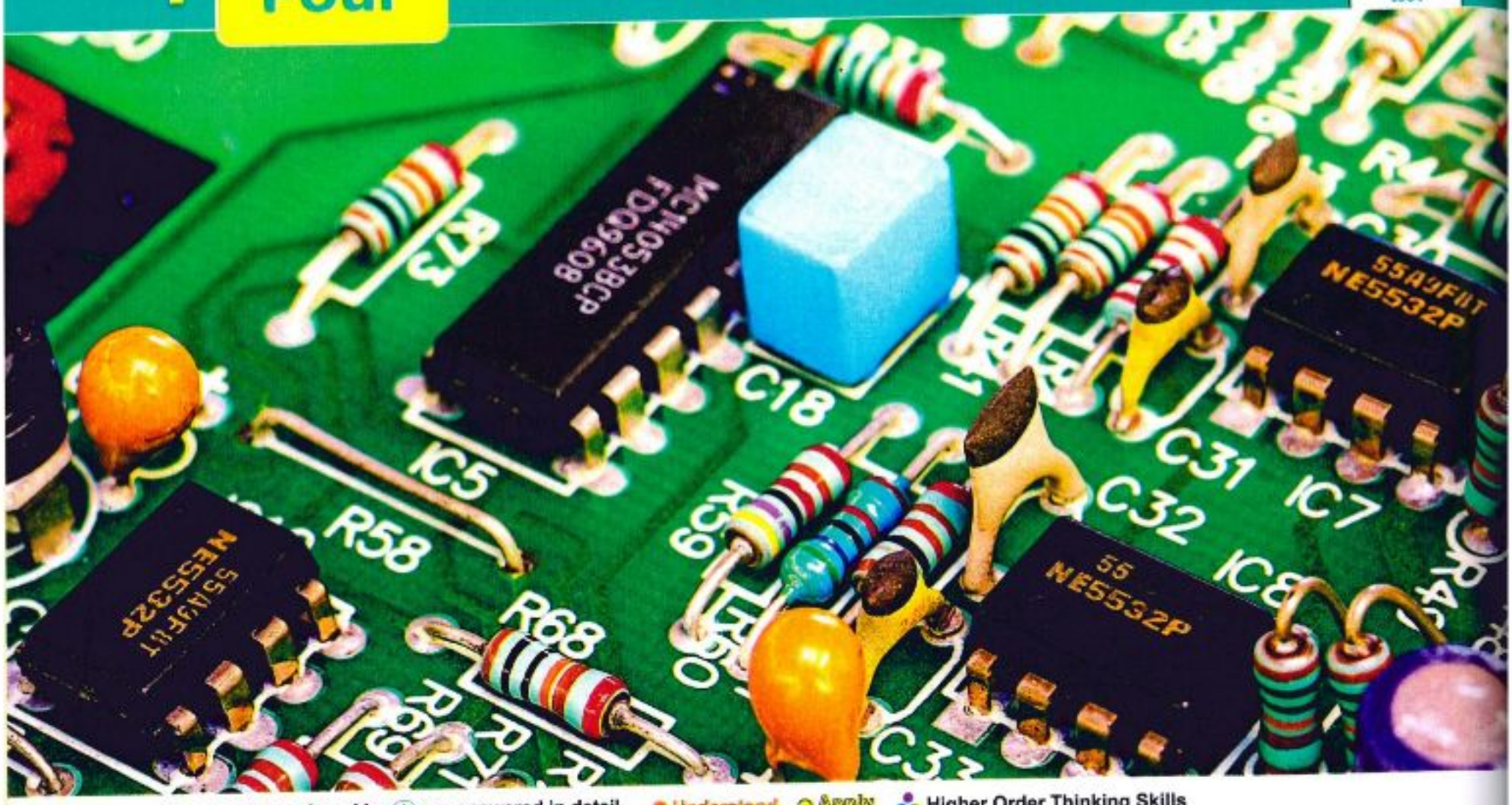
Chapter 1

Questions on Lesson Four

Kirchhoff's Laws

Interactive test

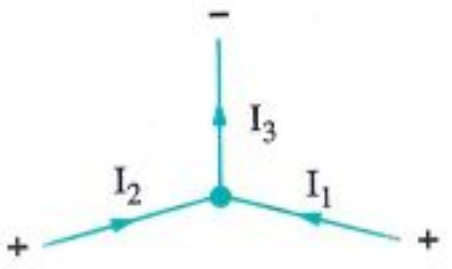


The questions signed by ✳ are answered in detail. ● Understand ○ Apply ●● Higher Order Thinking Skills

Important guidelines

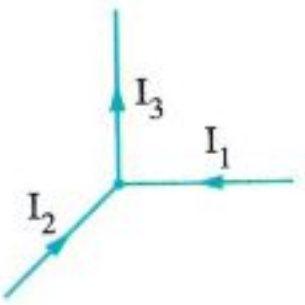
⇒ **Kirchhoff's laws:**

• **Kirchhoff's first law :**



$\Sigma I = 0$

$I_1 + I_2 - I_3 = 0$



$\Sigma I_{in} = \Sigma I_{out}$

$I_1 + I_2 = I_3$

• **Kirchhoff's second law :**

You must consider the following sign rules when applying Kirchhoff's second law in a closed loop:

(1) When using the mathematical formula: $\Sigma V_B = \Sigma IR$

In the resistor	In the battery
Path direction I R $V = +IR$	Path direction + − $V = V_B$

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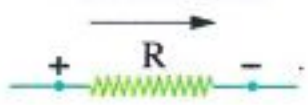
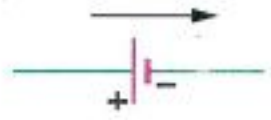
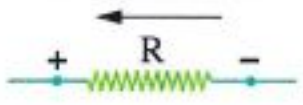
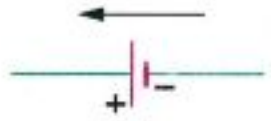
Path direction	Path direction
$V = -IR$	$V = -V_B$

(2) When using the mathematical formula: $\Sigma V = 0$

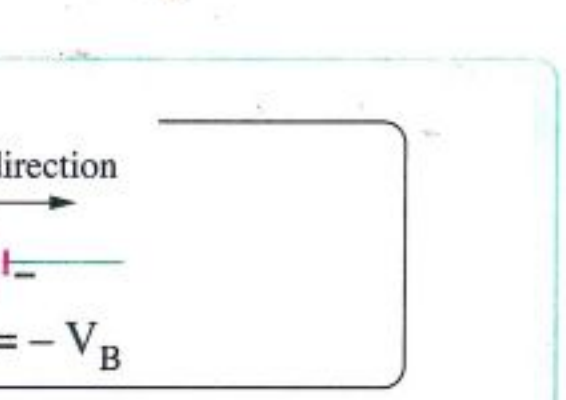
In the resistor	In the battery
Path direction  $V = -IR$	Path direction  $V = -V_B$
Path direction  $V = IR$	Path direction  $V = V_B$

First Multiple choice questions

Kirchhoff's first law

1 In the network shown in the figure, ...

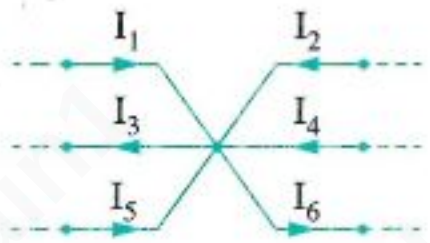
	Electric current (I)	Current direction (I)
(a)	3 A	from a to c
(b)	3 A	from c to a
(c)	5 A	from a to c
(d)	5 A	from c to a



2 In the opposite figure, if $I_1 = I_2 = I_3 = I_4 = I_5$, then I_6 = ...

(a) I_1 (b) $2\,I_1$

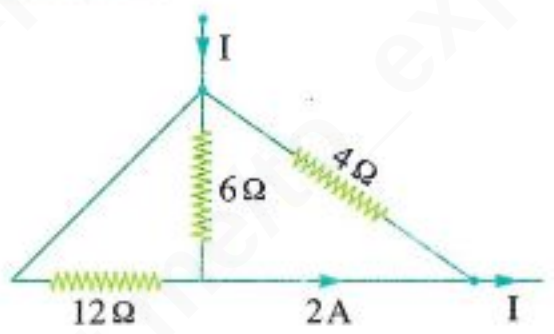
(c) $3\,I_1$ (d) $4\,I_1$



3 In the opposite figure, the value of I is ..... .

(a) 2 A (b) 4 A

(c) 6 A (d) 12 A



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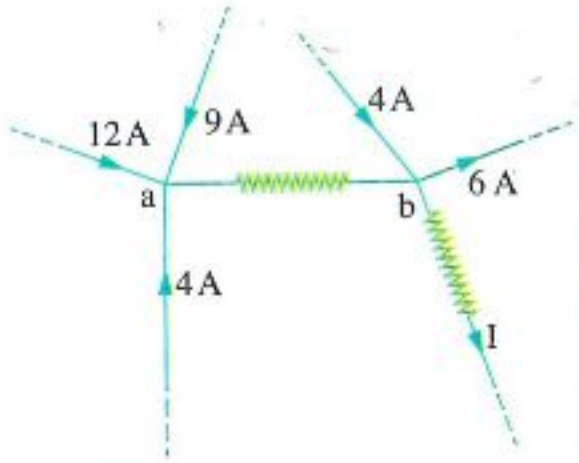
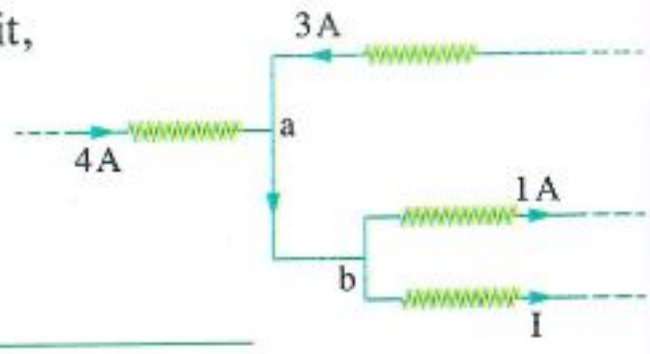
4 The opposite figure represents a part of an electric circuit, hence the value of I is ..... .



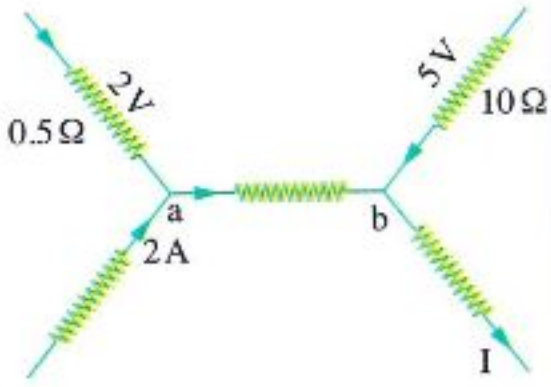
(a) 19 A
(b) 23 A
(c) 27 A
(d) 31 A

5 The opposite figure represents a part of an electric circuit, hence the value of I is ..... .



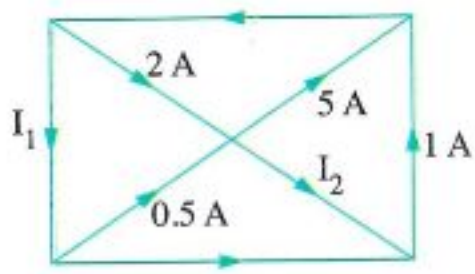
(a) 2 A (b) 4 A
(c) 6 A (d) 8 A

6 The opposite figure represents a part of an electric circuit, hence the value of I is ..... .



(a) 2.5 A
(b) 3.5 A
(c) 6.5 A
(d) 7.5 A

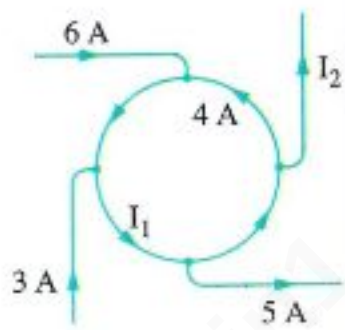
7 In the opposite circuit:



(i) The intensity of current I_1 is ..... .
(a) – 2.5 A (b) 3.5 A (c) 4 A (d) 6 A

(ii) The intensity of current I_2 is ..... .
(a) – 2.5 A (b) 3.5 A (c) 4 A (d) 6 A

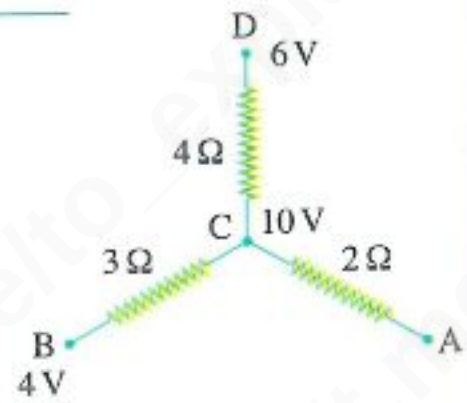
8 A metal ring is embedded in an electric circuit through which electric currents pass as shown in the opposite figure. So:



(i) I_1 equals ..... .
(a) 0 A (b) 4 A (c) 9 A (d) 13 A

(ii) I_2 equals ..... .
(a) 2 A (b) 4 A (c) 9 A (d) 12 A

9 In the opposite electric circuit, if the electric potentials of the points B, C and D are 4 V, 10 V and 6 V respectively, then the electric potential of point A equals ..... .



(a) 4 V (b) 8 V
(c) 12 V (d) 16 V

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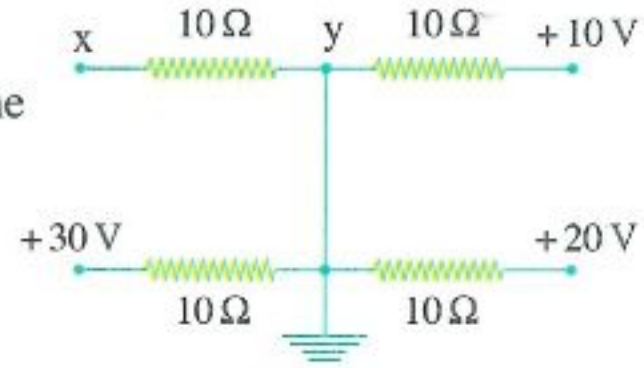
10 The opposite figure shows a part of an electrical circuit indicating the electric potentials at some points. Then, the intensity of the electric current passing between the two points (x) and (y) shown in the figure equals ..... .

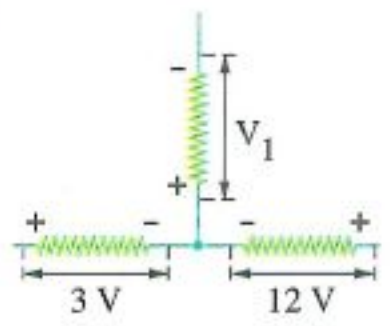


(a) 1 A (b) 4 A

(c) 5 A (d) 6 A

---

11 The opposite diagram represents a part of a closed electric circuit, so if each resistor has a resistance of 3 Ω, the value of V_1 is ..... .

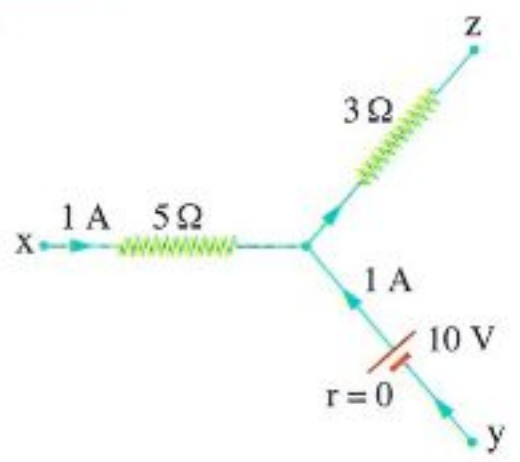


(a) 10 V (b) 20 V

(c) 15 V (d) 12 V

---

12 In the opposite figure, the correct arrangement for the potential difference at points x, y and z is .....



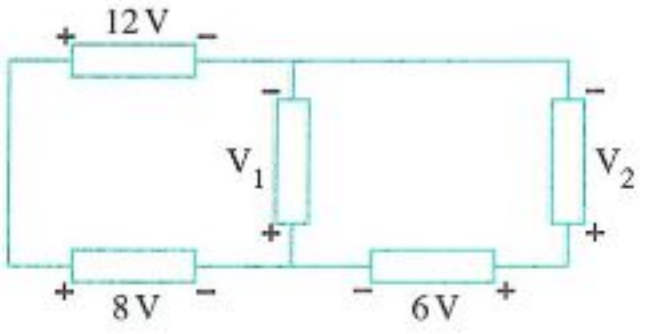
(a) $V_x > V_y > V_z$ (b) $V_y > V_x > V_z$

(c) $V_z > V_x > V_y$ (d) $V_x > V_z > V_y$

Kirchhoff's second law

13 In the shown circuit, the values of ..... .

	V_1	V_2
(a)	4 V	10 V
(b)	4 V	7 V
(c)	10 V	10 V
(d)	10 V	7 V



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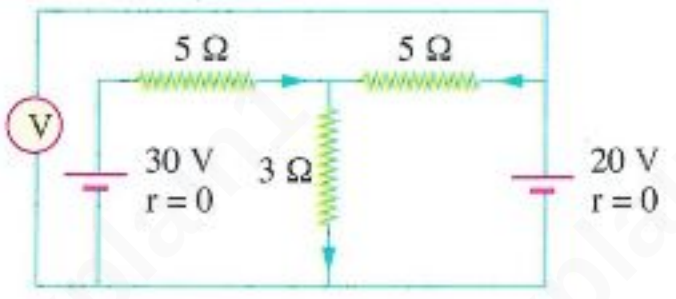
14 In the opposite electric circuit, the reading of the voltmeter is ..... .

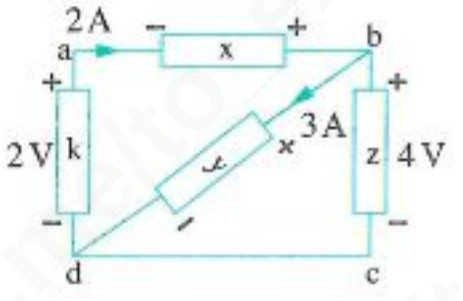


(a) 20 V (b) 15 V

(c) 5 V (d) 0

---

15 ✱ In the opposite circuit, the powers $(P_w)_x$ and $(P_w)_y$ are ..... respectively.



(a) 4 W, 12 W (b) 12 W, 4 W

(c) 16 W, 12 W (d) 4 W, 14 W

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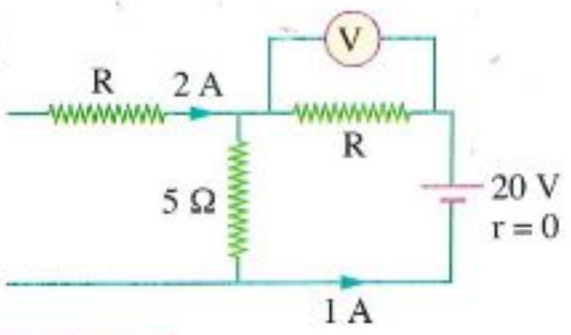
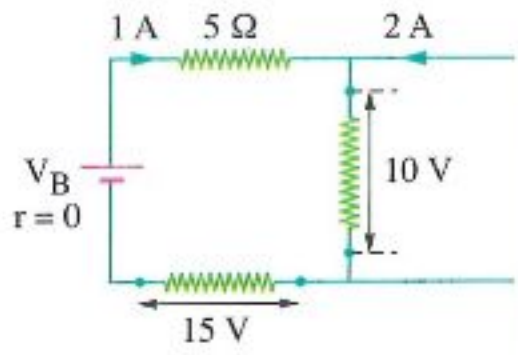
16 The opposite diagram represents a part of an electric circuit, so the voltmeter reading is ..... .



(a) 20 V (b) 15 V
(c) 5 V (d) 1 V

---

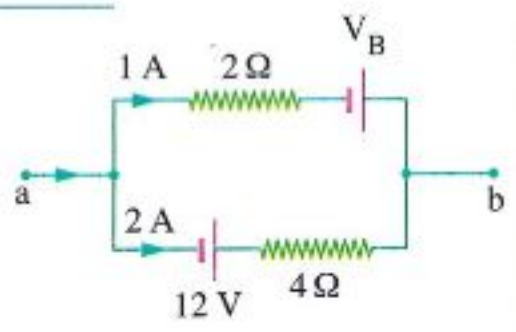
17 The opposite figure represents a part of an electric circuit through which an electric current is passing, so the value of V_B is ..... .



(a) 20 V (b) 30 V
(c) 40 V (d) 50 V

---

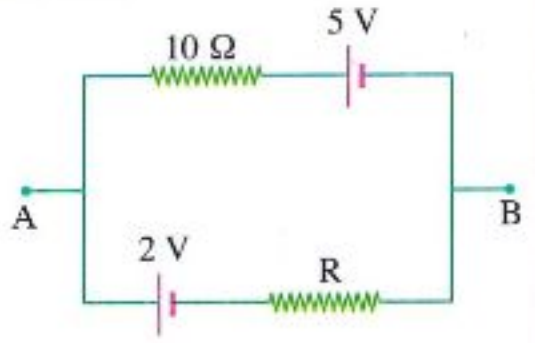
18 The opposite figure represents a part of an electric circuit, so the magnitude of the electromotive force V_B equals ..... .



(a) 3 V (b) 4 V
(c) 6 V (d) 8 V

---

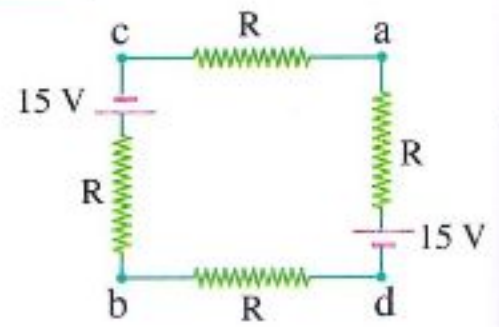
19 If the potential difference between A and B in the opposite electric circuit equals 4 V, then the value of resistance R equals ..... .



(a) 5 Ω (b) 10 Ω
(c) 15 Ω (d) 20 Ω

---

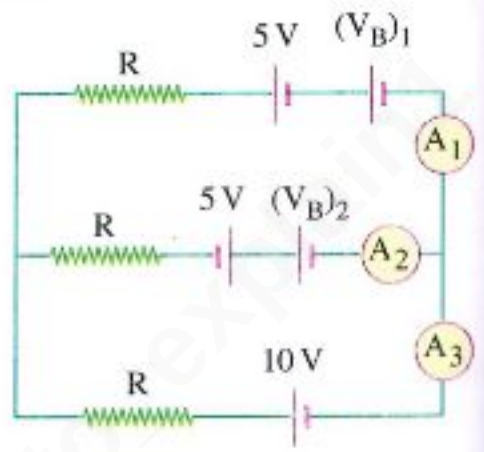
20 ✱ In the electric circuit shown in the figure, if the value of R is 7.5 Ω, the potential difference between points a and b equals ..... .



(a) 0 (b) 5 V
(c) 10 V (d) 15 V

---

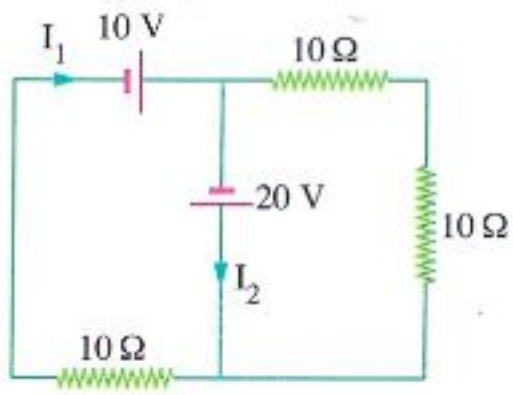
21 In the opposite electrical circuit, if the reading of each of the three ammeters is equal to zero, and all the batteries have negligible internal resistances, then the values of the electromotive forces $(V_B)_1$ and $(V_B)_2$ respectively are ..... .



(a) 5 V, 10 V
(b) 10 V, 5 V
(c) 5 V, 15 V
(d) 15 V, 5 V

https://t.me/to_explain1

22 In the opposite electric circuit:



(i) The current intensity I_1 equals ..... .

(a) 1 A (b) 2 A

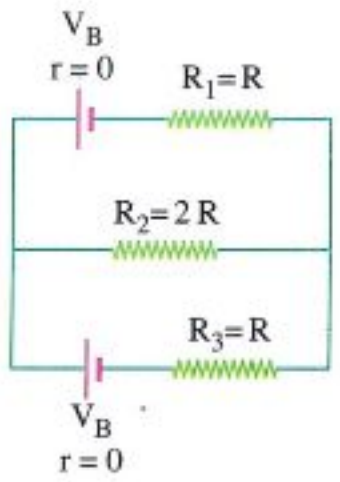
(c) 3 A (d) 4 A

(ii) The current intensity I_2 equals ..... .

(a) 1 A (b) 2 A (c) 3 A (d) 4 A

---

23 The opposite figure shows a closed electric circuit, so the resistance which carries the greatest electric current intensity is ..... .



(a) R_1

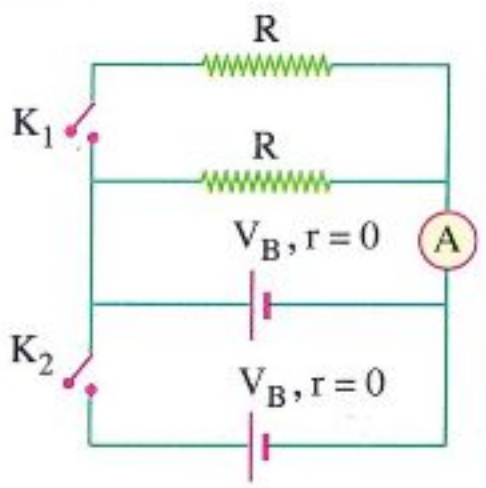
(b) R_2

(c) R_3

(d) R_1, R_2

---

24 In the opposite electrical circuit, if the ammeter reading is I, so its reading when:



(i) closing switch (K_1) only will be ..... .

(a) I (b) $\frac{I}{2}$

(c) 2 I (d) 4 I

(ii) closing switch (K_2) only will be ..... .

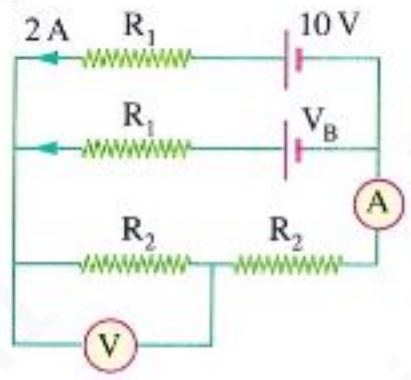
(a) I (b) $\frac{I}{2}$ (c) 2 I (d) 4 I

(iii) closing both switches (K_1 and K_2) together will be ..... .

(a) I (b) $\frac{I}{2}$ (c) 2 I (d) 4 I

---

25 * In the opposite circuit, if the ammeter reading is 4 A and the voltmeter reading is 3 V, the electromotive force (V_B) equals ..... .

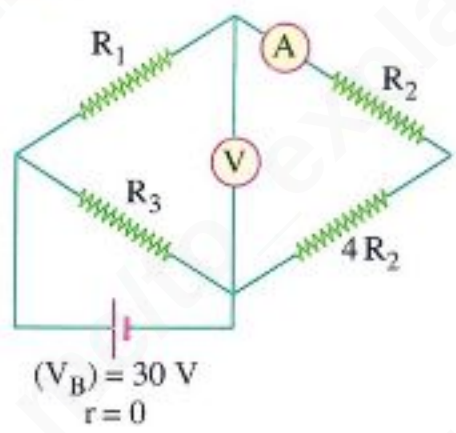


(a) 4 V (b) 6 V

(c) 10 V (d) 14 V

---

26 In the opposite electrical circuit, if the ammeter reading is 1 A and the voltmeter reading is 10 V, then the values of the resistances (R_1) and (R_2) respectively are ....., ...

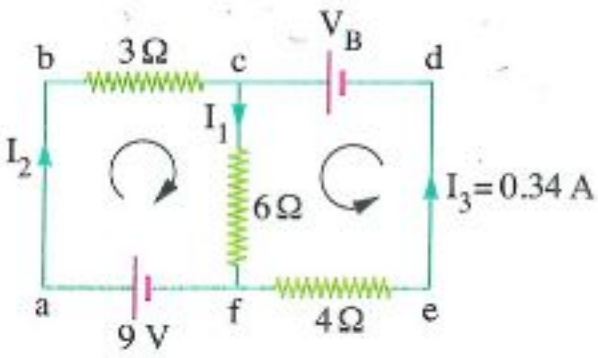


(a) 10 Ω, 5 Ω (b) 30 Ω, 2 Ω

(c) 20 Ω, 10 Ω (d) 20 Ω, 2 Ω

https://t.me/to_explain1

27 ✳ In the opposite electric circuit:



(i) The intensity of current I_1 equals ..... .

(a) 4.01 A (b) 8.02 A

(c) 0.77 A (d) 1.11 A

(ii) The intensity of current I_2 equals ..... .

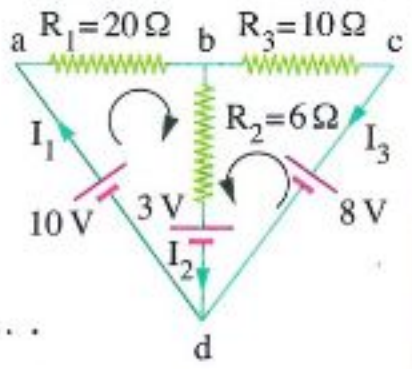
(a) 0.77 A (b) 4.01 A (c) 8.02 A (d) 1.11 A

(iii) The electromotive force V_B equals ..... .

(a) 2.01 V (b) 4.03 V (c) 6.01 V (d) 8.02 V

---

28 ✳ In the opposite electric circuit:



(i) The intensity of the current that passes in resistor R_1 equals ..... .

(a) 0.22 A (b) – 0.23 A

(c) 0.45 A (d) 0.53 A

(ii) The intensity of the current that passes in resistor R_2 equals ..... .

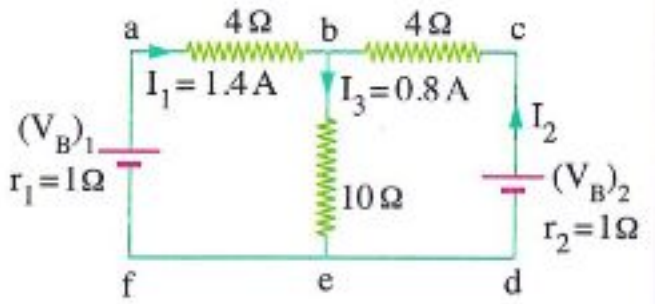
(a) 0.22 A (b) – 0.23 A (c) 0.45 A (d) 0.53 A

(iii) The intensity of the current that passes in resistor R_3 equals ..... .

(a) 0.22 A (b) – 0.23 A (c) 0.45 A (d) 0.53 A

---

29 ✳ In the opposite electric circuit:



(i) The electromotive force $(V_B)_1$ equals ..... .

(a) 5 V (b) 8 V

(c) 15 V (d) 20 V

(ii) The electromotive force $(V_B)_2$ equals ..... .

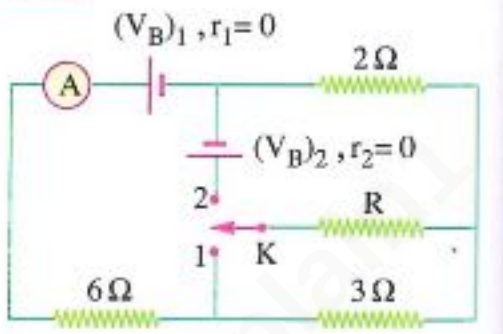
(a) 5 V (b) 8 V (c) 10 V (d) 12 V

(iii) The magnitude of potential difference between points e and b equals ..... .

(a) 5 V (b) 6 V (c) 7 V (d) 8 V

---

30 In the opposite electric circuit, the ammeter reading is 2 A, so if when closing switch K in position (1), the ammeter reading becomes 2.2 A and when closing switch K in position (2), the ammeter reading becomes 1.81 A, then:



(i) The electromotive force of battery $(V_B)_1$ is ..... .

(a) 20 V (b) 22 V (c) 18 V (d) 16 V

(ii) The resistance of R equals ..... .

(a) 3 Ω (b) 6 Ω (c) 2 Ω (d) 12 Ω

(iii) The electromotive force of battery $(V_B)_2$ is approximately ..... .

(a) 12 V (b) 14 V (c) 16 V (d) 18 V

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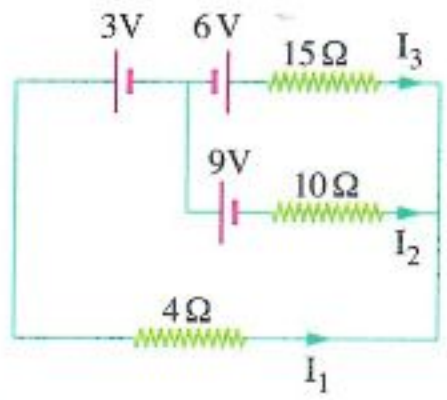
31 ✳ By applying Kirchhoff's laws on the opposite circuit, you can find that:

(Knowing that: The directions indicated on the figure are hypothetical directions and are not necessarily the correct directions for the current)



(i) The intensity of electric current I_1 is ..... .

(a) 0.36 A (b) 0.6 A (c) – 0.36 A (d) – 0.6 A

(ii) The intensity of electric current I_2 is ..... .

(a) 0.96 A (b) 0.6 A (c) – 0.96 A (d) – 0.6 A

(iii) The intensity of electric current I_3 is ..... .

(a) 0.36 A (b) 0.96 A (c) – 0.36 A (d) – 0.96 A

---

32 A student connected a 6 V and 12 V batteries of negligible internal resistances with two identical ohmic resistors, two ammeters and a switch to form an electric circuit as shown in figure (1), then he reversed the terminals of the 6 V battery so that the circuit became as in figure (2):

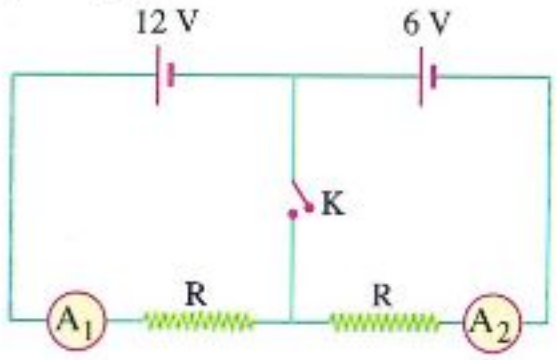


Figure (1)

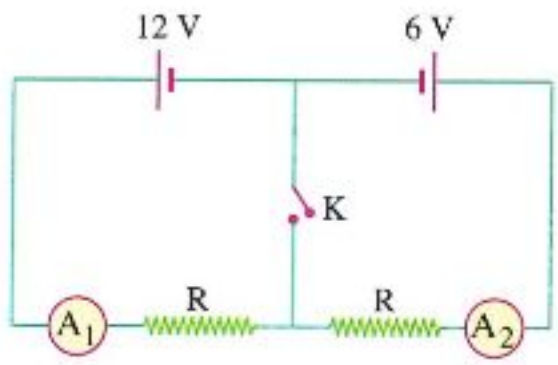


Figure (2)

When the switch (K) is closed, what happens to the readings of the two ammeters A_1 and A_2 respectively in:

(i) figure (1)?

(a) Decreases, increases. (b) Decreases, doesn't change.

(c) Doesn't change, decreases. (d) Increases, decreases.

(ii) figure (2)?

(a) Increases, doesn't change. (b) Increases, increases.

(c) Decreases, decreases. (d) Doesn't change, doesn't change.

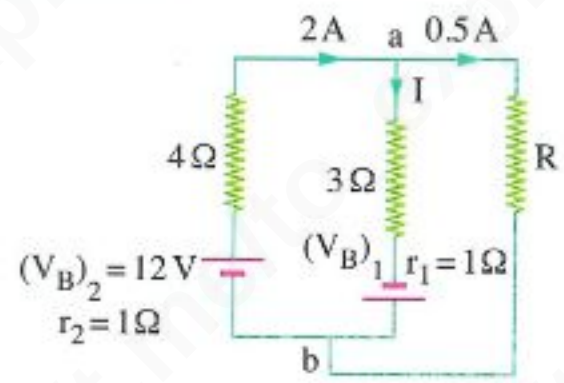
---

33 ✳ From the opposite circuit diagram:

(i) The magnitude of potential difference between the two points a, b equals ..... .

(a) 1 V (b) 2 V

(c) 4 V (d) 6 V



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(ii) The electromotive force $(V_B)_1$ equals ..... .

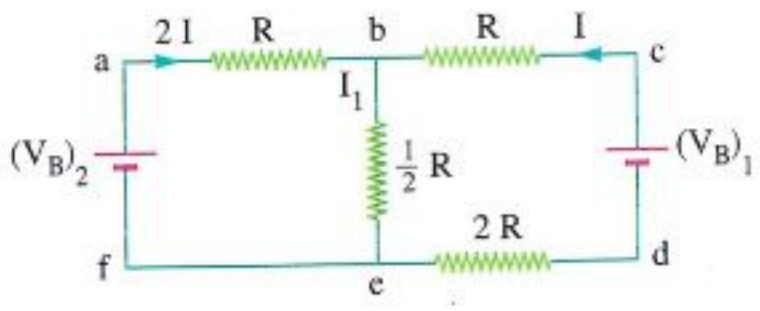
(a) 9 V (b) 6 V (c) 4 V (d) 2 V

(iii) The resistance R is ..... .

(a) 2.5 Ω (b) 2 Ω (c) 4 Ω (d) 7.5 Ω

---

34 ✱ From the opposite circuit, the ratio $\left(\frac{(V_B)_1}{(V_B)_2}\right)$ equals ..... .

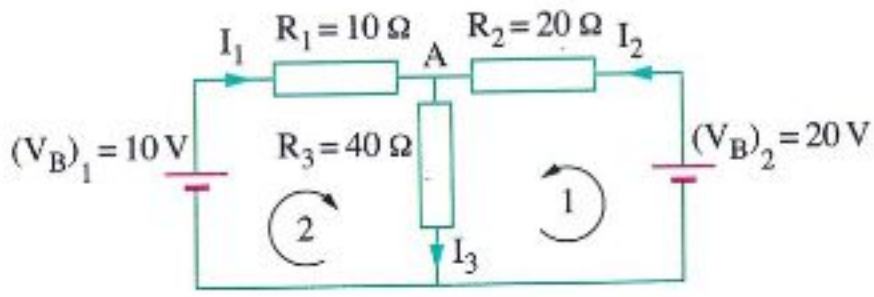


(a) $\frac{4}{5}$ (b) $\frac{5}{4}$

(c) $\frac{9}{7}$ (d) $\frac{7}{9}$

---

35 ✱ In the opposite electric circuit:



(i) The intensity of the electric current that passes in resistor R_3 is ..... .

(a) $\frac{5}{3}$ A (b) $\frac{4}{7}$ A

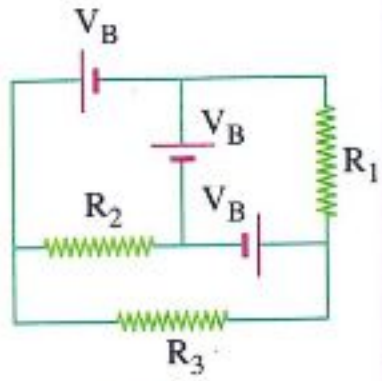
(c) $\frac{2}{7}$ A (d) $\frac{4}{9}$ A

(ii) The consumed power in the circuit is ..... .

(a) 8.57 W (b) 4.42 W (c) 3.51 W (d) 2.31 W

---

36 The opposite circuit contains multiple identical electric cells of negligible internal resistances, so which resistance doesn't carry any electric current?

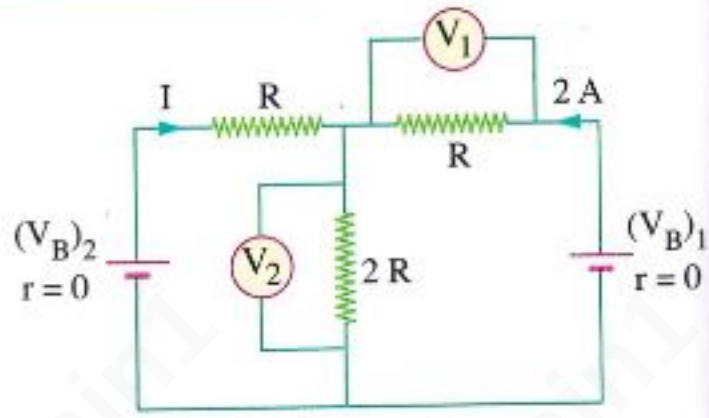


(a) R_1 (b) R_2

(c) R_3 (d) R_1, R_2

---

37 ✱ The opposite figure represents an electric circuit. If $V_2 = 4\ V_1$, then the value of I equals ..... .



(a) 2 A

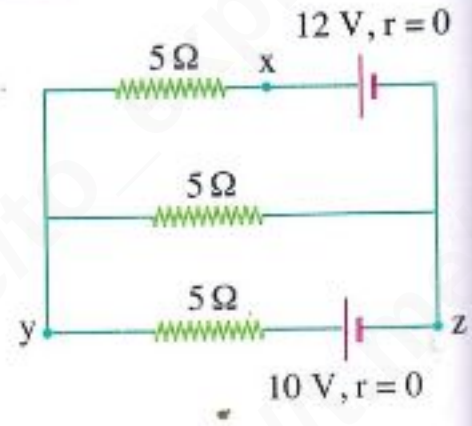
(b) 4 A

(c) 6 A

(d) 8 A

---

38 The opposite diagram represents a closed electric circuit, so .....



(a) $V_{xy} > V_{xz}$ (b) $V_{xy} = V_{xz}$

(c) $V_{xy} < V_{xz}$ (d) $V_{xy} = V_{yz}$

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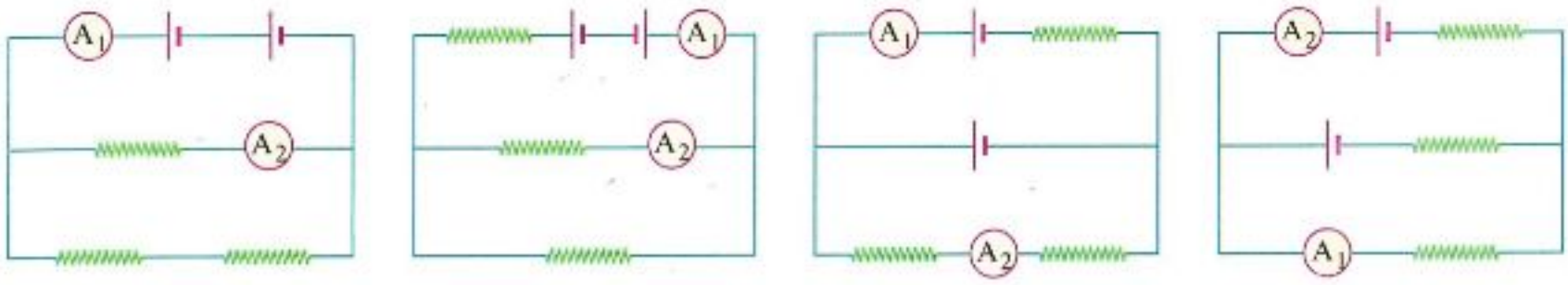
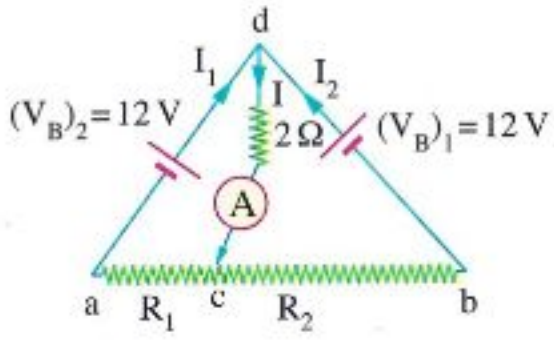
39 In the following electric circuits, all resistors are identical and all batteries are identical and have negligible internal resistances, so in which of these circuits the ammeter reading A_1 is double of the ammeter reading A_2?



(a) (b) (c) (d)

---

40 ✳ In the opposite electric circuit, if wire ab has a homogeneous resistance of 10 Ω and point c is the point of contact between the slider and wire ab which divides the wire into two resistors R_1 and R_2 where $R_2 = 1.5\ R_1$, so:



(i) The intensity of current I_1 equals ..... .

(a) 0.93 A (b) 1.09 A (c) 1.64 A (d) 2.73 A

(ii) The intensity of current I_2 equals ..... .

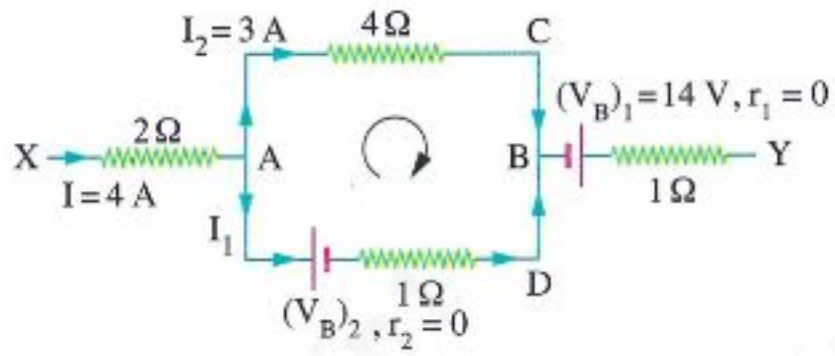
(a) 0.93 A (b) 1.09 A (c) 1.64 A (d) 2.73 A

(iii) The intensity of current I equals ..... .

(a) 0.93 A (b) 1.09 A (c) 1.64 A (d) 2.73 A

---

41 ✳ The opposite figure represents a part of an electric circuit, using Kirchhoff's laws and considering the shown data and the directions of currents and loops on the figure, so:



(i) The potential difference between the points X and Y equals ..... .

(a) 5 V (b) 7 V

(c) 10 V (d) 11 V

(ii) The magnitude of emf of battery $(V_B)_2$ equals ..... .

(a) 4 V (b) 8 V

(c) 9.5 V (d) 11 V

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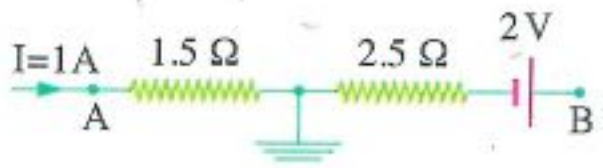
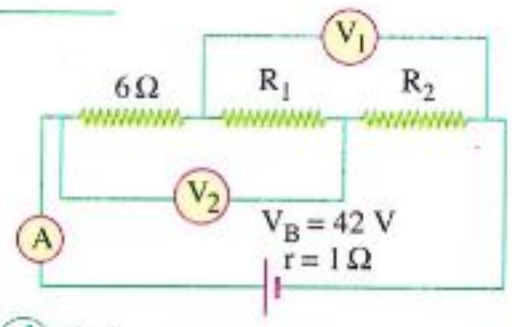
42 The opposite figure shows a part of an electric circuit through which a current of intensity 1 A passes, so ..... .



	The potential at point A (V_A)	The potential at point B (V_B)
(a)	– 1.5 V	2 V
(b)	1.5 V	2 V
(c)	– 1.5 V	0.5 V
(d)	1.5 V	– 0.5 V

43 ✳ In the opposite electrical circuit, if the voltmeter readings V_1 and V_2 are 21 V and 24 V respectively, then:



(i) The ammeter reading is ..... .

(a) 1 A (b) 2 A (c) 3 A (d) 4 A

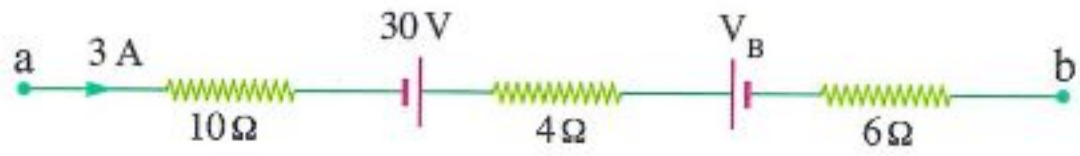
(ii) The value of resistance R_1 equals ..... .

(a) 2 Ω (b) 4 Ω (c) 5 Ω (d) 6 Ω

(iii) The value of the resistance (R_2) equals ..... .

(a) 2 Ω (b) 4 Ω (c) 5 Ω (d) 6 Ω

44 ✳ The following figure shows a part of an electric circuit, if the consumed power between the two points a and b equals 210 W and the internal resistances of the electric cells are negligible, so:



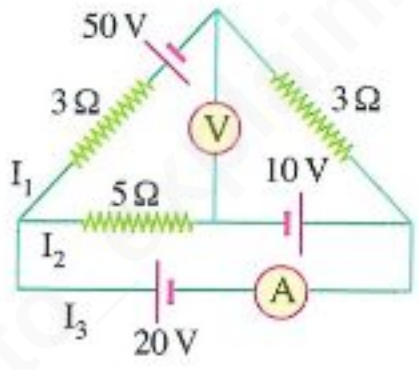
(i) The unknown electromotive force (V_B) equals ..... .

(a) 30 V (b) 20 V (c) 10 V (d) 5 V

(ii) The potential difference between the two points a and b equals ..... .

(a) 20 V (b) 30 V (c) 40 V (d) 50 V

45 ✳ In the opposite electric circuit, the readings of the ammeter and voltmeter are ..... , ...



	The ammeter's reading	The voltmeter's reading
(a)	2 A	5 V
(b)	1 A	5 V
(c)	2 A	3 V
(d)	1 A	3 V

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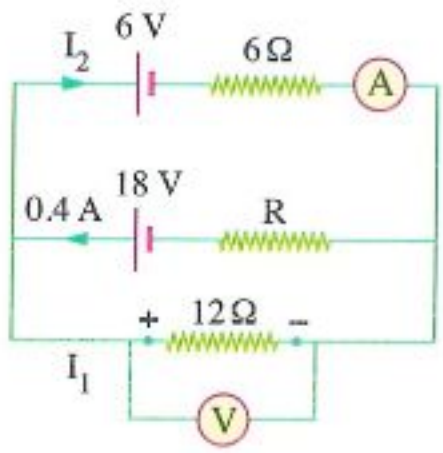
46 In the opposite electric circuit:



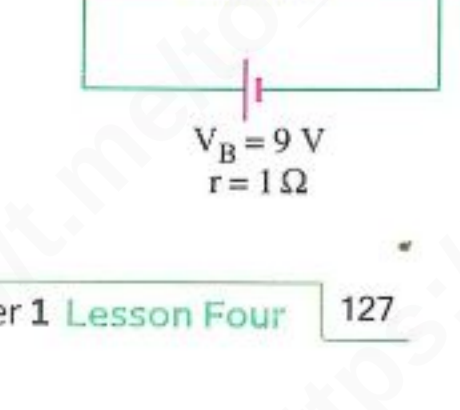
(i) The readings of the ammeter and voltmeter are ..... , ...

	The ammeter's reading	The voltmeter's reading
(a)	0.067 A	5.6 V
(b)	0.067 A	3.7 V
(c)	4.067 A	5.6 V
(d)	4.067 A	3.7 V

(ii) The resistance of R is ..... .

(a) 11 Ω (b) 12 Ω (c) 31 Ω (d) 36 Ω

47 In the opposite electrical circuit, if the voltmeter reading is 6 V, then the electromotive force (V_B) of the battery equals ..... .



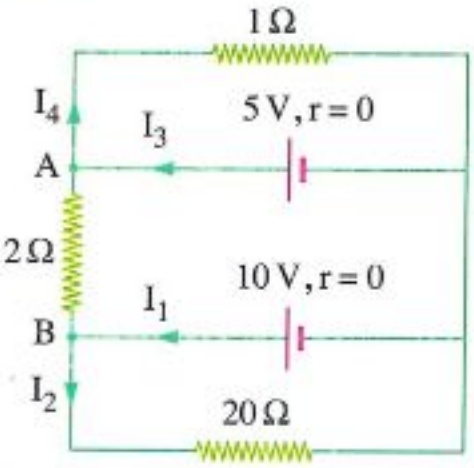
(a) 4 V

(b) 8 V

(c) 10 V

(d) 12 V

48 In the opposite electric circuit:



(i) The current intensity and the direction through the 2 Ω resistor equals ..... .

(a) 1.5 A from A to B (b) 1.5 A from B to A

(c) 2.5 A from A to B (d) 2.5 A from B to A

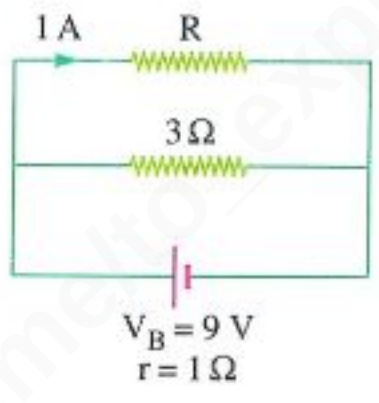
(ii) The current intensity I_1 equals ..... .

(a) 1 A (b) 2 A (c) 3 A (d) 4 A

(iii) The current intensity I_4 equals ..... .

(a) 1.5 A (b) 2.5 A (c) 3.5 A (d) 4.5 A

49 In the opposite electrical circuit, if the intensity of the electric current passing through resistor R is 1 A, then the value of resistor R equals ..... .



(a) 1.5 Ω (b) 3 Ω

(c) 6 Ω (d) 12 Ω

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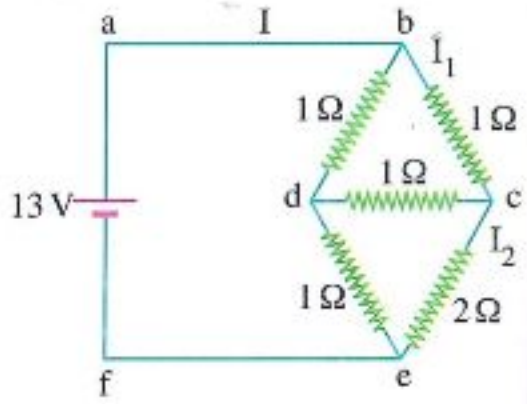
50 ✱ In the opposite electric circuit, the total resistance of the circuit equals ..... .



(a) 0.5 Ω

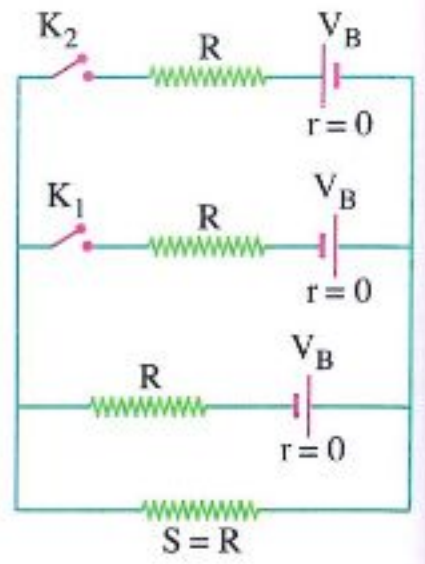
(b) 1 Ω

(c) 1.18 Ω

(d) 1.25 Ω

---

51 In the opposite electric circuit, what happens to the electric power consumed in resistor S when closing:



(i) switch K_1 only?

(a) Increases. (b) Decreases.

(c) Doesn't change. (d) Vanishes.

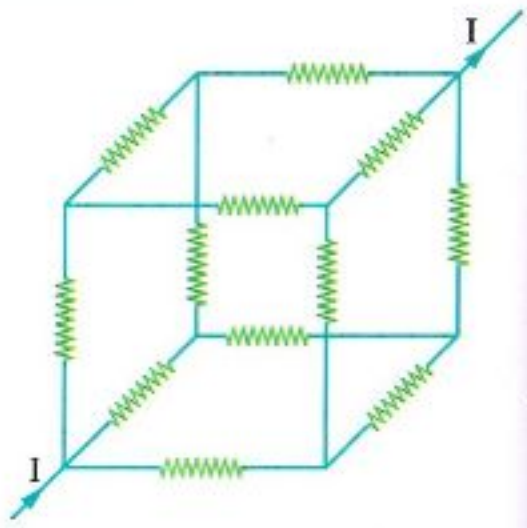
(ii) switch K_2 only?

(a) Increases. (b) Decreases.

(c) Doesn't change. (d) Vanishes.

---

52 ✱ In the shown figure, 12 resistors each of resistance R, are connected together in the form of a cube, so the equivalent resistance of the shape in terms of R equals ..... .



(a) $\frac{1}{2}$ R (b) $\frac{5}{6}$ R

(c) $\frac{3}{2}$ R (d) R

Second Essay questions

1 **Mention the scientific principle on which the following is based:**

(a) Kirchhoff's first law.

(b) Kirchhoff's second law.

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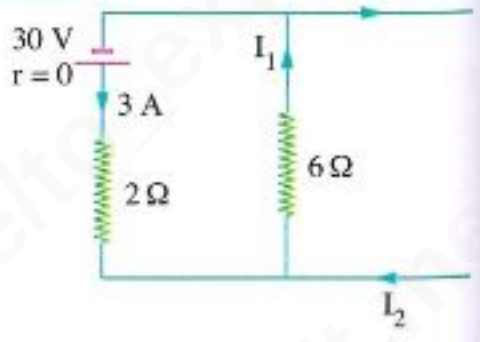
2 The opposite figure represents a part of a closed electric circuit, **calculate** the current intensity I_2



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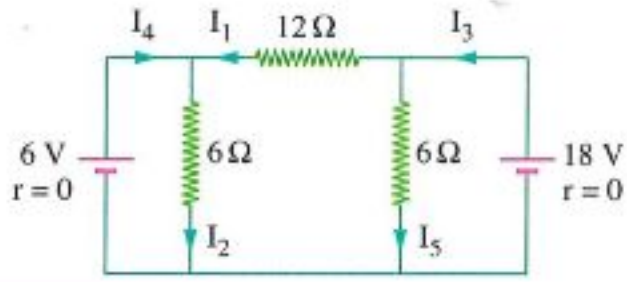
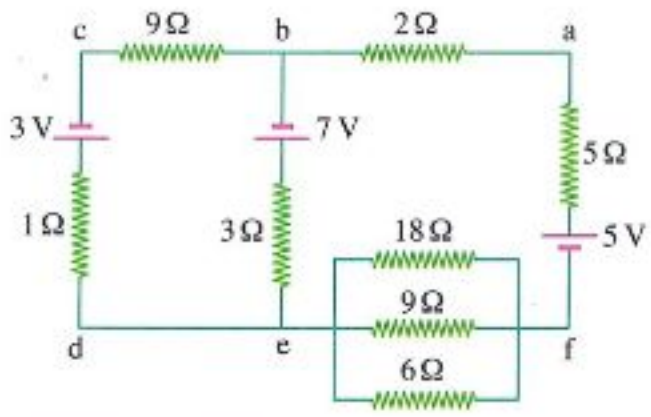
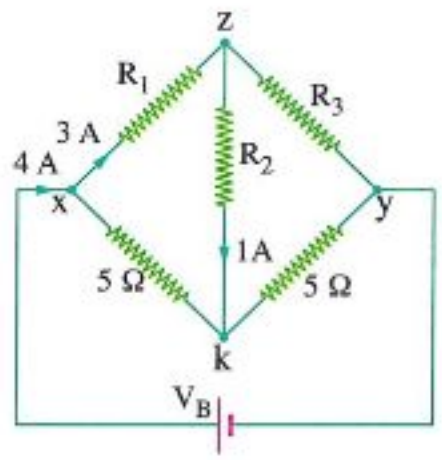
3 **Calculate** current intensities I_3, I_4 in the opposite electric circuit.



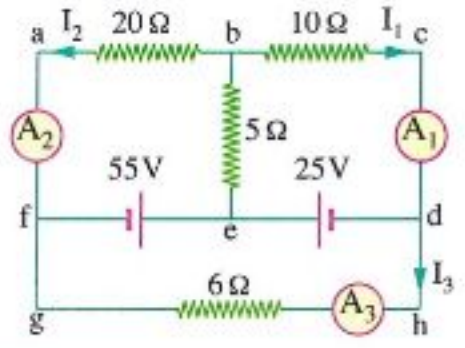
4 From the opposite circuit, **calculate** the current intensity passing through the resistor 3 Ω.



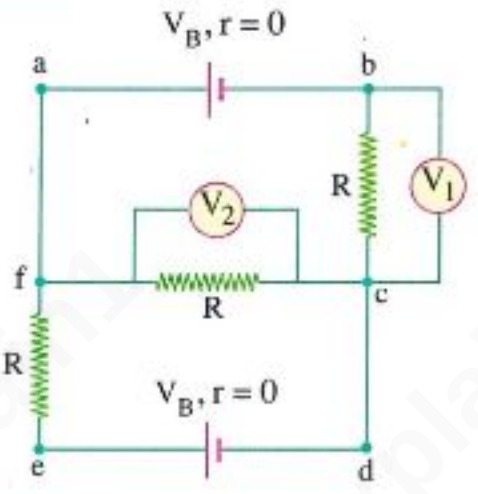
5 The opposite figure represents an electric circuit, **calculate** the emf (V_B) of the battery with neglecting its internal resistance.



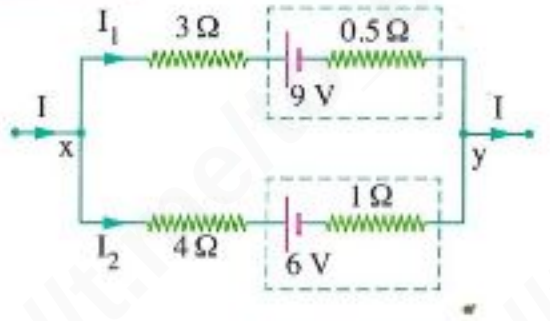
6 In the opposite electric circuit, the reading of ammeter A_1 is 1 A and the internal resistances of the batteries are negligible, **calculate** the ratio between the readings of ammeters A_2 and A_3 $\left(\frac{A_2}{A_3}\right)$.



7 In the opposite electric circuit,
prove that: $\frac{V_1}{V_2} = \frac{1}{2}$



8 The opposite figure represents a part of an electric circuit, if the potential difference between the points x and y equals 16 V, **calculate** the current intensity I.



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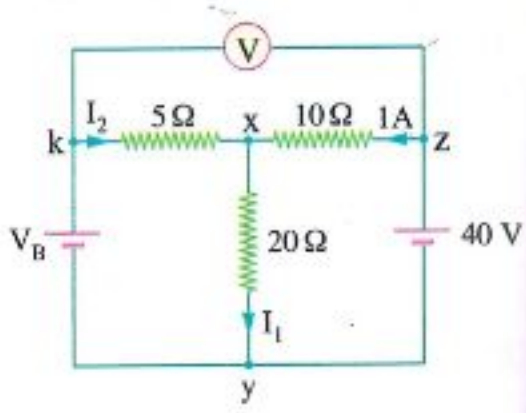
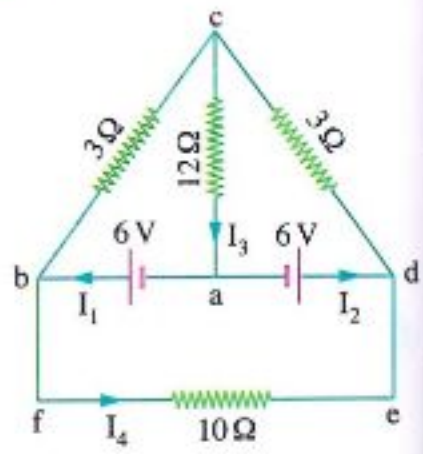
9 In the opposite electric circuit, if the internal resistance of the batteries is negligible, **calculate :**

(a) The voltmeter reading (V).

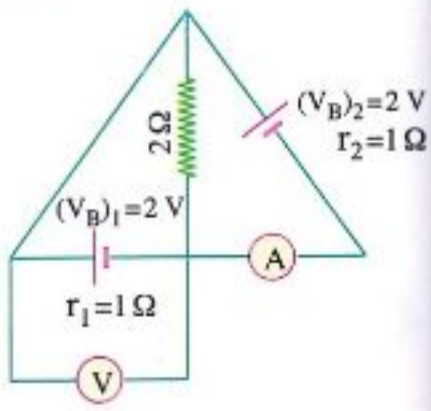
(b) The emf (V_B).



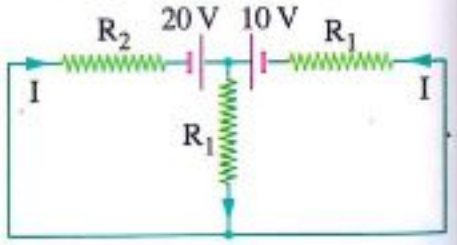
10 From the opposite circuit, **calculate** the current intensity passing in the 12 Ω resistor.



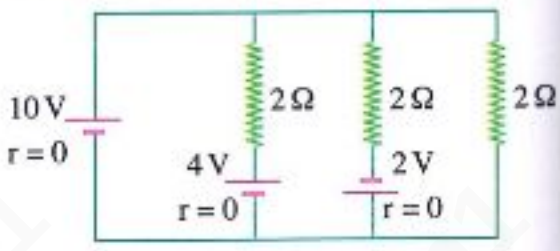
11 In the opposite electric circuit, **find** the reading of each of the ammeter and voltmeter.



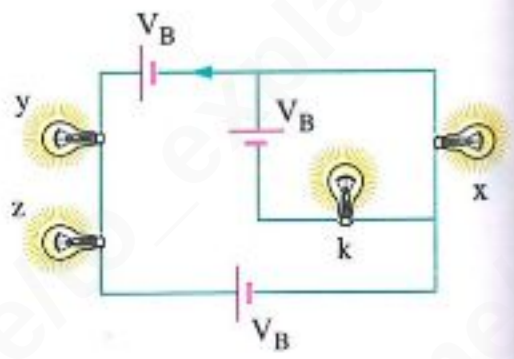
12 From the opposite electric circuit, if the current intensity is the same in each of the two batteries and equals (I) ampere, **find** the ratio between the two resistances $\left(\frac{R_1}{R_2}\right)$.



13 In the opposite electric circuit, **calculate** the current intensity passing in the 10 V battery.



14 The opposite figure illustrates an electric circuit that contains identical batteries of negligible internal resistances and also contains multiple identical bulbs, **which** of the bulbs' filaments glows more intensely?



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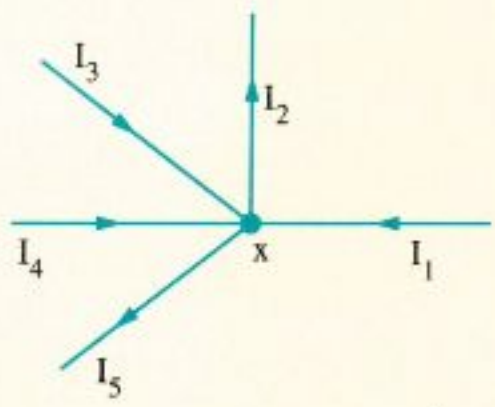
Questions of the Previous Years Exams ? on Lesson 4

Kirchhoff's first law

1 By applying Kirchhoff's first law at the point (x), so ..... . *(Exp. June 21)*



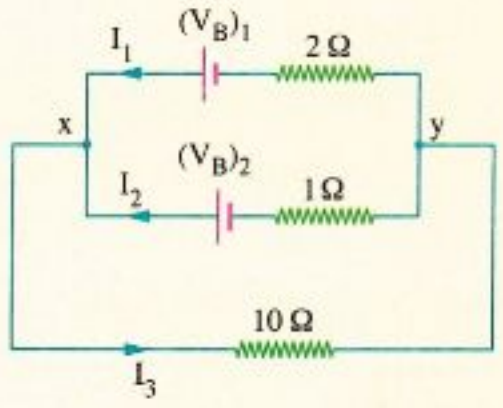
(a) $I_1 + I_3 + I_4 + I_2 + I_5 = 0$

(b) $-I_1 - I_3 - I_4 + I_2 + I_5 = 0$

(c) $-I_1 - I_3 + I_4 + I_2 + I_5 = 0$

(d) $I_1 + I_3 + I_4 - I_2 + I_5 = 0$

2 From the opposite electric circuit, the correct equation is ..... *(2nd session 21)*



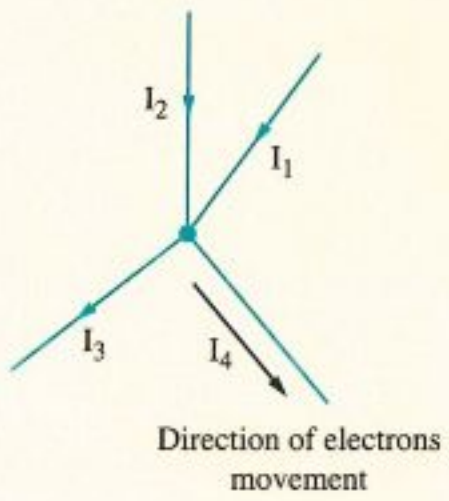
(a) $-I_1 - I_2 + I_3 = 0$

(b) $I_1 - I_2 - I_3 = 0$

(c) $-I_1 + I_2 + I_3 = 0$

(d) $I_1 + I_2 + I_3 = 0$

3 The figure shows a part of a closed electric circuit:
If the directions of I_1, I_2 and I_3 represent the conventional currents while I_4 represents the direction of the electrons motion. So, current (I_3) = ... *(2nd session 22)*



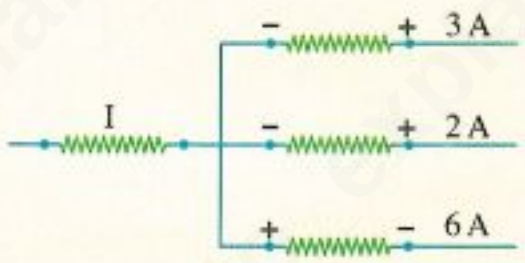
(a) $I_1 + I_2 - I_4$

(b) $I_1 + I_2 + I_4$

(c) $I_4 + I_1 - I_2$

(d) $I_4 + I_2 - I_1$

4 The figure shows a part of a closed electric circuit, then the value of (I) = ... *(2nd session 23)*



(a) 11 A

(b) 2 A

(c) 1 A

(d) 4 A

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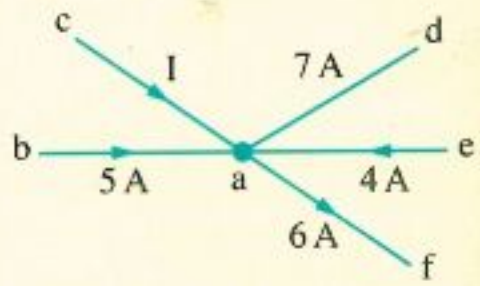
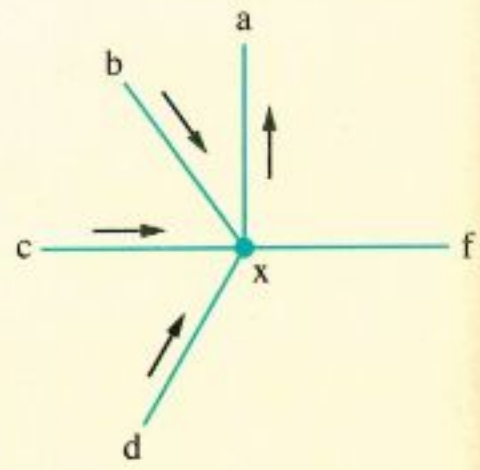
5 The opposite figure represents electric currents through multiple branches. So, the value of current (I) and the direction of current (7 A) respectively are ..... , ... *(Exp. 25)*



(a) 4 A, from a to d (b) 4 A, from d to a

(c) 13 A, from a to d (d) 13 A, from d to a

6 In the figure, if the directions shown represent the directions of electrons motion, and the intensities of the currents in branches xa, xc and xd are 6 A, 3 A, 15 A respectively, and 2.5×10^{19} electrons/second pass through branch xb, then the number of electrons passing through branch xf and their direction of motion are respectively ..... , ... *(Exp. 25)*

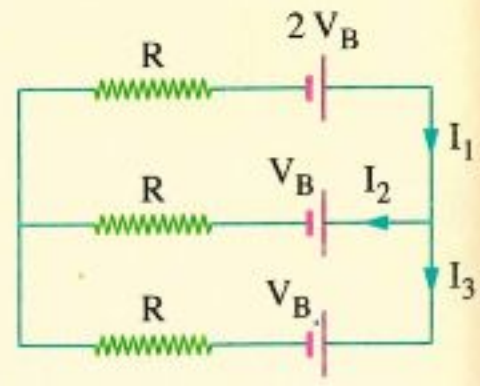


(a) 1×10^{20} electrons/second, from x to f (b) 1×10^{20} electrons/second, from f to x

(c) 1.6×10^{19} electrons/second, from x to f (d) 1.6×10^{19} electrons/second, from f to x

Kirchhoff's second law

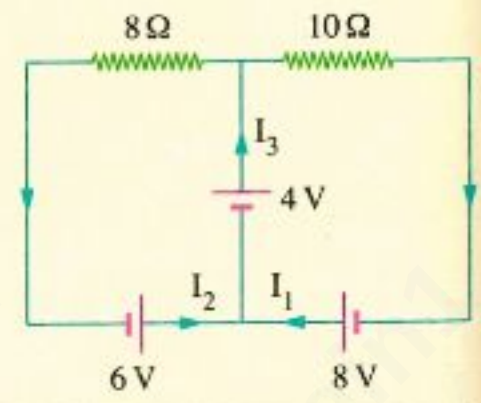
7 Using the data shown on the opposite circuit, the ratio $\left(\frac{I_2}{I_1}\right)$ = ... *(Exp. May 21)*



(a) $\frac{2}{1}$ (b) $\frac{3}{1}$

(c) $\frac{1}{2}$ (d) $\frac{1}{3}$

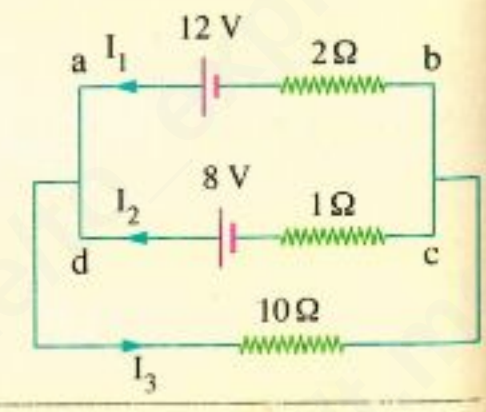
8 In the opposite circuit, the value of electric current I_3 is ..... . *(Exp. June 21)*



(a) 1.2 A (b) 1.25 A

(c) 2 A (d) 2.45 A

9 In the opposite electric circuit, we can apply Kirchhoff's second law to the closed path (adcba) as follows ..... . *(1st session 21)*



(a) $3 I_1 - I_3 - 4 = 0$ (b) $2 I_1 + I_2 + 4 = 0$

(c) $2 I_1 - I_2 - 20 = 0$ (d) $2 I_1 - I_2 + 4 = 0$

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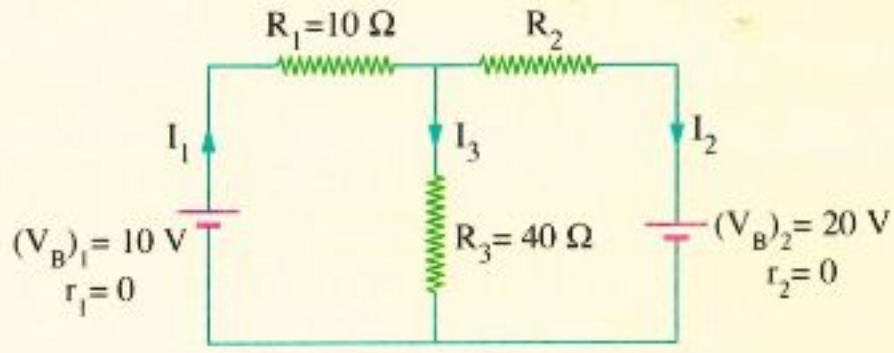
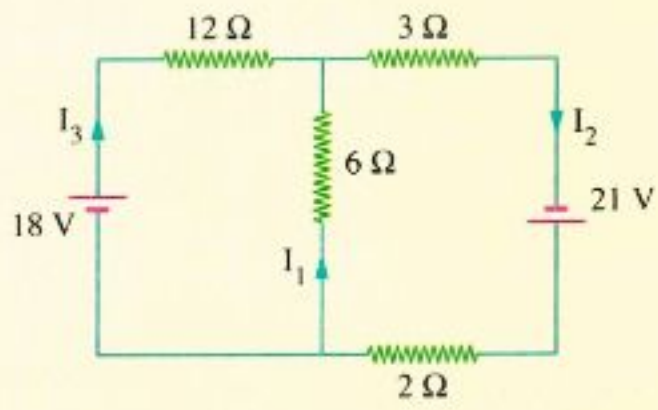
10 In the opposite circuit, if $(I_3 = -2\,I_1)$, the value of the passing electric current in resistor R_3 equals ..... . *(1st session 21)*



(a) $\frac{3}{7}$ A (b) $\frac{4}{7}$ A

(c) $\frac{2}{7}$ A (d) 1 A

11 In the shown electric circuit, if $I_3 = 2$ A, the value of I_2 is ..... . *(2nd session 21)*



(a) 1 A

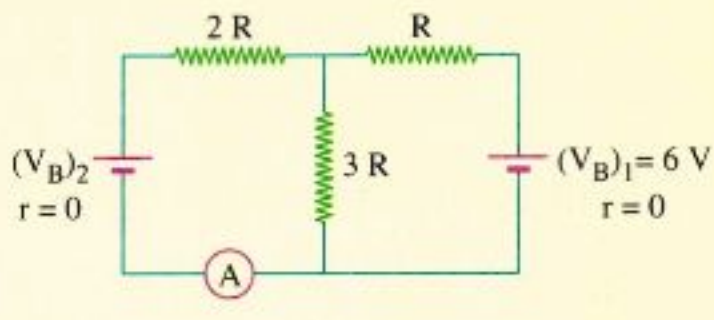
(b) 2 A

(c) 3 A

(d) 4 A

12 In the shown electric circuit:

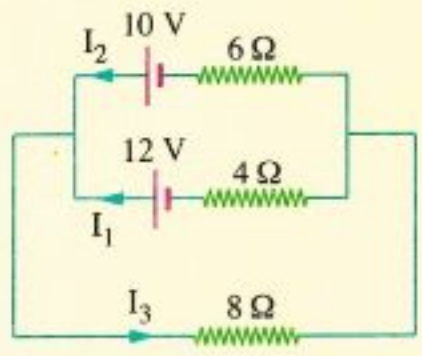
The value of $(V_B)_2$ that makes the reading of the ammeter vanishes = ... *(1st session 22)*



(a) 6 V (b) 4.5 V

(c) 8 V (d) 12 V

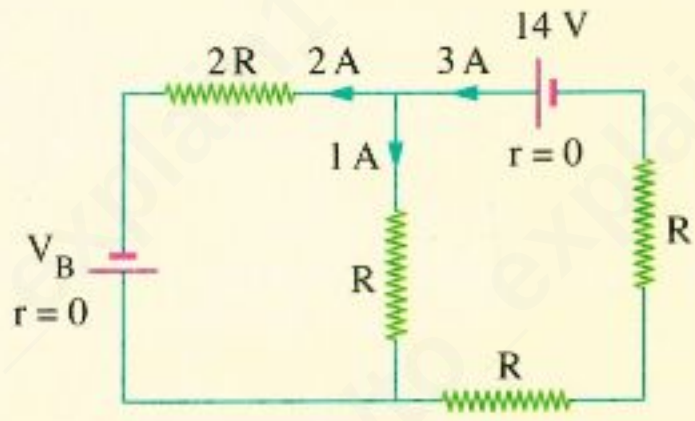
13 In the shown electric circuit, the value of the intensity of electric current passing through the 8 Ω resistor equals ..... *(1st session 22)*



(a) 0.23 A (b) 0.846 A

(c) 1.077 A (d) 1.306 A

14 In the shown closed electric circuit, the value of V_B = ... *(2nd session 22)*



(a) 10 V

(b) 4 V

(c) 15 V

(d) 6 V

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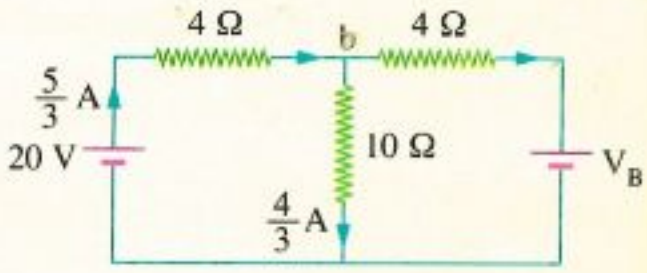
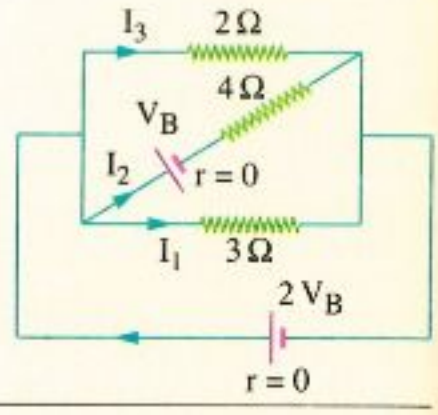
15 In the illustrated electric circuit, the electromotive force of the battery V_B is ..... . *(Exp. 23)*



(a) 12 V (b) $\frac{4}{3}$ V

(c) $\frac{40}{3}$ V (d) $\frac{44}{3}$ V

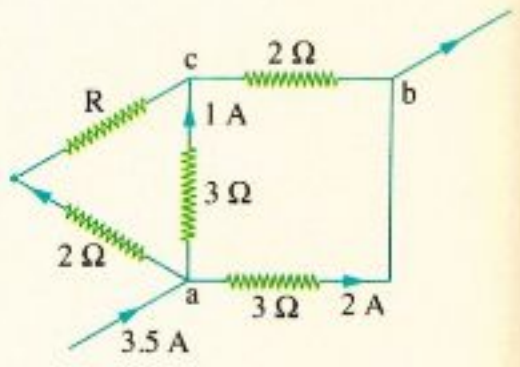
16 In the shown closed electric circuit, the ratio between: $\frac{I_3}{I_2}$ = ... *(1st session 23)*



(a) $\frac{2}{1}$ (b) $\frac{1}{4}$

(c) $\frac{1}{2}$ (d) $\frac{4}{1}$

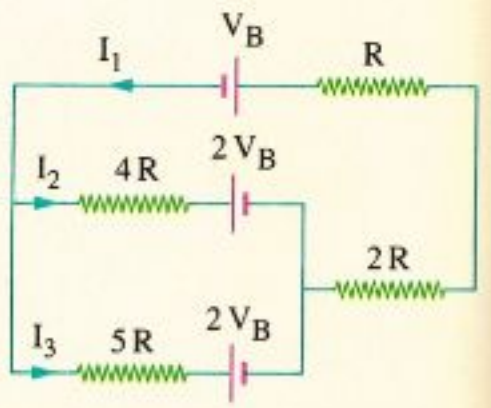
17 The figure illustrates a part of a closed electric circuit. Then the resistance (R) equals ..... . *(2nd session 23)*



(a) 4 Ω (b) 2 Ω

(c) 6 Ω (d) 3 Ω

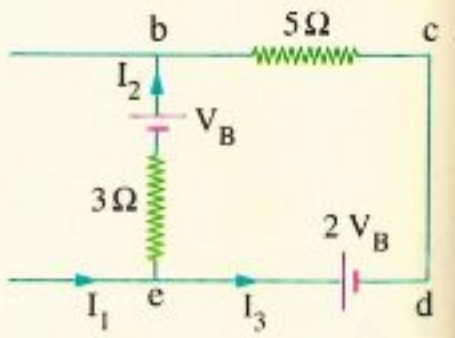
18 From the shown electric circuit, I_1 = ... I_3 *(1st session 24)*



(a) 2.25 (b) 1.25

(c) 0.8 (d) 1.8

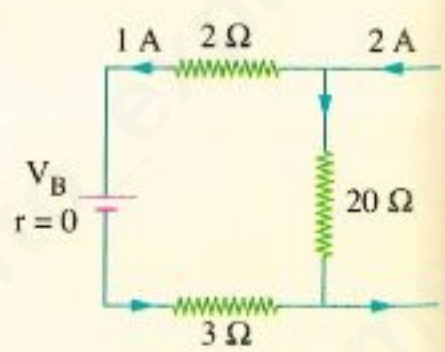
19 The opposite figure shows a part from an electric circuit, by using Kirchhoff's laws, which equation is correct? *(2nd session 24)*



(a) $3 I_1 + 7 I_2 = -3 V_B$ (b) $3 I_2 - 5 I_3 = -3 V_B$

(c) $3 I_2 - 5 I_3 = 3 V_B$ (d) $3 I_1 - 8 I_2 = 3 V_B$

20 The opposite figure represents a section of electric circuit that carries an electric current, then the value of V_B is ..... . *(Exp. 25)*



(a) 30 V (b) 25 V

(c) 20 V (d) 15 V

https://t.me/to_explain1

Test on Chapter 1

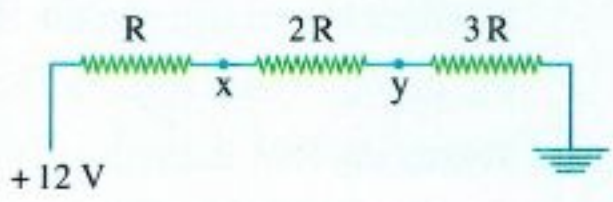
Answered

First Choose the correct answer

1 In the opposite figure, the value of I is ..... .

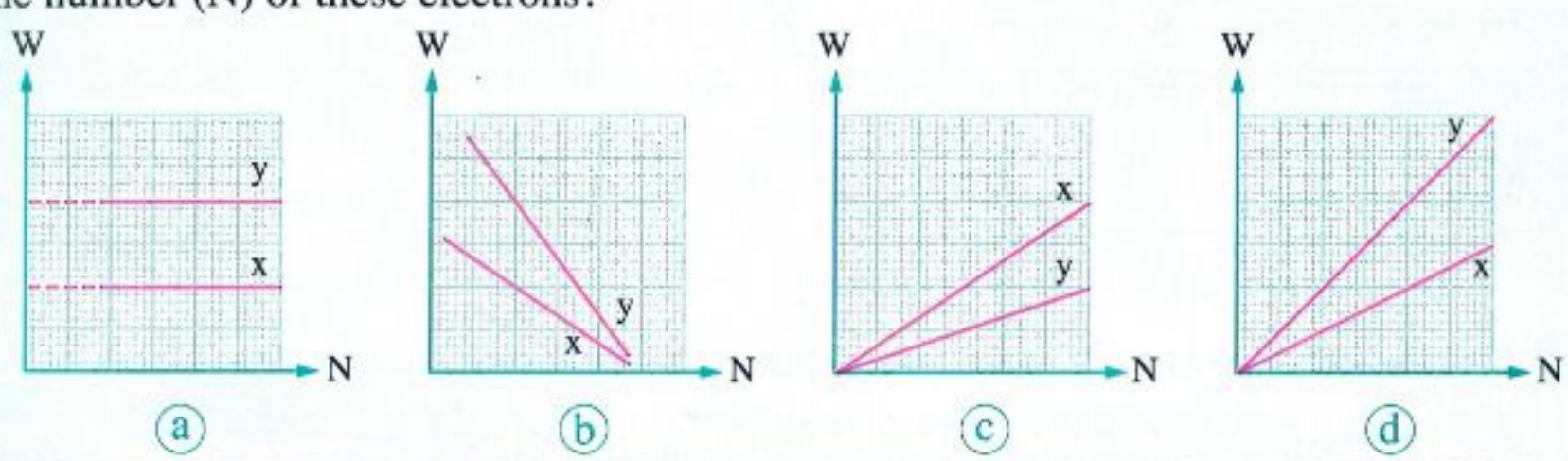
(a) 8 A (b) 6 A
(c) 4 A (d) 3 A

2 The opposite figure shows a section of electric circuit, so the ratio between the potentials of the two points x and y shown on the figure $\left(\frac{V_x}{V_y}\right)$ equals ..... .

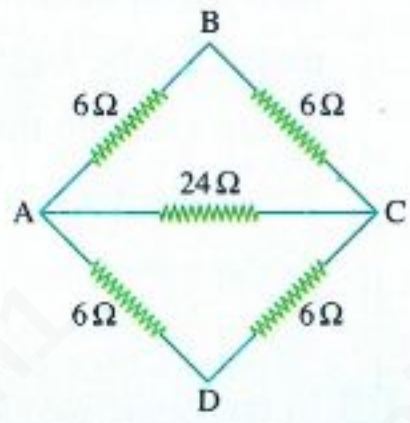


(a) $\frac{3}{5}$ (b) $\frac{5}{3}$ (c) $\frac{1}{3}$ (d) $\frac{3}{1}$

3 Two conductors x and y have electrical resistances R and 2 R respectively, each of them carries an electric current of intensity I, which of the following graphs represents the relation between the work done (W) to transfer electrons across the two conductors and the number (N) of these electrons?

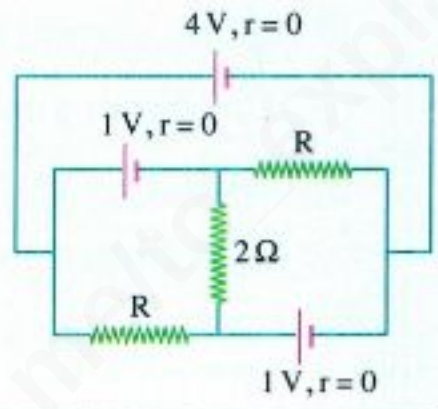


4 A set of electric resistors are connected together as shown in the opposite figure, so this set has a higher equivalent resistance when connecting a battery to the two terminals ..... .



(a) A, C (b) A, B
(c) B, D (d) C, D

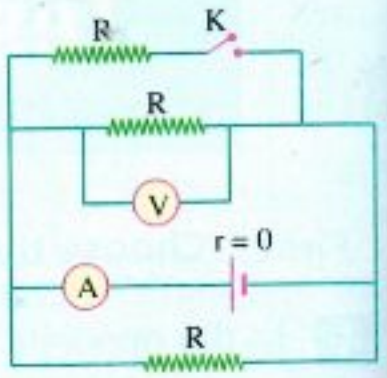
5 The electric current intensity through the 2 Ω resistor in the opposite electric circuit equals ..... .



(a) 0.5 A (b) 1 A
(c) 2 A (d) 4 A

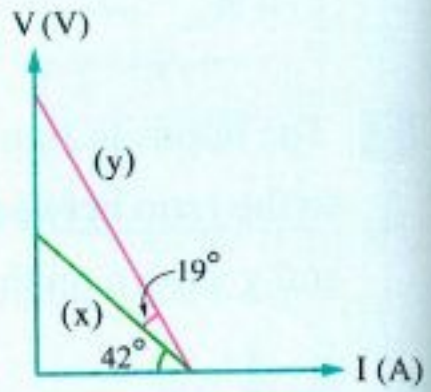
https://t.me/to_explain1

6 What happens to the readings of both ammeter and voltmeter respectively when closing switch K in the opposite electric circuit?



(a) Increases, doesn't change.
(b) Doesn't change, doesn't change.
(c) Decreases, increases.
(d) Doesn't change, increases.

7 Each of two electric cells (x) and (y) is connected to a different electric circuit. The opposite figure represents the graph of voltages (V) across the two electric cells versus current intensity (I) through each of them, so the ratio between the two electromotive forces of the electric cells $\left(\frac{(V_B)_x}{(V_B)_y}\right)$ is approximately equal to ..... .



(a) 0.2 (b) 0.3 (c) 0.4 (d) 0.5

8 Each of the two opposite figures (1) and (2) is a section of an electric circuit through which a direct current is passing, so the electric energy consumed by resistance R in figure (2) through a time interval of 10 s equals ..... .

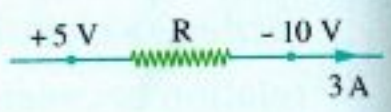


Figure (1)

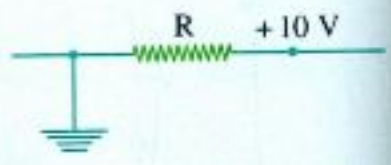
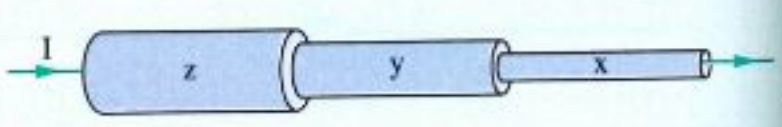


Figure (2)

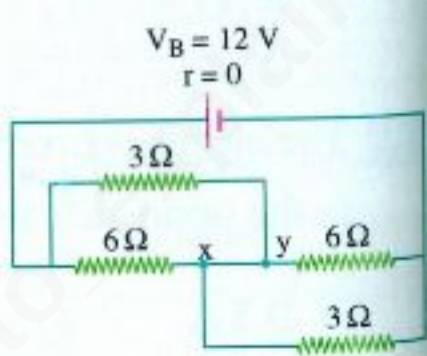
(a) 10 J (b) 20 J
(c) 100 J (d) 200 J

9 Three solid conductors x, y and z are made of the same metal and have the same length, their cross-sectional diameters are d, 2d, 3d respectively, so if they are connected together in series, then a direct electric current is set up through them as shown in the opposite figure, so the ratio of potential differences across the three conductors $V_x : V_y : V_z$ respectively are ..... , ...



(a) 36 : 9 : 4 (b) 9 : 4 : 1 (c) 3 : 2 : 1 (d) 6 : 3 : 2

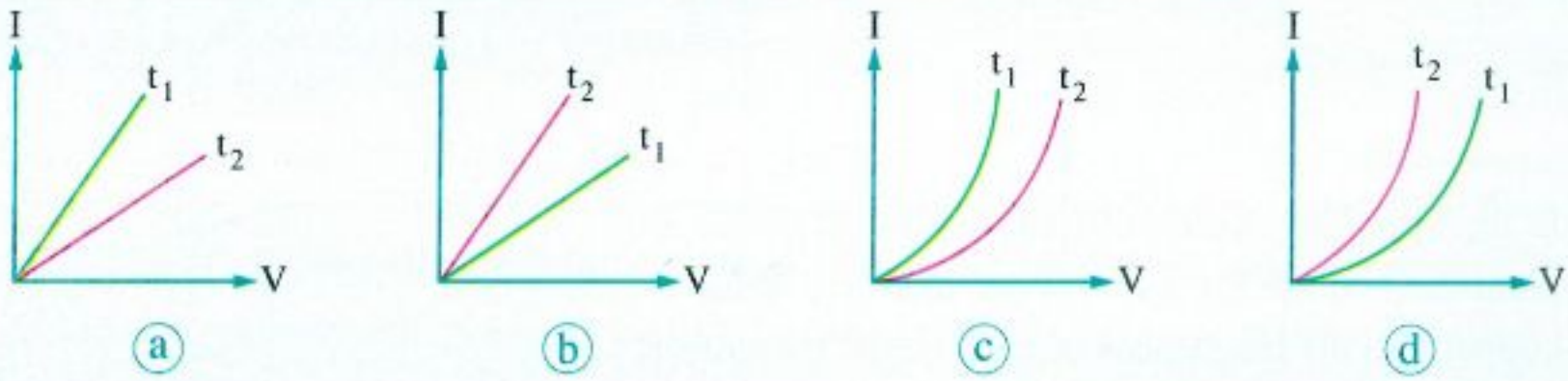
10 In the opposite electric circuit, the direction and the intensity of electric current between points x and y are ..... .



(a) 0.5 A from y to x
(b) 1 A from y to x
(c) 0.5 A from x to y
(d) 1 A from x to y

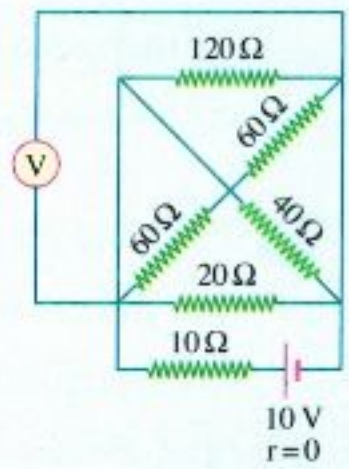
https://t.me/to_explain1

11 An Ohm's law experiment has been conducted for determining the resistance of a metal wire at a constant temperature t_1 then after raising the temperature of the wire to t_2. So, which of the following graphs could represent the experiment results?

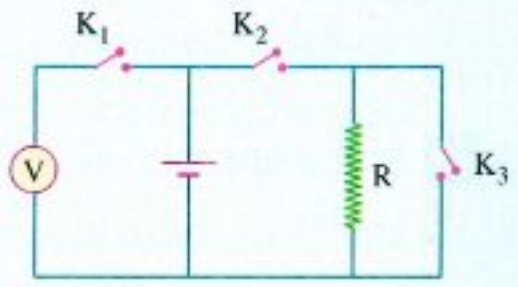


12 In the opposite electric circuit, the reading of the voltmeter (V) is ..... .

(a) 10 V
(b) 5 V
(c) 2.5 V
(d) 1 V



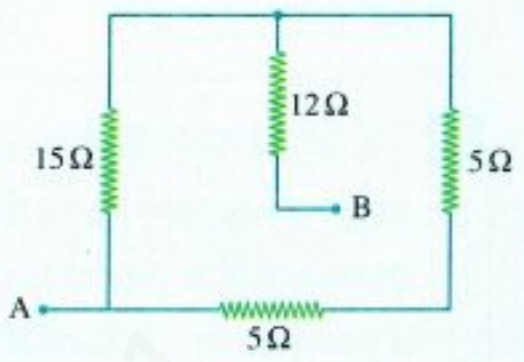
13 In the opposite electric circuit, a voltmeter is connected across a battery of emf V_B and internal resistance r, so the voltmeter shows the highest possible reading in this circuit when closing ..... .



(a) switches K_1 and K_3 only
(b) switches K_1 and K_2 only
(c) switches K_2 and K_3 only
(d) all switches K_1, K_2 and K_3

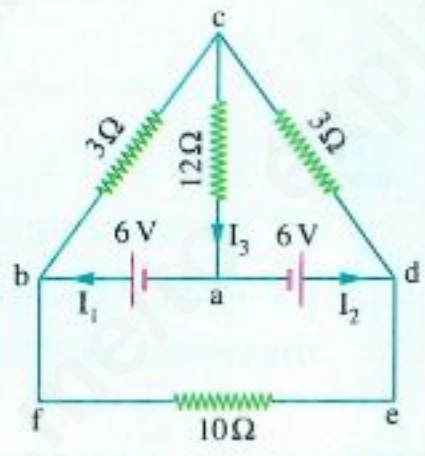
14 In the opposite figure, when connecting a battery between points A and B, an electric current of intensity 2 A passes through the 12 Ω resistor, so potential difference across the battery terminals equals ..... .

(a) 10 V
(b) 12 V
(c) 20 V
(d) 36 V



15 In the opposite electric circuit, the intensity of current through the 12 Ω resistor equals ..... .

(a) 0.11 A
(b) 0.22 A
(c) 0.33 A
(d) 0.44 A



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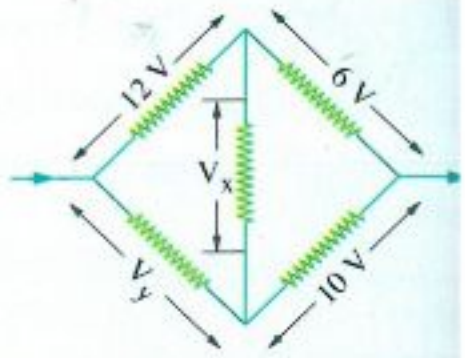
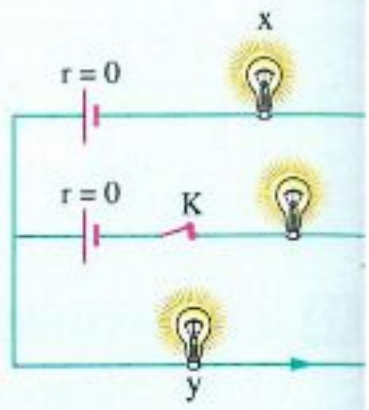
16 The opposite figure illustrates a section of electric circuit, so the ratio of voltages $\left(\frac{V_x}{V_y}\right)$ equals ..... .



(a) $\frac{1}{1}$ (b) $\frac{1}{2}$

(c) $\frac{2}{1}$ (d) $\frac{1}{4}$

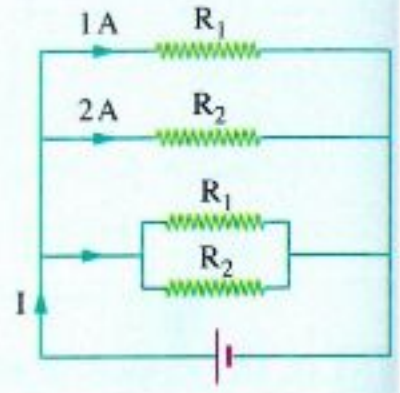
17 In the opposite electric circuit, the two batteries are identical and the three lamps are identical, what happens to the brightness of each of the two lamps x, y respectively when opening switch K?



(a) Increases, increases. (b) Decreases, decreases.

(c) Increases, decreases. (d) Decreases, increases.

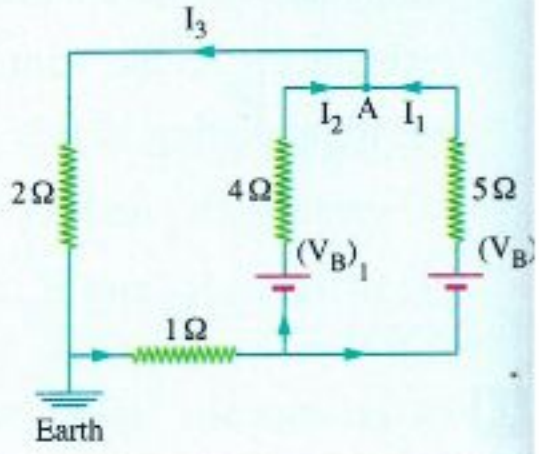
18 The total electric current intensity (I) that passes in the opposite electric circuit equals ..... .



(a) 5 A (b) 6 A

(c) 8 A (d) 9 A

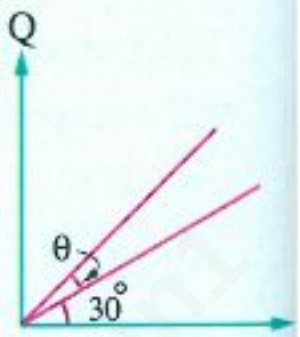
19 In the opposite electric circuit, the two batteries $(V_B)_1$ and $(V_B)_2$ have electromotive forces 7 V and 10.5 V respectively and the internal resistance of each of them is 1 Ω, the electric potential of point A equals ..... .



(a) 1 V (b) 2 V

(c) 3 V (d) 5 V

20 Two resistors R and 2R are connected together in parallel with an electric cell, and the opposite graph represents the relation between the amount of electric charge (Q) that passes through a section of each of them and the time (t), so angle θ which is shown in the graph equals ..... .



(a) 15° (b) 19.1° (c) 30° (d) 49.1°

21 A lightbulb (A) is labelled with (240 V, 480 W), a lightbulb (B) is labelled with (140 V, 70 W) and a lightbulb (C) is labelled with (100 V, 50 W), so the equivalent resistance of the three lightbulbs after connecting them together such that each of them works with its maximum power equals ..... .

(a) 280 Ω (b) 200 Ω (c) 120 Ω (d) 96 Ω

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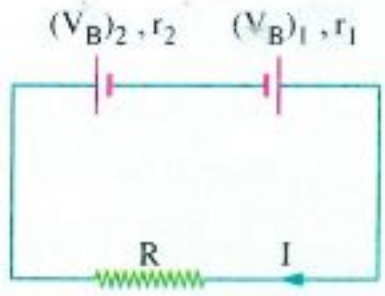
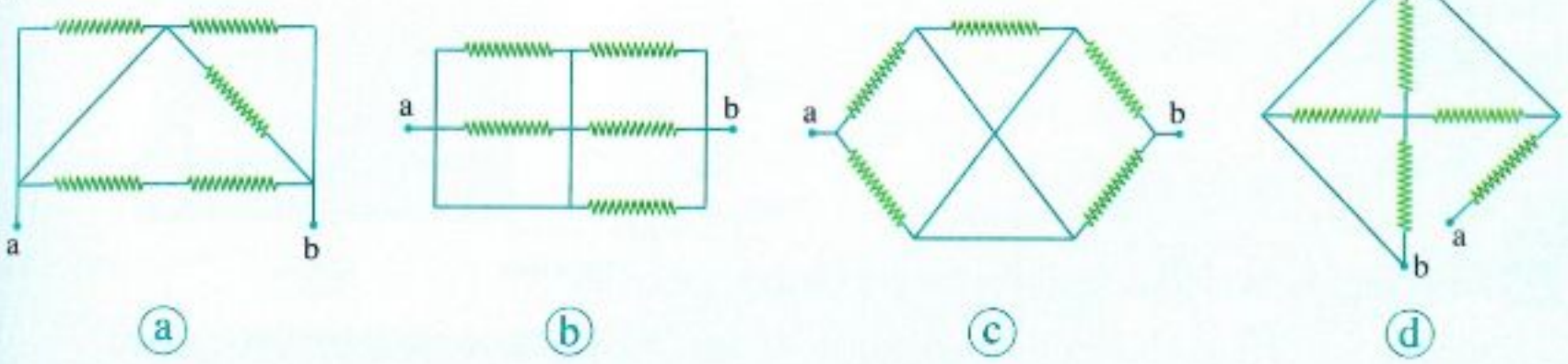
22 In the opposite electric circuit, an electric current of intensity I is passing, if when reversing the terminals of battery $(V_B)_1$, the current intensity through the circuit increases to 3I, so the ratio $\left(\frac{(V_B)_1}{(V_B)_2}\right)$ equals ..... .



(a) $\frac{2}{1}$ (b) $\frac{3}{1}$ (c) $\frac{4}{1}$ (d) $\frac{5}{1}$

23 The following figures illustrate four methods of connecting five resistors, each of resistance R, so which of these methods gives the least equivalent resistance between points a and b?



(a) (b) (c) (d)

24 Two wires x and y are made of the same metal, each has a uniform cross-section and the length of wire x is double that of wire y. When the two wires were connected in series in an electric circuit, the potential differences across them were V and 2 V respectively, so the ratio between the masses of the two wires $\left(\frac{m_x}{m_y}\right)$ equals ..... .

(a) $\frac{4}{1}$ (b) $\frac{1}{4}$ (c) $\frac{8}{1}$ (d) $\frac{1}{8}$

25 Figure (1) represents the graph of the readings of voltmeters (V_1) and (V_2) versus the ammeter reading (I) in the electric circuit illustrated in figure (2):

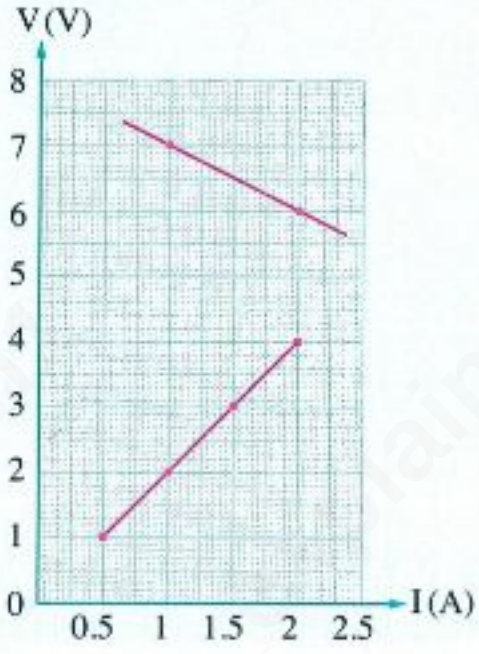


Figure (1)

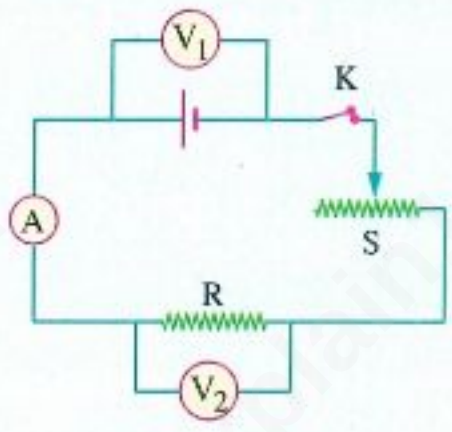


Figure (2)

So, the resistance of S when the ammeter reading is 1.25 A, equals ..... .

(a) 1.7 Ω (b) 2 Ω (c) 3.4 Ω (d) 6.4 Ω

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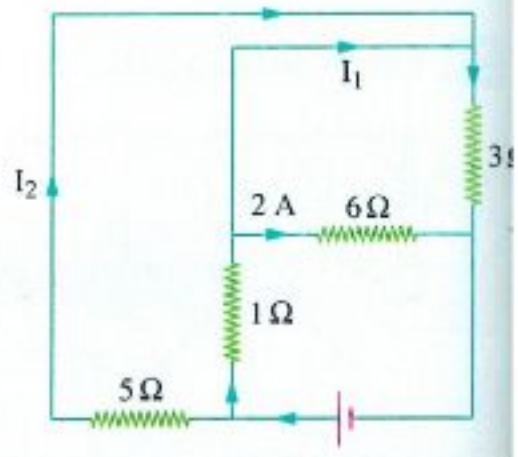
26 Two wires are made of the same metal, the first has resistance R_o while the ratio between its length to its diameter equals x and the second has resistance nR_o while the ratio between its length to its diameter is y, so the ratio between the radii of the two wires $\left(\frac{r_1}{r_2}\right)$ equals .....

(a) $\frac{x}{y}$ (b) $\frac{y}{x}$ (c) $n\frac{x}{y}$ (d) $n\frac{y}{x}$

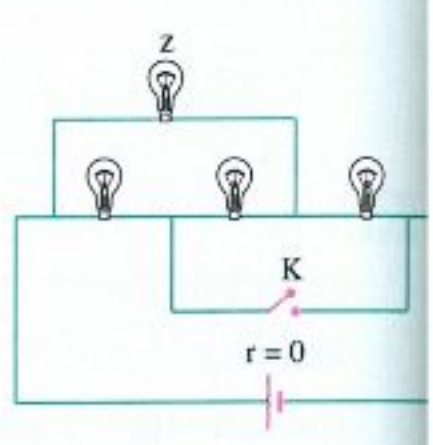
27 In the opposite electric circuit, the intensities of currents I_1 and I_2 respectively are ....., ...

(a) 4 A, 1 A
(b) 2 A, 2 A
(c) 3 A, 5 A
(d) 3 A, 1 A



28 Four identical electric lightbulbs are connected in an electric circuit as shown in the opposite figure. Given that the internal resistance of the battery is negligible, so when closing switch K, the brightness of lightbulb z ..... .

(a) increases (b) decreases
(c) vanishes (d) doesn't change

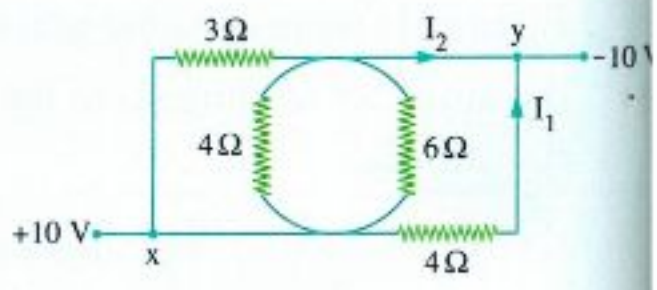


Second Answer the following questions

29 The opposite figure illustrates a section of an electric circuit, **calculate:**

(a) Current intensity I_1

(b) Current intensity I_2



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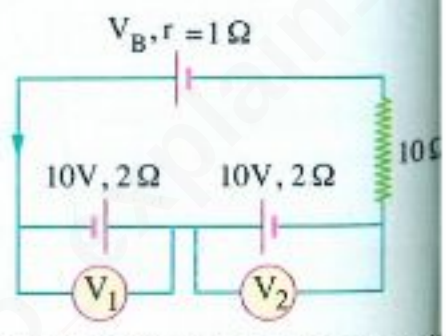
30 In the opposite electric circuit, if the voltmeter reading V_1 equals zero, **find**:

(a) The emf of battery V_B

(b) The reading of voltmeter V_2



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Chapter Two

Magnetic Effects of the Electric Current and Measuring Instruments

Lesson One	Magnetic Effect of the Electric Current.
Lesson Two	Following of the Magnetic Effect of the Electric Current.
Lesson Three	Magnetic Force and the Torque.
Lesson Four	The Measuring Instruments.

- Questions on each lesson from the Previous Years Exams.
- Test on Chapter 2

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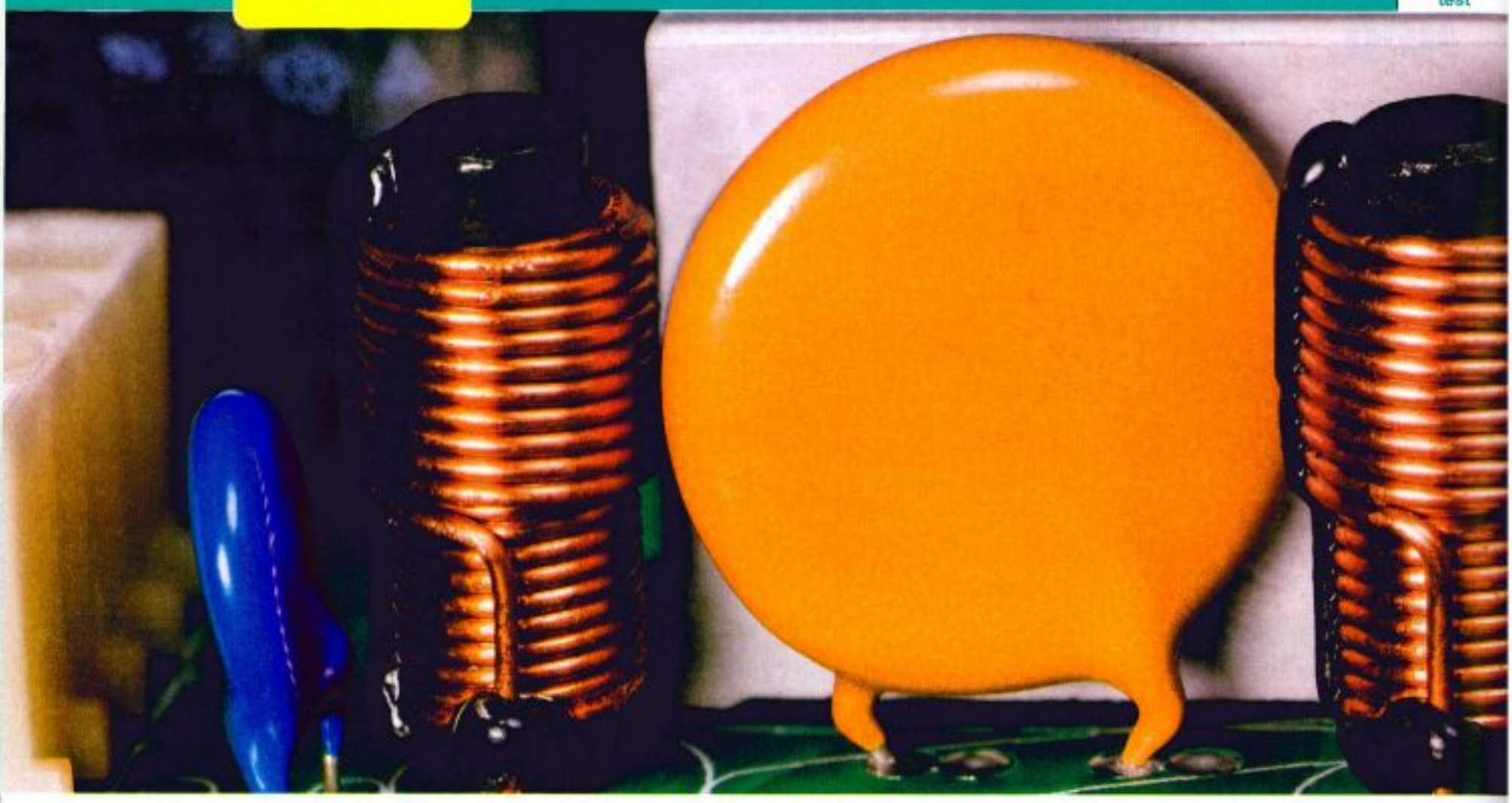
Chapter 2

Questions on Lesson One

Magnetic Effect of the Electric Current

Interactive test



The questions signed by ✱ are answered in detail. ● Understand ○ Apply ∴ Higher Order Thinking Skills

Important guidelines

Magnetic flux (ϕ_m)

- If the field is:
  - Perpendicular to the area → $\phi_m = BA$
  - Making angle (θ) with the normal to the area → $\phi_m = BA\cos\theta$
  - Parallel to the area → $\phi_m = 0$
- If the coil is rotated with angle (θ) from:
  - Perpendicular position → $\phi_m = BA\cos\theta$
  - Parallel position → $\phi_m = BA\cos(90 - \theta)$

- **The magnetic flux density (B) at a point at a distance d from the axis of a straight wire carrying electric current of intensity I:** $B = \mu \frac{I}{2\pi d}$
  Where: μ is the permeability of the medium

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- **The magnetic flux density or the magnetic field (B) is a vector quantity, so if the magnetic flux density due to an electric current in a wire is B_1 at a certain point and the wire is placed in an external magnetic field of flux density B_2 then when:**

- The two fields have the same direction: $B_t = B_1 + B_2$

- The two fields have opposite directions: $B_t = B_1 - B_2$ $(B_1 > B_2)$

- The two fields are perpendicular to each other: $B_t = \sqrt{B_1^2 + B_2^2}$

The net magnetic flux density due to the flow of electric currents in two parallel wires

If the two currents are in the same direction

- Outside the region between the two wires: $B_t = B_1 + B_2$
- Neutral point: At a point in the region between the two wires $B_1 = B_2$

$$\frac{\mu I_1}{2\pi(x-d)} = \frac{\mu I_2}{2\pi d}$$

$$\therefore \frac{I_1}{x-d} = \frac{I_2}{d}$$

Where: x is the distance between the two wires, d is the distance between the neutral point and the wire of the less current $(I_2 < I_1)$

- In the region between the two wires: $B_t = B_1 - B_2$ $(B_1 > B_2)$

If the two currents are in opposite directions

- Outside the region between the two wires: $B_t = B_1 - B_2$ $(B_1 > B_2)$
- Neutral point: At a point outside the region between the two wires $B_1 = B_2$

$$\frac{\mu I_1}{2\pi(x+d)} = \frac{\mu I_2}{2\pi d} \therefore \frac{I_1}{x+d} = \frac{I_2}{d}$$

Where: x is the distance between the two wires, d is the distance between the neutral point and the wire of less current $(I_2 < I_1)$

- In the region between the two wires: $B_t = B_1 + B_2$

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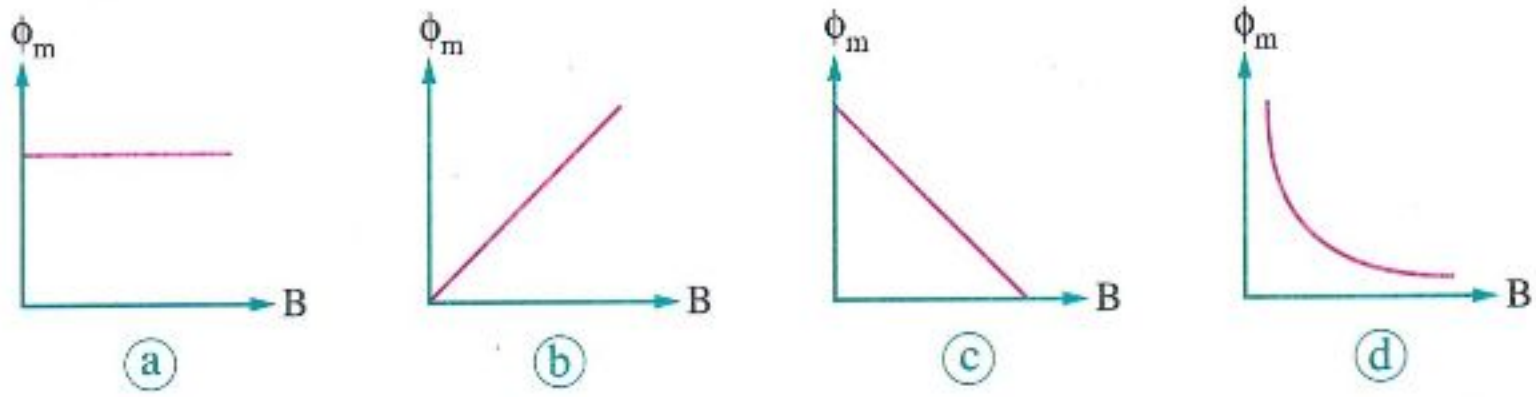
First Multiple choice questions

Use the following constants, if needed: $\mu_{air} = 4\pi \times 10^{-7}$ Wb/A.m, $e = 1.6 \times 10^{-19}$ C

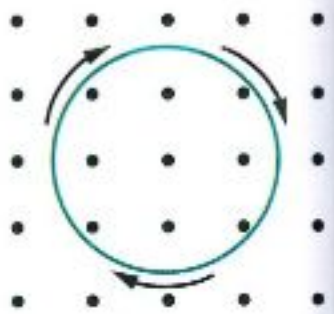
Magnetic flux and flux density

1 A rectangular coil is placed perpendicular to a magnetic field of a uniformly changing strength. Which of the following graphs represents the relation between the total flux (ϕ_m) and the magnitude of the magnetic flux density (B) in which the coil exists?



(a) (b) (c) (d)

2 The opposite figure represents a circular coil placed perpendicular to a uniform magnetic field. If the coil is rotated about its axis which is perpendicular to its plane in the clockwise direction by an angle of 90°, then the flux that penetrates the coil ..... .



(a) increases (b) equals zero

(c) decreases (d) does not change

3 ✱ A ring of cross-sectional area 0.2 m^2 is placed perpendicular to a uniform magnetic flux of density 0.04 Wb/m^2. So, the magnetic flux which passes through this ring equals ..... .

(a) 0.002 Wb (b) 0.004 Wb (c) 0.006 Wb (d) 0.008 Wb

4 ✱ A square frame of side length 20 cm is placed in a uniform magnetic field of flux density 3×10^{-2} tesla, if the flux which passes through the frame is 6×10^{-4} weber, the angle between the frame plane and the magnetic lines equals ..... .

(a) 20° (b) 30° (c) 45° (d) 90°

5 ✱ A coil of cross-sectional area 2 m^2 is placed in a magnetic field of flux density 0.05 Wb/m^2 where the magnetic flux that passes through the coil is the maximum value, so the magnetic flux when the coil rotates with an angle of:

(i) 30°, equals ..... .

(a) 0.01 Wb (b) – 0.1 Wb (c) 0.7 Wb (d) 0.087 Wb

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(ii) 45°, equals ..... .

(a) – 0.01 Wb (b) 0.03 Wb (c) 0.07 Wb (d) 0.09 Wb

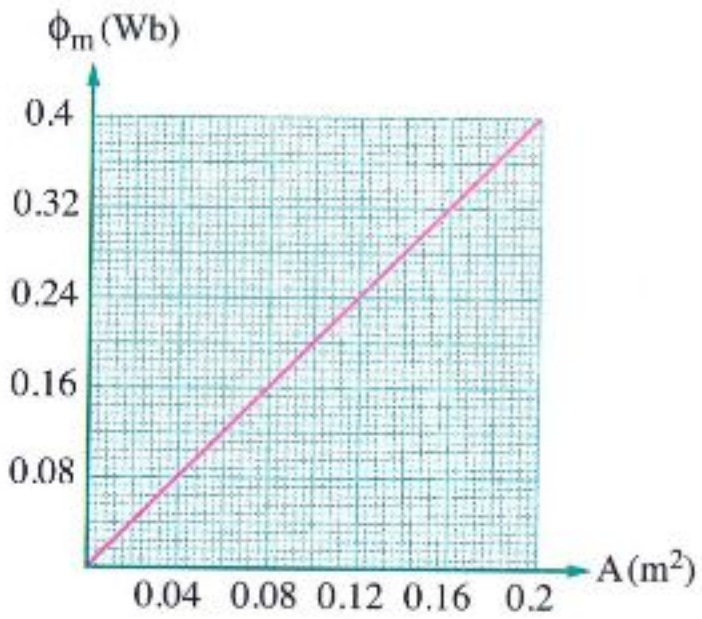
(iii) 135°, equals ..... .

(a) 0.1 Wb (b) 0.005 Wb (c) – 0.07 Wb (d) – 0.09 Wb

(iv) 180°, equals ..... .

(a) – 0.1 Wb (b) 0.2 Wb (c) – 0.3 Wb (d) 0.4 Wb

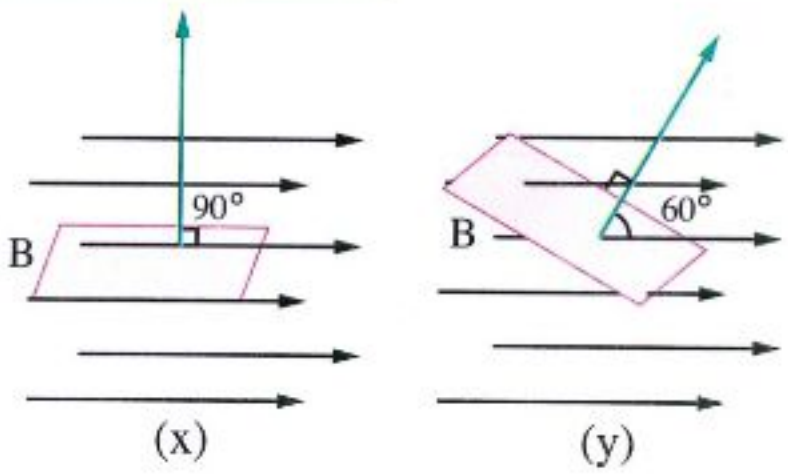
6 Multiple rectangular coils of different areas are placed in a uniform magnetic field where the coil planes have an angle 30° with the direction of the field and the opposite graph shows the relation between the total magnetic flux that passes through the coil (ϕ_m) and the area of the coil (A), so the magnetic flux density that affects all the coils is ..... .



(a) 1 T (b) 4 T

(c) 0.5 T (d) 0.8 T

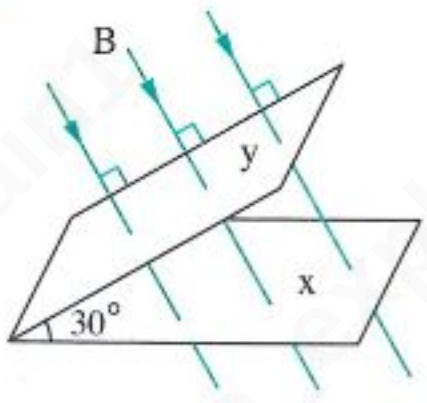
7 * The opposite figure shows two different positions (x) and (y) for a coil of area 0.2 m^2 in a uniform magnetic field of flux density 0.8 T, so the change in the magnetic flux $\Delta\phi_m$ through the coil between the two positions equals ..... .



(a) 0 (b) 0.08 Wb

(c) 0.4 Wb (d) 0.16 Wb

8 Two rectangular coils of the same area are fixed together such that one is inclined relative to the other at an angle of 30° If the two coils are exposed to a magnetic flux of density B and its direction as shown in the opposite figure, then the ratio between the values of magnetic flux that penetrates the two coils $\left(\frac{(\phi_m)_x}{(\phi_m)_y}\right)$ equals ..... .



(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{\sqrt{3}}{2}$ (d) $\frac{2}{\sqrt{3}}$

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9 A coil of face area A is placed perpendicular to a uniform magnetic field of flux density B, the magnitude of the change in magnetic flux that penetrates the coil when it rotates from the perpendicular position around an axis in the same plane:

(i) $\frac{1}{4}$ cycle equals ..... .

(a) zero (b) BA (c) $\frac{3}{2}$ BA (d) 2 BA

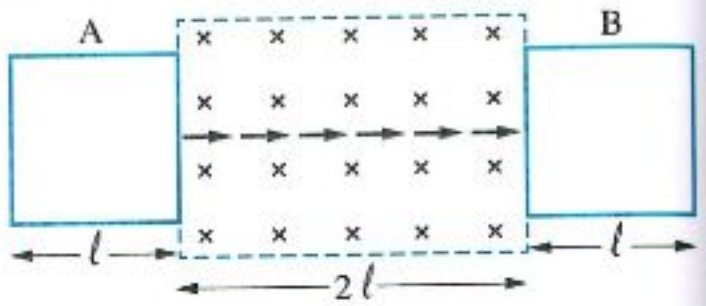
(ii) $\frac{1}{2}$ cycle equals ..... .

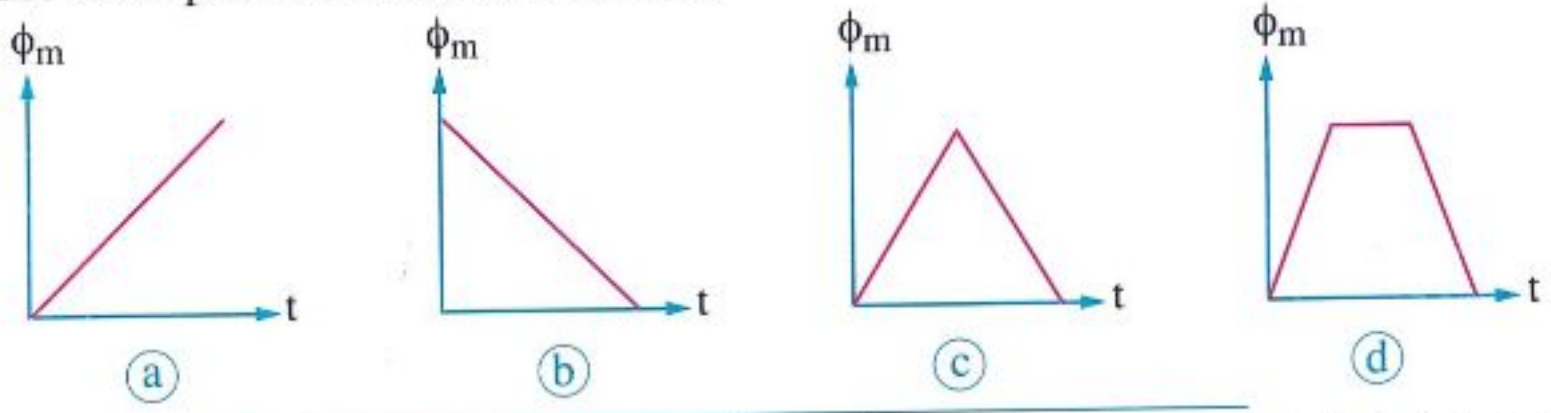
(a) zero (b) BA (c) $\frac{3}{2}$ BA (d) 2 BA

(iii) $\frac{1}{3}$ cycle equals ..... .

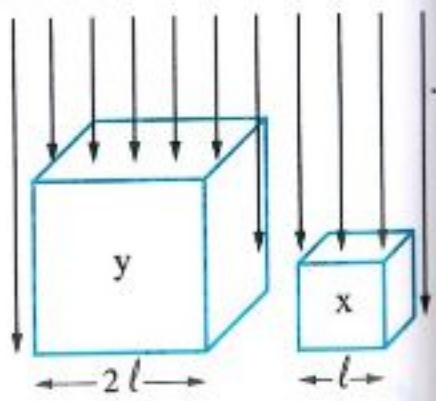
(a) zero (b) BA (c) $\frac{3}{2}$ BA (d) 2 BA

10 The opposite diagram shows a square coil that is moving with constant velocity towards the right direction of the page penetrating a uniform magnetic field which is normal into the page, so the relation between the magnetic flux (ϕ_m) that passes through the coil during its motion from position A to position B and the time (t) is ..... .





11 Two cubes x and y that have side lengths ℓ and 2ℓ respectively are affected by a uniform magnetic field perpendicularly on the upper surface of each of them as shown in the opposite figure, so which of the following relationships represents the relation between the magnetic fluxes that pass through the upper surfaces of them?



(a) $(\phi_m)_y = \frac{1}{4}(\phi_m)_x$ (b) $(\phi_m)_y = (\phi_m)_x$ (c) $(\phi_m)_y = 2(\phi_m)_x$ (d) $(\phi_m)_y = 4(\phi_m)_x$

12 A coil of area A is placed perpendicular to a uniform magnetic field and a magnetic flux of 10^{-3} Wb passes through its face, when the coil is rotated, its area is decreased by 10 cm^2 which flux passes as in the opposite figure, if the magnetic flux passes through the coil became 7.5×10^{-4} Wb, then the area of the coil (A) equals ..... .

(a) 10 cm^2 (b) 20 cm^2 (c) 40 cm^2 (d) 80 cm^2

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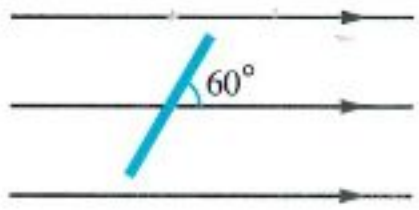

(13) ✱ In the opposite figure, a rectangular coil of area A is placed in a magnetic field of flux density B such that the plane of the coil makes an angle of 60° with the field, where the magnitude of the passing flux through the coil equals 2×10^{-6} T.m^2, so the magnitude of the flux that is passing through the coil, when it rotates:

(i) In clockwise direction:

① through 30°, equals ..... .

ⓐ 3.854×10^{-8} Wb ⓑ 1.155×10^{-6} Wb

ⓒ 9.731×10^{-5} Wb ⓓ 8.514×10^{-7} Wb

② through quarter of a cycle, equals ..... .

ⓐ 6.25×10^{-6} Wb ⓑ 7.93×10^{-4} Wb

ⓒ 1.155×10^{-6} Wb ⓓ 9.11×10^{-4} Wb

(ii) In counterclockwise direction:

① through 30°, equals ..... .

ⓐ 1.155×10^{-6} Wb ⓑ 2.31×10^{-6} Wb

ⓒ 4.692×10^{-7} Wb ⓓ 3.854×10^{-8} Wb

② through quarter of a cycle, equals ..... .

ⓐ 1.155×10^{-6} Wb ⓑ 2.231×10^{-5} Wb

ⓒ 4.692×10^{-7} Wb ⓓ 3.854×10^{-8} Wb

---

(14) ✱ In the opposite figure, a coil of cross-sectional area A is placed in a magnetic field of flux density B, such that it makes an angle of 30° with the field, hence the total flux that is passing through the coil equals ϕ_m. The minimum angle by which the coil should rotate, so that the flux through it becomes:

(i) $2\,\phi_m$, equals ..... .

ⓐ 30° ⓑ 45° ⓒ 60° ⓓ 90°

(ii) $\frac{2}{3}\,\phi_m$, equals ..... .

ⓐ 20.31° ⓑ 10.53° ⓒ 13.9° ⓓ 15.52°

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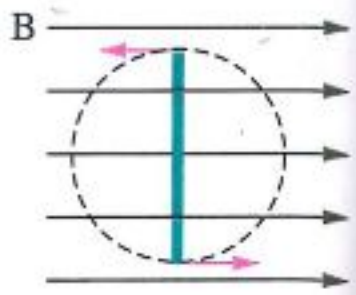
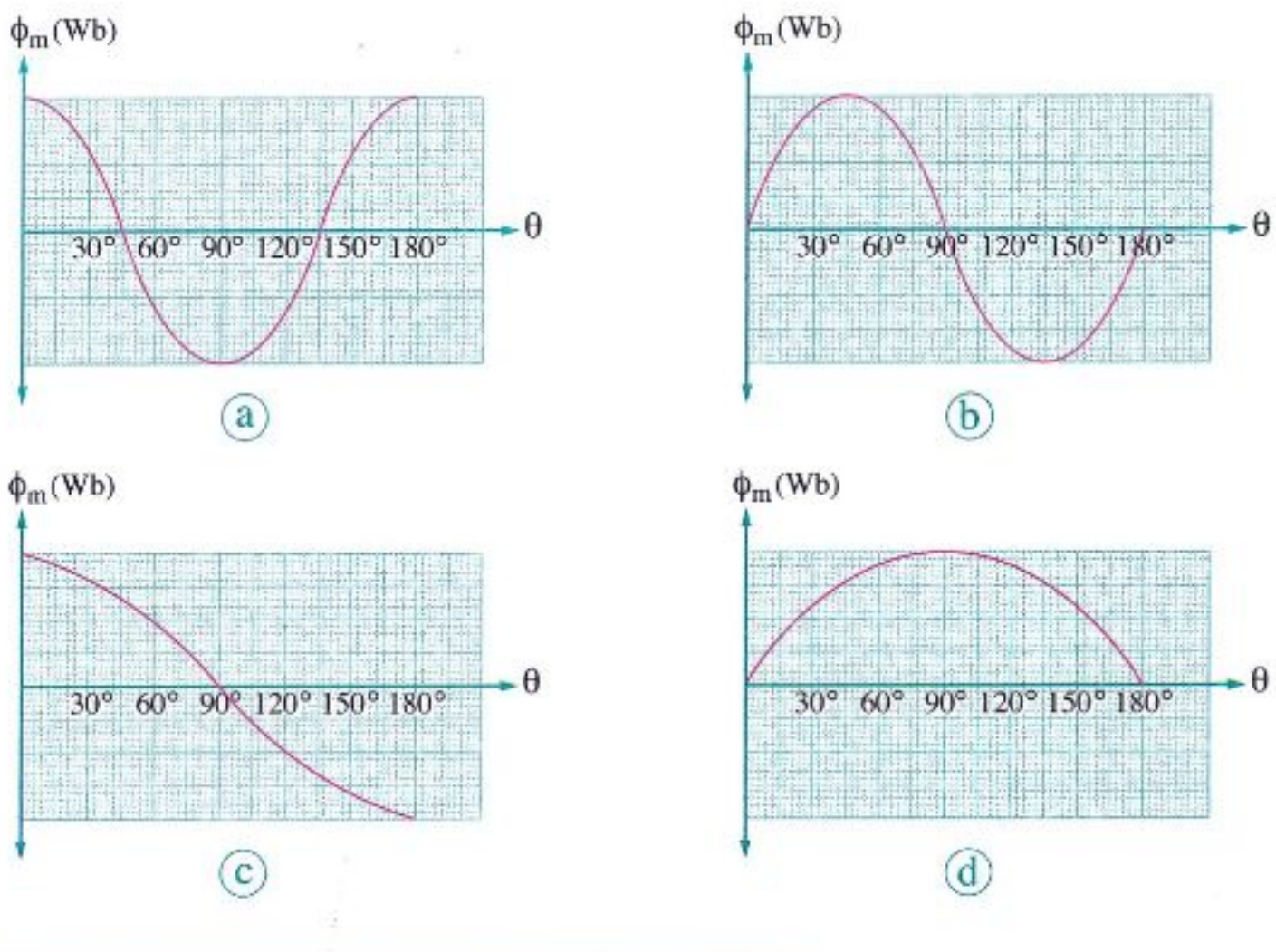
15 A rectangular coil rotates in a uniform magnetic field as in the opposite figure, hence the graph that represents the relation between the magnetic flux (ϕ_m) that penetrates the coil and the angle of rotation (θ) in which the coil rotates during a half cycle, starting from the perpendicular position to the magnetic field will be ..... .





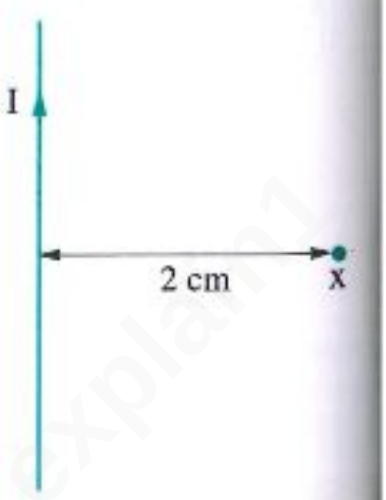
The magnetic field due to a current-carrying wire

16 The unit of $Wb.A^{-1}.m^{-1}$ is the measuring unit of ..... .

(a) magnetic flux
(b) magnetic flux density
(c) magnetic permeability
(d) electric power

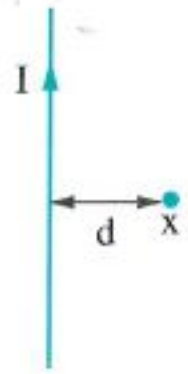
17 In the opposite figure, a long straight wire has a resistance of 0.2 Ω where the potential difference between its ends is 1 V, then the magnetic flux density at point x is ..... .

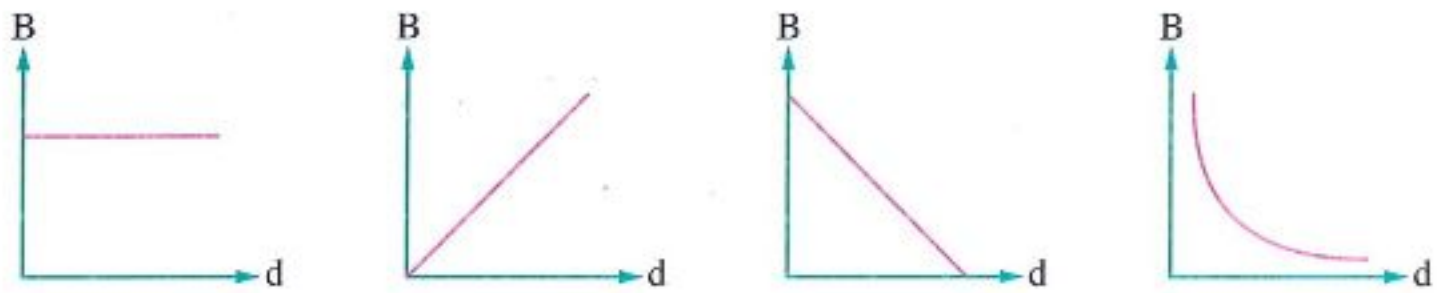
(a) 5×10^{-5} T and its direction is into the page
(b) 5×10^{-5} T and its direction is out of the page
(c) 2×10^{-5} T and its direction is into the page
(d) 2×10^{-5} T and its direction is out of the page



https://t.me/to_explain1

18 Which of the following graphs represents the relation between the magnetic flux density (B) at point x and the separation distance (d) of point x from the wire axis as shown in the opposite figure?

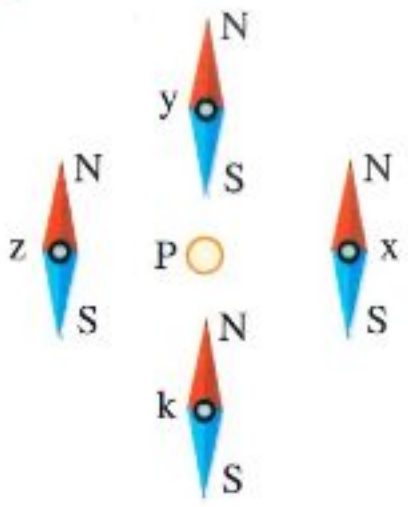




(a) (b) (c) (d)

---

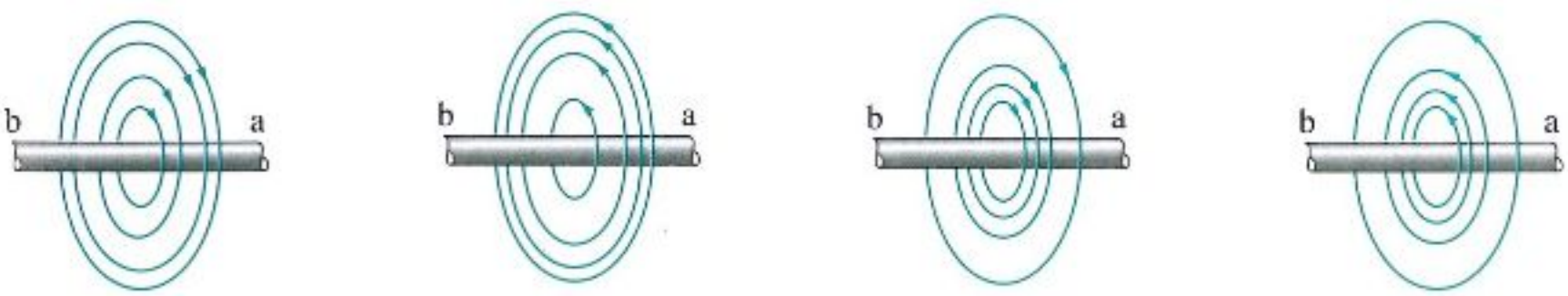
19 The opposite figure shows four compasses around a vertical straight wire (P), each needle of them is in the plane of the magnetic meridian, when the direction of the electric current passing through the wire is downward (into the page), a magnetic field is produced whose strength is greater than the magnetic field of the Earth, then the needle whose direction that refers to the north pole does not change is ..... .



(a) x (b) y (c) z (d) k

---

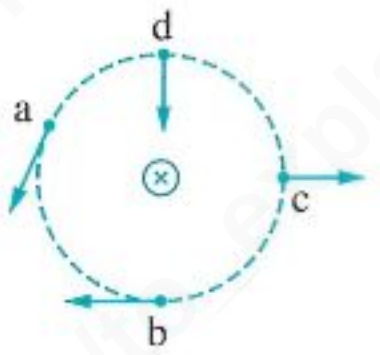
20 A direct electric current passes through wire ab where the free electrons pass from the terminal a to terminal b, which of the following figures correctly represents the resulted magnetic flux lines around the wire?



(a) (b) (c) (d)

---

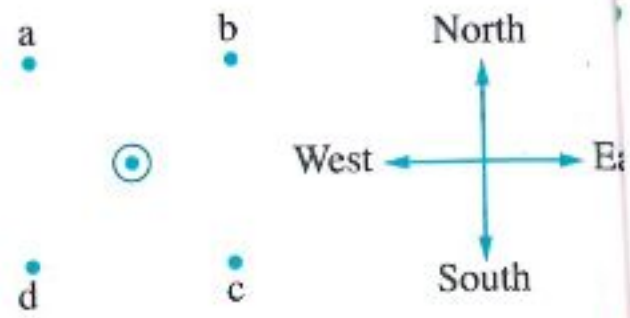
21 The opposite figure shows a straight wire that is perpendicular to the plane of the page while carrying an electric current whose direction is into the page and the points a, b, c and d are located in the plane of the page and at equal distances from the wire, so the direction of the generated magnetic field due to the current of the wire is correct at point ..... .



(a) a (b) b (c) c (d) d

https://t.me/to_explain1

22 The opposite figure shows a straight wire which is placed normal to the plane of the page while carrying an electric current that flows out of the page, hence the direction of the magnetic field will be towards the northwestern direction at point ..... .



(a) a (b) b (c) c (d) d

23 * A straight wire is carrying a current of intensity 4 A. If the density of the magnetic flu at a certain point around the wire is 2×10^{-5} T, the separating distance of this point from the axis of the wire equals ..... .

(a) 0.01 m (b) 0.02 m (c) 0.03 m (d) 0.04 m

24 A straight wire carries an electric current of intensity I, if the produced magnetic flux at point whose perpendicular distance 5 cm is 5×10^{-5} T, the rate of the electrons passing through a section of the wire is equal to ..... .

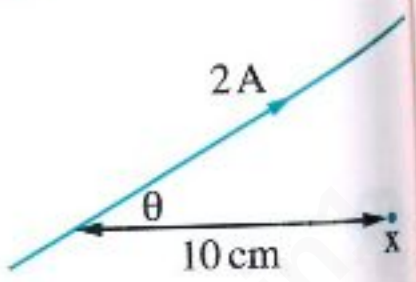
(a) 5.61×10^{21} electrons/s (b) 7.81×10^{21} electrons/s

(c) 5.61×10^{19} electrons/s (d) 7.81×10^{19} electrons/s

25 * A battery of emf 8 V whose internal resistance is 2 Ω is connected to a straight wire of length 20 cm, cross-sectional area 3×10^{-8} m^2 and resistivity 4.5×10^{-6} Ω.m, so the magnetic flux density at a point that lies at a perpendicular distance of 10 cm away from the axis of the wire equals ..... .

(a) 4×10^{-6} T (b) 5×10^{-7} T (c) 6×10^{-8} T (d) 7×10^{-9} T

26 * In the opposite figure, the magnetic flux density due to the flow of the electric current in the wire at point x is ..... .



(a) equal to 4×10^{-6} T (b) greater than 4×10^{-6} T

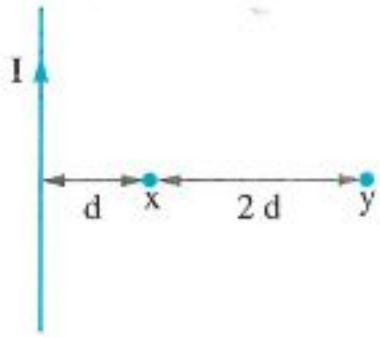
(c) smaller than 4×10^{-6} T (d) indeterminable

27 If the ratio between the magnetic flux densities at the points (X, Y) near a straight current-carrying wire is $\frac{B_X}{B_Y} = \frac{2}{3}$, so the ratio between the perpendicular distances of these two points from the wire $\frac{d_X}{d_Y}$ is ..... .

(a) $\frac{2}{3}$ (b) $\frac{1}{3}$ (c) $\frac{1}{6}$ (d) $\frac{3}{2}$

https://t.me/to_explain1

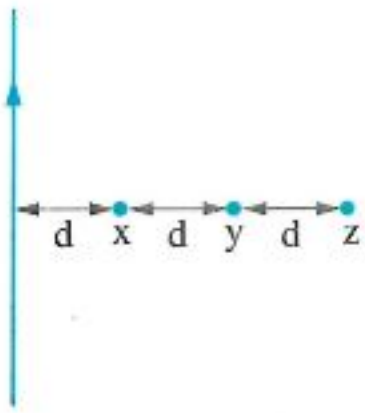
28 The opposite figure represents a straight wire that is carrying a direct electric current, so the ratio of the magnetic flux densities due to this current at points x to that at point y $\left(\frac{B_x}{B_y}\right)$ equals ..... .



(a) $\frac{1}{2}$ (b) $\frac{3}{1}$ (c) $\frac{2}{1}$ (d) $\frac{1}{3}$

---

29 The opposite figure represents a long straight wire carries a DC current, if the magnetic flux density at point z equals (B), then the magnetic flux density :



(i) at point (x) ..... than the magnetic flux density at point (z).

(a) increases by $\frac{2}{3}$ B (b) decreases by $\frac{2}{3}$ B

(c) increases by 2 B (d) decreases by 2 B

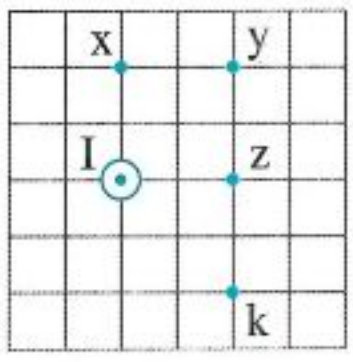
(ii) at point (y) ..... than the magnetic flux density at point (z).

(a) increases by $\frac{1}{3}$ B (b) decreases by $\frac{1}{3}$ B

(c) increases by $\frac{1}{2}$ B (d) decreases by $\frac{1}{2}$ B

---

30 A straight wire is placed perpendicular to the page and carries a direct electric current that is directed out of the page as shown in the opposite figure, so the correct order for the value of the magnetic flux density at the shown points is .....

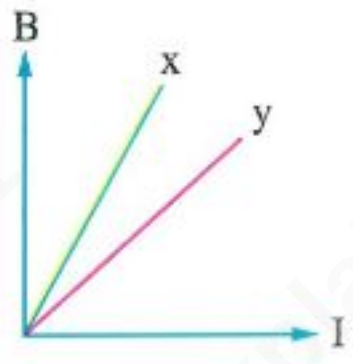


(a) $B_z > B_x = B_y > B_k$ (b) $B_y = B_z = B_k > B_x$

(c) $B_z > B_y = B_k > B_x$ (d) $B_z = B_x > B_y = B_k$

---

31 The opposite graph represents the relation between magnetic flux density (B) which results due to the flow of a direct current in a straight wire and the intensity of this current (I) at two different points (x and y), so ..... .



(a) the distance of point x from the axis of the wire is larger than that of point y

(b) the distance of point x from the axis of the wire is less than that of point y

(c) the distance of point x from the axis of the wire is equal to that of point y

(d) the answer can't be determined

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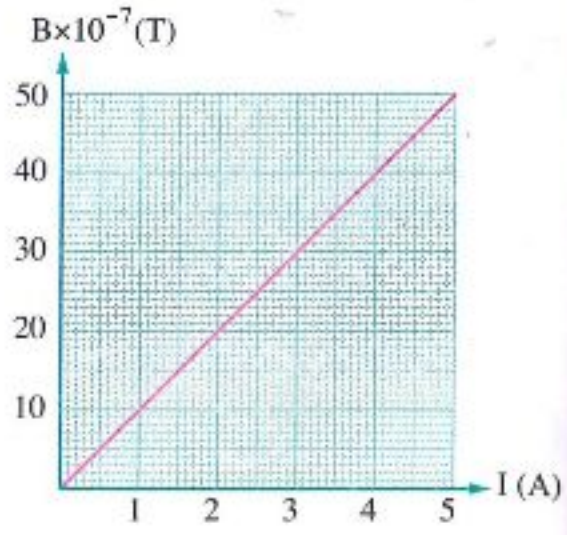
32 The opposite graph represents the relation between the magnetic flux density (B) at a definite point due to the flow of an electric current in a straight wire and the intensity of this current (I), so the separation distance between this point and the axis of the wire is ..... .

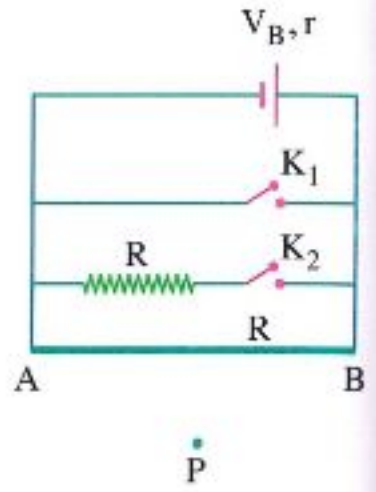


(a) 10 cm (b) 20 cm

(c) 40 cm (d) 100 cm

---

33 A straight wire AB of resistance R is connected to an electric circuit as shown in the opposite figure, so the magnetic flux density at point P due to an electric current passes through the wire AB has the maximum value when ..... .



(a) the two switches K_1, K_2 are opened

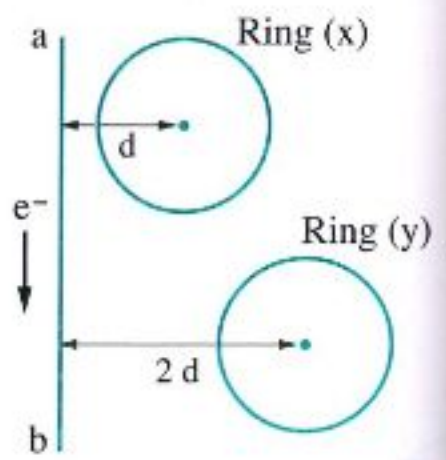
(b) the two switches K_1, K_2 are closed

(c) the switch K_1 is closed, the switch K_2 is opened

(d) the switch K_1 is opened, the switch K_2 is closed

---

34 Two identical metal rings x, y are placed in the same vertical plane and next to them and in their plane is a straight wire ab as in the opposite figure, if the free electrons move through the wire from the terminal a to the terminal b, then :



(i) The direction of the magnetic flux lines that penetrate the two rings is ..... .

(a) perpendicular to the plane of the two rings and inward

(b) perpendicular to the plane of the two rings and outward

(c) in the plane of the two rings and towards the wire

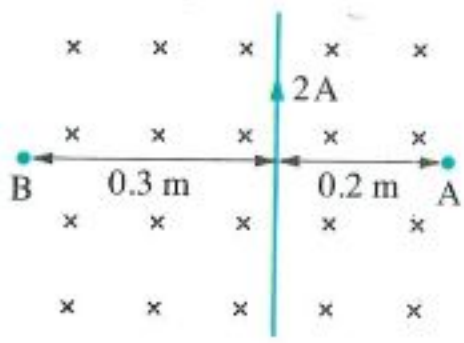
(d) in the plane of the two rings and away from the wire

(ii) The ratio between the values of the magnetic flux that passes through the two rings $\frac{(\phi_m)_x}{(\phi_m)_y}$ is ..... .

(a) greater than one (b) less than one (c) equal to one (d) can't be determined

https://t.me/to_explain1

35 ✱ In the opposite figure, a long straight wire carries an electric current of 2 A while being placed perpendicular to a uniform magnetic field of flux density 4×10^{-6} T, so the resultant magnetic flux density at:



(i) point A equals ..... .

(a) 3.5×10^{-6} T (b) 6×10^{-6} T

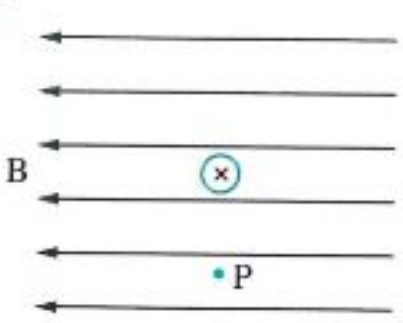
(c) 8×10^{-6} T (d) 9×10^{-6} T

(ii) point B equals ..... .

(a) 2.5×10^{-6} T (b) 5×10^{-6} T (c) 2.67×10^{-6} T (d) 9×10^{-6} T

---

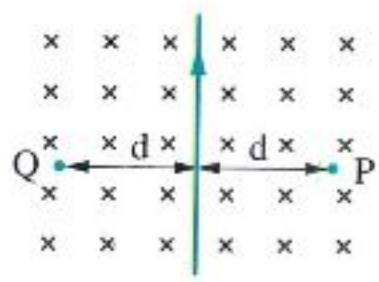
36 ✱ In the opposite figure, a long straight wire carries an electric current of 40 A whose direction is perpendicular into the plane of the page. The wire is placed in a uniform magnetic field of 6×10^{-5} T that is directed to the left of the page, so the resultant of the magnetic flux density at point P which is 10 cm away from the axis of the wire is ..... .



(a) 1.4×10^{-4} T (b) 1×10^{-4} T (c) 8×10^{-5} T (d) 2×10^{-5} T

---

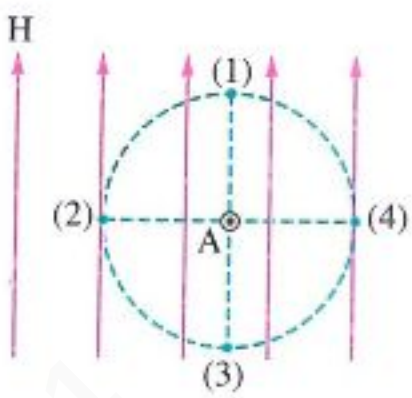
37 ✱ In the opposite figure, a straight wire is placed perpendicular to a uniform magnetic field of flux density B that is directed into the page. When an electric current of intensity I passes in the wire, the total magnetic flux density at point P becomes 3 B, so the net magnetic flux density at point Q is ..... .



(a) zero (b) B (c) 2 B (d) 3 B

---

38 ✱ In the opposite figure, a straight wire (A) is placed perpendicular to the plane of the page while carrying an electric current that is directed out of the page, hence it produces a magnetic flux of density H tesla at any point on the shown circle. If the horizontal component of the magnetic flux density of Earth's magnetic field is H tesla, the resultant magnetic flux density at:



(i) point (1) equals ..... tesla.

(a) $\sqrt{2}$ H (b) $\sqrt{3}$ H (c) H (d) 2 H

(ii) point (2) equals ..... tesla.

(a) 0 (b) H (c) 3 H (d) $\sqrt{5}$ H

(iii) point (3) equals ..... tesla.

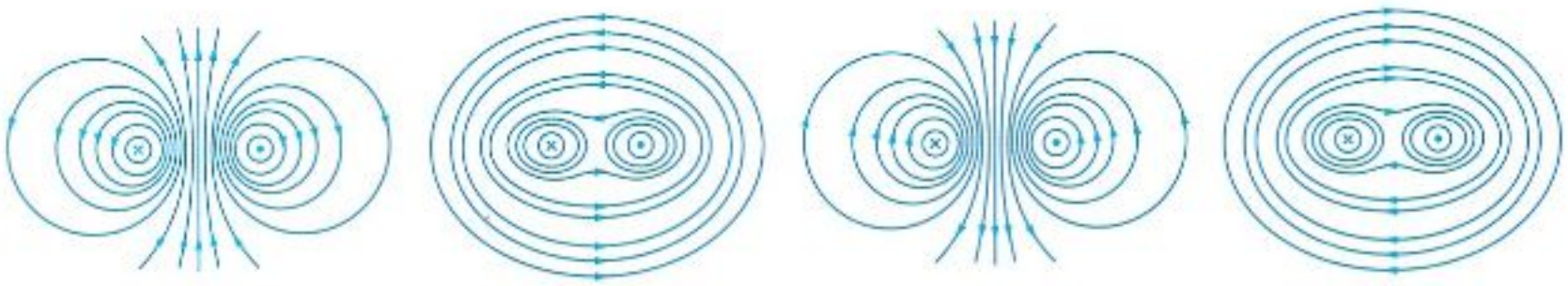
(a) 4 H (b) 2.5 H (c) $\sqrt{2}$ H (d) $\sqrt{7}$ H

(iv) point (4) equals ..... tesla.

(a) H (b) 2 H (c) 3 H (d) 4 H

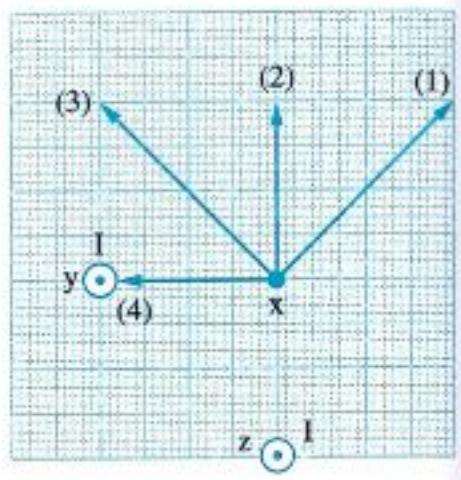
https://t.me/to_explain1

39 Which of the following diagrams correctly represents the magnetic flux lines pattern produced due to the flow of the same electric currents in two opposite directions through the two parallel wires?



(a) (b) (c) (d)

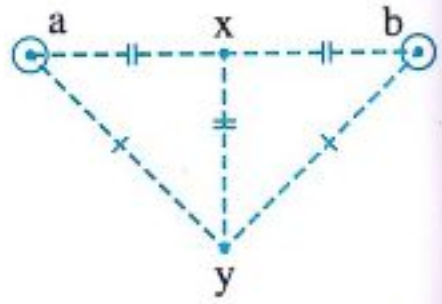
40 The opposite figure shows two parallel very long straight wires (y, z) that are carrying currents of equal intensities (I), hence the net magnetic flux density at point x is in the direction of ..... .



(a) (1) (b) (2)

(c) (3) (d) (4)

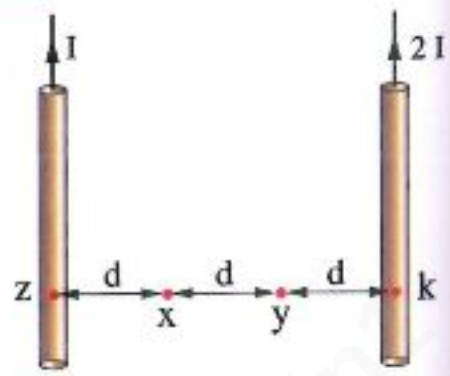
41 In the opposite figure, two parallel straight wires a, b which are perpendicular to the plane of the page carry electric currents I and 2 I respectively, so the net magnetic flux density (B) at point y is calculated from the relation; .....



(a) $B = B_a + B_b$ (b) $B = B_a - B_b$

(c) $B = B_b - 2\,B_a$ (d) $B = \sqrt{B_a^2 + B_b^2}$

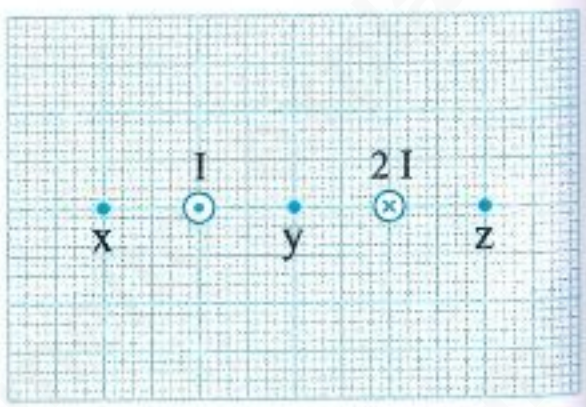
42 The opposite figure shows two long parallel straight wires where each of them carries an electric current, so the magnetic flux density is greater at point ..... .



(a) x (b) y

(c) z (d) k

43 Two anti-parallel electric currents of intensities I, 2 I pass through two long straight wires as shown in the opposite figure, so the correct order of magnetic flux densities at points x, y and z is .....

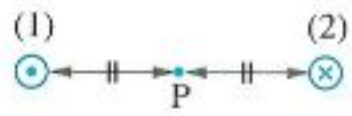


(a) $B_x > B_y > B_z$ (b) $B_z > B_y > B_x$

(c) $B_y > B_x > B_z$ (d) $B_y > B_z > B_x$

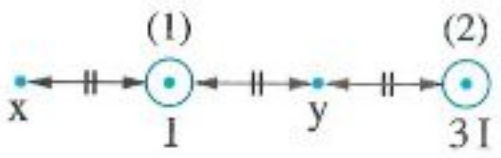
https://t.me/to_explain1

44 The opposite figure shows two very long parallel straight wires that are perpendicular to the page while each of them carries an electric current. If the electric current through the first wire is greater than that in the second wire, then the direction of the resultant magnetic flux at point P is in the plane of the page and to the ..... .



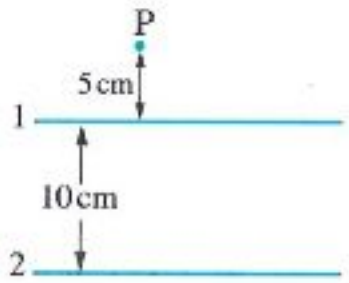
(a) right (b) left (c) upward (d) downward

45 In the opposite figure, two long straight parallel wires (1) , (2) carry electric currents of intensities I and 3 I respectively. When comparing the resultant magnetic flux densities at points x and y, we find that the resultants ..... .



(a) have the same magnitude and direction
(b) are different in both magnitude and direction
(c) have the same magnitude and differ in direction
(d) differ in magnitude but have the same direction

46 ✱ The opposite figure shows two parallel wires, where wire 1 carries a current of intensity 2 A and wire 2 carries a current of 4 A, so the total magnetic flux density at:



(i) point P, if the two currents are in the same direction, equals ..... .

(a) 1.33×10^{-5} T (b) 2.66×10^{-5} T (c) 4.43×10^{-6} T (d) 6.65×10^{-6} T

(ii) point P, if the two currents are in opposite directions, equals ..... .

(a) 4.14×10^{-5} T (b) 3.06×10^{-7} T (c) 2.9×10^{-8} T (d) 2.67×10^{-6} T

47 ✱ If 2.5×10^{20} electrons pass every one second through a cross-section of a straight wire x which is placed parallel to another straight wire y that is at a distance of 5 cm and carries a current of 40 A, so the magnetic flux density at the mid-point between the two wires when the electrons motion in wire x and the direction of the current in wire y:

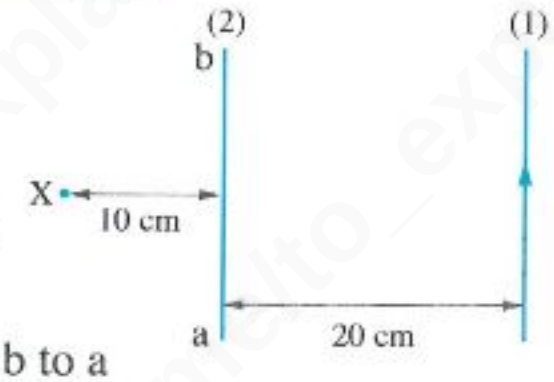
(i) are in the same direction, equals ..... .

(a) 1.6×10^{-4} T (b) 0 (c) 2.56×10^{-4} T (d) 6.4×10^{-4} T

(ii) are in opposite directions, equals ..... .

(a) 0 (b) 6.4×10^{-4} T (c) 3.2×10^{-4} T (d) 1.92×10^{-4} T

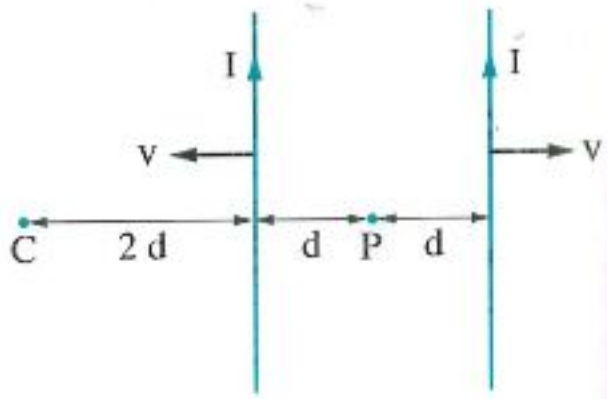
48 The opposite figure shows two parallel long wires (1), (2) which are separated by a distance of 20 cm in the same plane of the page. Wire (1) carries a current of intensity 9 A, so the magnitude and the direction of current I in wire (2) that makes the net magnetic field at point X vanishes is ..... .



(a) 4.5 A, from a to b (b) 4.5 A, from b to a
(c) 3 A, from a to b (d) 3 A, from b to a

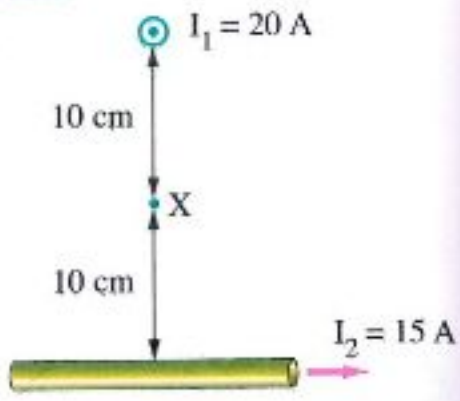
https://t.me/to_explain1

49 Two parallel straight wires carry an electric current of intensity I in the same direction while the two wires are moved a distance d in two opposite directions at the same instant with a uniform velocity (v) as shown in the opposite figure, so the resultant of the magnetic flux at each of the two points C, P respectively ..... .



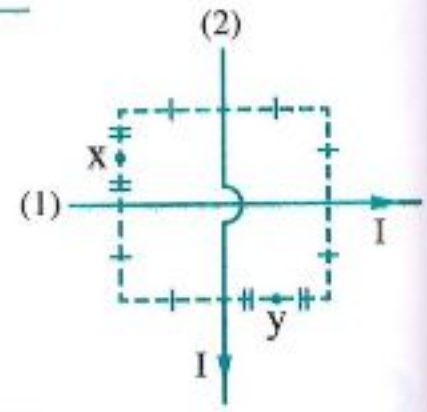
(a) remains non existent, increases
(b) remains non existent, decreases
(c) increases, increases
(d) increases, decreases

50 In the opposite figure, two long straight wires are perpendicular to each other, while the shortest distance between them is 20 cm. If the first wire carries 20 A in perpendicular direction out of the page and the second wire carries a current of 15 A in a direction parallel to the page, the net magnetic flux density at point X will be ..... .



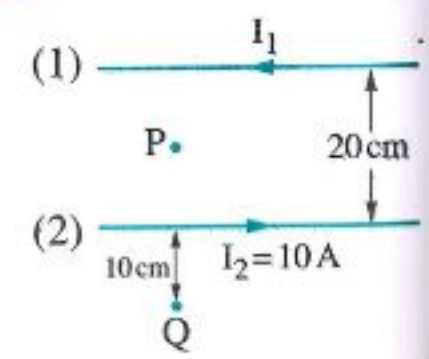
(a) 3×10^{-5} T
(b) 4×10^{-5} T
(c) 5×10^{-5} T
(d) 6×10^{-5} T

51 ✱ The opposite figure shows two insulated perpendicular straight wires, each carries a current of intensity I, so the ratio between the two flux densities at the two points x and y respectively is ..... .



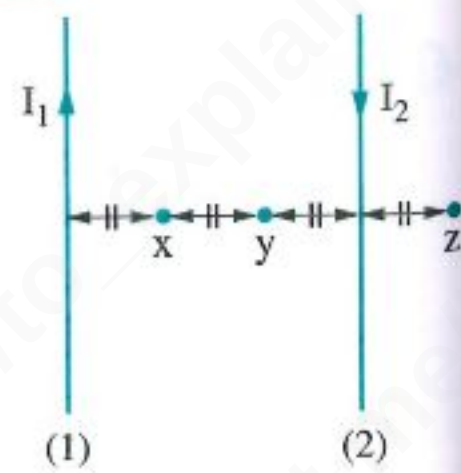
(a) 1 : 1
(b) 1 : 2
(c) 2 : 1
(d) 2 : 3

52 ✱ The opposite figure shows two parallel straight wires (1), (2). If the total magnetic flux density B_t at point P (in the middle of the distance between the two wires) equals 6×10^{-5} T, the total magnetic flux density at point Q equals ..... .



(a) 3.35×10^{-5} T
(b) 2.68×10^{-6} T
(c) 2.01×10^{-5} T
(d) 6.7×10^{-6} T

53 ✱ In the opposite figure, two long straight parallel wires (1) , (2) carry electric currents. If the resultant magnetic flux densities at the two points x and y are equal, and the resultant magnetic flux density at point z is (B), then the resultant magnetic flux density at point x is ..... .



(a) 0.75 B
(b) B
(c) 1.5 B
(d) 2 B

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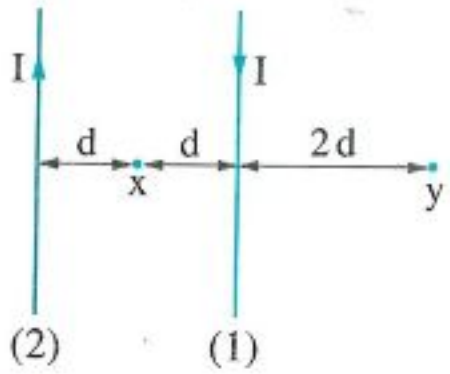
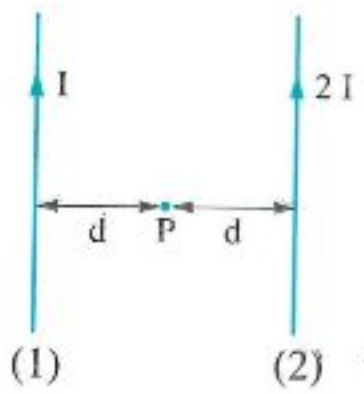
54 ✱ If the magnetic flux density at point x is B, then the magnetic flux density at point y is ..... .



(a) $\frac{B}{12}$ (b) 12 B

(c) $\frac{B}{2}$ (d) $\frac{B}{8}$

55 ✱ The opposite figure represents two very long parallel straight wires where each of them carries an electric current. If the magnetic flux density due to the current of wire (1) at point P equals B, so the resultant and the direction of the magnetic flux density at point P are ..... .



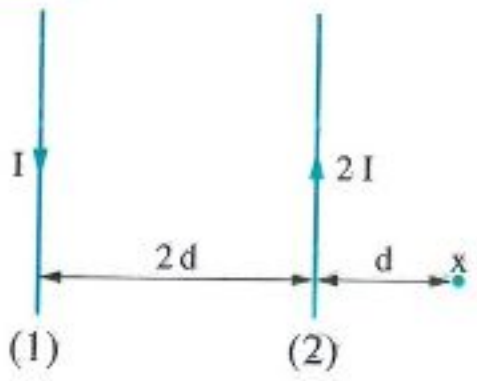
(a) B, perpendicular into the page

(b) 3 B, perpendicular into the page

(c) B, perpendicular out of the page

(d) 3 B, perpendicular out of the page

56 In the opposite figure, when the electric current intensity in wire (1) increases to 6 I, the resultant of the magnetic flux density at point x ..... .



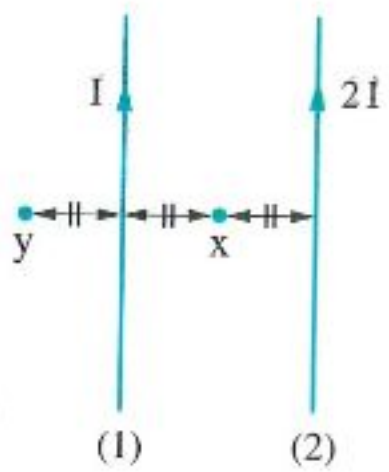
(a) increases to three times its initial value

(b) increases to six times its initial value

(c) becomes zero

(d) decreases to one third its initial value

57 Two long straight parallel wires (1) and (2) carry electric currents in the same direction with intensities I and 2I respectively as shown in the opposite figure, which of the following changes leads to an increase in the magnetic flux density at both points x and y?



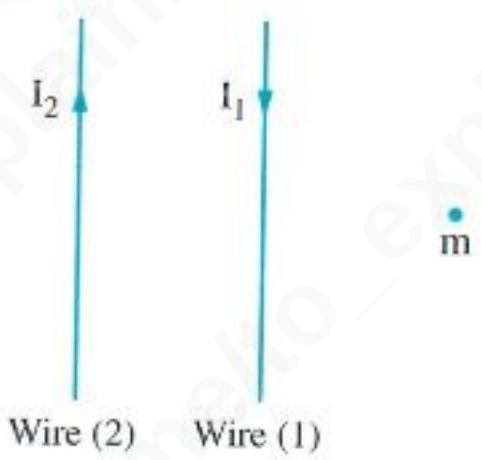
(a) The current intensity increases in wire 1 to 2 I

(b) The current intensity increases in wire 1 to 3 I

(c) The current intensity increases in wire 2 to 4 I

(d) No current passes through wire 2

58 In the opposite figure, two long straight parallel wires (1) and (2), carry electric currents in two opposite directions where $I_1 > I_2$. Which of the following changes leads to an increase in the magnitude of the resultant magnetic flux density at point m?



(a) The current intensity I_2 increases until it equals I_1

(b) The current intensity I_1 decreases until it equals I_2

(c) The direction of the current in one of the wires is reversed.

(d) Bringing one wire closer to the other.

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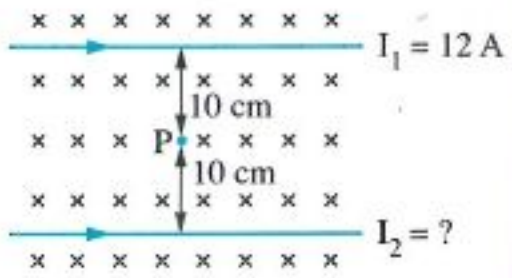
59 The opposite figure shows two very long and parallel straight wires that are placed in the plane of the page affected by a uniform external magnetic field of flux density 2×10^{-5} T whose direction is perpendicular into the plane of the page, if the resultant magnetic flux density at point P equals 2×10^{-5} T and its direction is into the page, so the electric current intensity that passes through the second wire equals ..... .



(a) 24 A (b) 18 A (c) 12 A (d) 6 A

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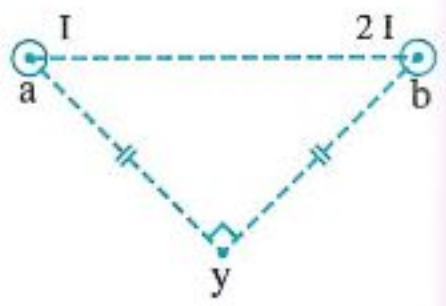
60 In the opposite figure, two straight parallel wires a and b carry electric currents I and 2 I respectively, as shown. If the formed flux density due to wire a at point y is B, the net flux density at point y equals ..... .

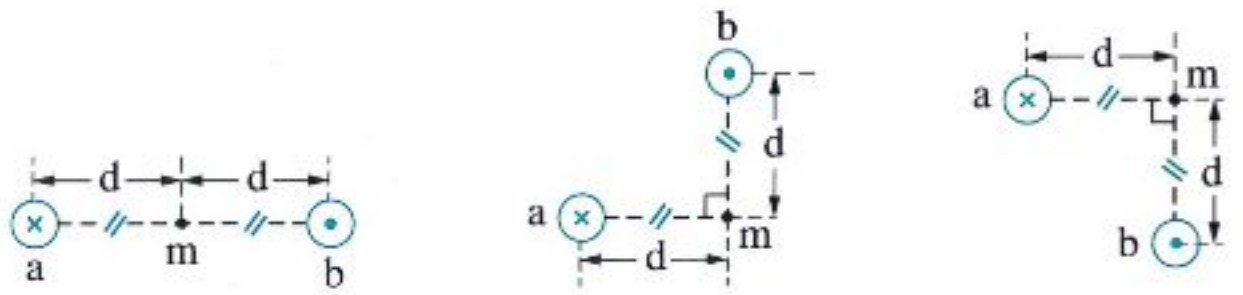


(a) B (b) 2 B

(c) $\sqrt{3}$ B (d) $\sqrt{5}$ B

---

61 Two long straight parallel wires a and b are placed perpendicular to the plane of the page and carry two electric currents of the same intensities and in two opposite directions, if the wires are placed in different positions relative to each other as shown in the following figures:



Then at point (m),

(i) the resultant magnetic flux density is ..... .

(a) greater in figure (1) (b) greater in figure (2)

(c) greater in figure (3) (d) equal in the three figures

(ii) the resultant magnetic flux density in figures (2) and (3) ..... .

(a) have the same magnitude and direction

(b) have the same magnitude but are opposite in direction

(c) differ in magnitude but have the same direction

(d) differ in magnitude and are opposite in direction

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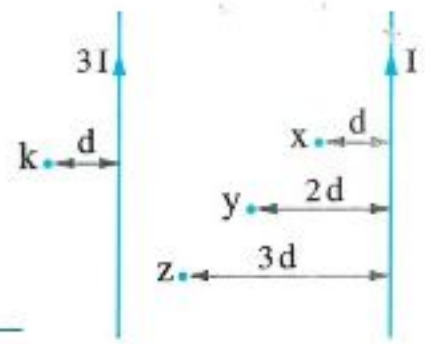
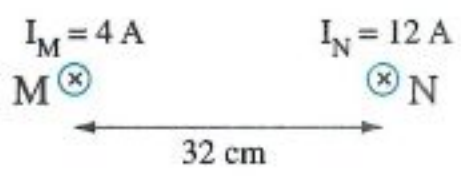
62 In the opposite figure, if the distance between the two wires equals 4 d. So, the neutral point is point ..... .



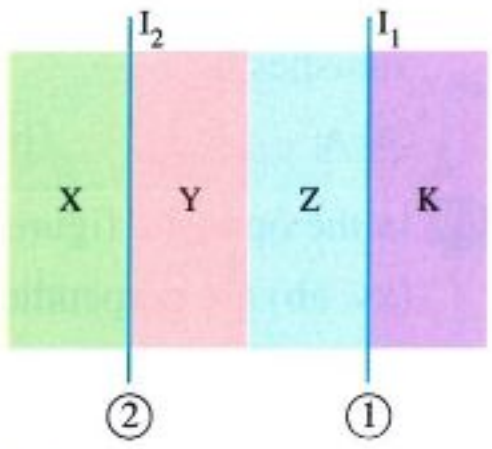
(a) x (b) y
(c) z (d) k

63 The opposite figure shows two long parallel wires M and N. If the two wires are perpendicular to the page and carry currents that flow into the page, the neutral point will be ..... .



(a) between them at a distance 8 cm from wire M
(b) outside of them at a distance 8 cm from wire M
(c) between them at a distance 24 cm from wire M
(d) outside of them at a distance 24 cm from wire M

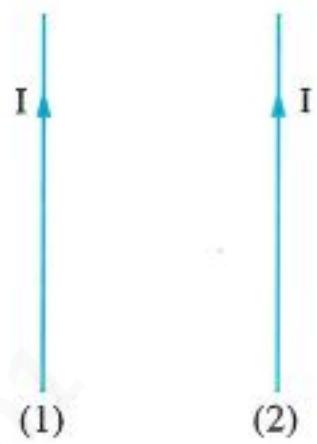
64 * The opposite figure represents two long straight parallel wires in the same plane, each of them carries electric current where $I_1 > I_2$. So, in which of the regions X, Y, Z, K, the neutral point lies if the currents which are passing in the wires are:



(i) In the same direction?
(a) X (b) Y (c) Z (d) K

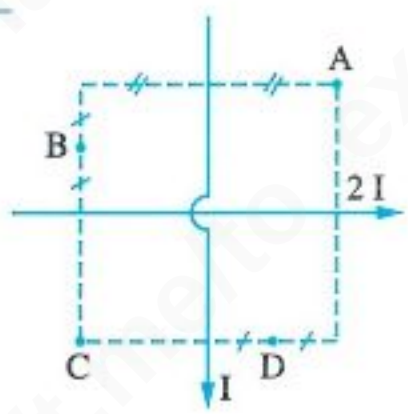
(ii) In opposite directions?
(a) X (b) Y (c) Z (d) K

65 Two parallel straight wires (1), (2) carry an electric current of intensity I in the same direction, which of the following procedures leads to the disappearance of the neutral point?



(a) One of the two wires is displaced away from the other.
(b) The electric current intensity is doubled in one of the two wires.
(c) The direction of the current is reversed in one of the two wires.
(d) The direction of the current is reversed in each of the two wires.

66 In the opposite figure, two insulated perpendicular wires carry electric currents, so the net magnetic flux density vanishes at the point ..... .



(a) A (b) B
(c) C (d) D

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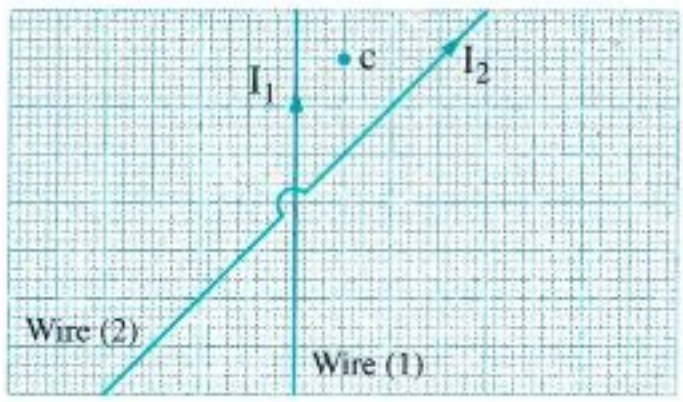
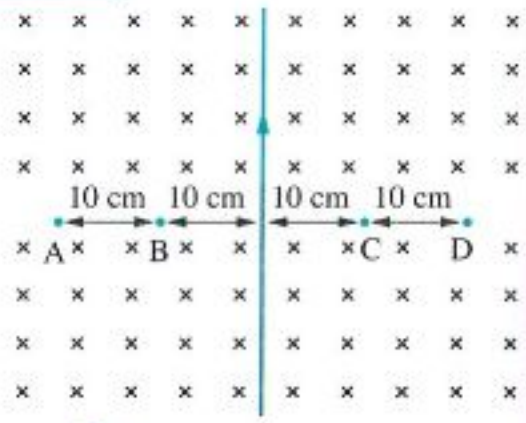
67 Two long insulated straight wires 1 and 2, carry electric currents with intensities I_1 and I_2, and their directions are as shown in the opposite figure.
If point c represents the neutral point, which of the following relations is correct regarding the current intensities of the two wires?



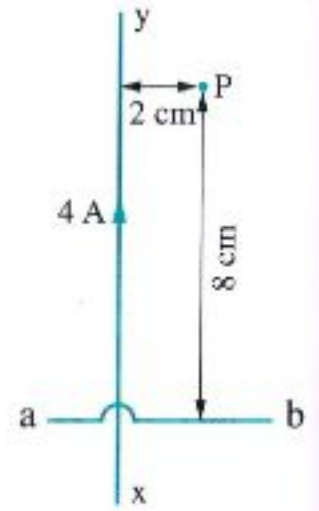
(a) $I_1 > I_2$ (b) $I_1 < I_2$
(c) $I_1 = I_2$ (d) Indeterminable.

68 In the opposite figure, a long straight wire that carries an electric current of intensity 10 A, is placed in the plane of the page perpendicular to a uniform magnetic field of flux density 2×10^{-5} T that is directed into the page, then the point at which the resultant magnetic flux density vanishes is ..... .



(a) A (b) B (c) C (d) D

69 In the opposite figure, two very long straight and isolated wires (xy, ab) are perpendicular to each other. Wire (xy) carries a current of intensity 4 A, so the intensity and the direction of the current that has to be set up in wire (ab) so that the resultant magnetic flux density at point P vanishes are ..... .

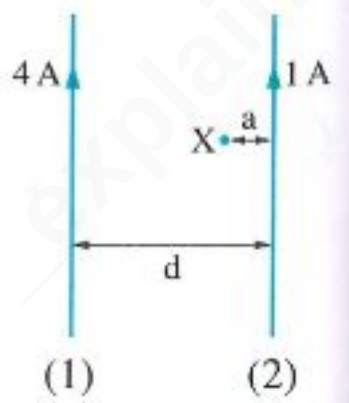


(a) 8 A, from a to b (b) 8 A, from b to a
(c) 16 A, from a to b (d) 16 A, from b to a

70 ✱ A small compass is placed at a point between two straight parallel wires where it lies at a distance of 20 cm from the first wire which carries a current of intensity 2 A, directed from south to north and at a distance of 40 cm from the second wire, so the intensity and the direction of the current in the second wire that don't make the compass needle deflect are ..... .

(a) 4 A, from north to south (b) 2 A, from north to south
(c) 4 A, from south to north (d) 2 A, from south to north

71 ✱ The opposite figure shows two parallel straight wires (1) and (2) that carry currents where point X lies at the neutral point and away from wire (2) by a distance a, hence if the intensity of the electric current in wire (2) is increased to 4 A, the neutral point has moved a distance of 10 cm, so the distance d between the axes of the two wires equals ..... .



(a) 18.51 cm (b) 20.83 cm (c) 24.75 cm (d) 33.33 cm

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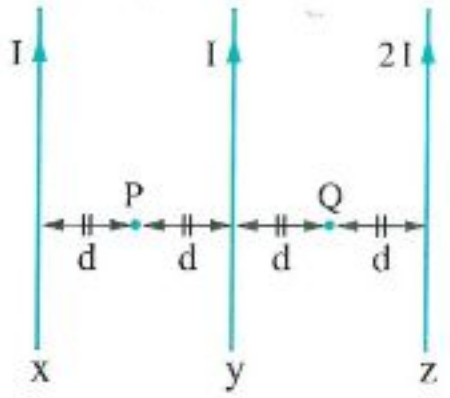
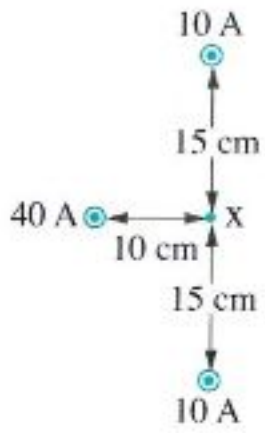
72 In the opposite figure, three long straight wires are parallel and each of them carries an electric current, so the directions of the magnetic fields at points P and Q are ..... .



	P	Q
(a)	out of the page	out of the page
(b)	into the page	into the page
(c)	out of the page	into the page
(d)	into the page	out of the page

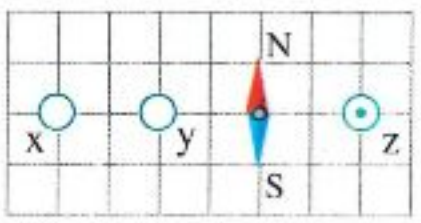
73 The opposite figure represents three wires that are perpendicular to the plane of the page, each of them carries an electric current as in the figure, then the net magnetic flux density at point x equals ..... .



(a) 2×10^{-5} T (b) 8×10^{-5} T

(c) 9×10^{-5} T (d) 4×10^{-4} T

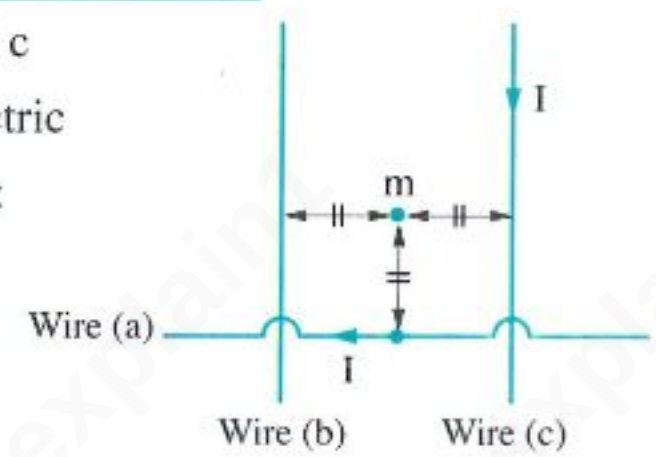
74 Three vertical straight wires x, y and z are in one plane and carry an electric current of intensity I, a compass is placed between two wires y, z, then its needle takes the position shown in the opposite figure, by ignoring the effect of the magnetic field of the Earth, then the directions of the currents in the two wires x, y respectively are ..... .



(a) out of the page, out of the page (b) out of the page, into the page

(c) into the page, out of the page (d) into the page, into the page

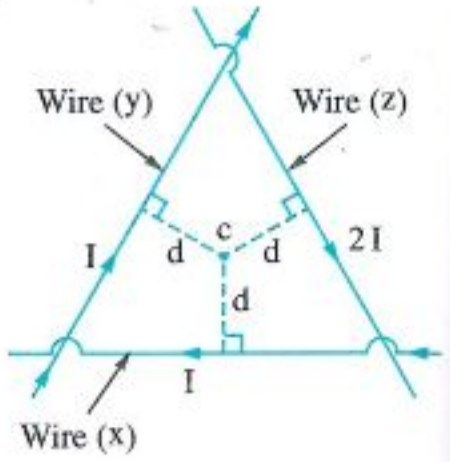
75 In the opposite figure, three long straight wires a, b and c are placed in one plane and each of them carries an electric current, if the point m represents the neutral point, then:



	The direction of the current in wire (b)	The intensity of the current in wire (b)
(a)	Upward	I
(b)	Upward	2I
(c)	Downward	I
(d)	Downward	2I

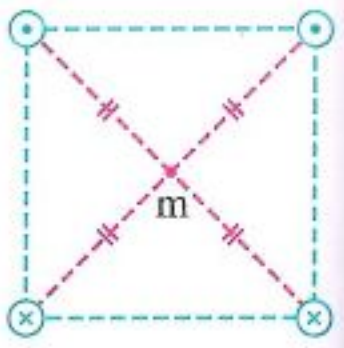
https://t.me/to_explain1

76 ✱ In the opposite figure, three current-carrying wires x, y, z are in the same plane. If the magnetic flux density due to the current in wire z at point c equals B_o, then the value of the net magnetic flux density at point c which is due to the currents in the wires is equal to ..... .



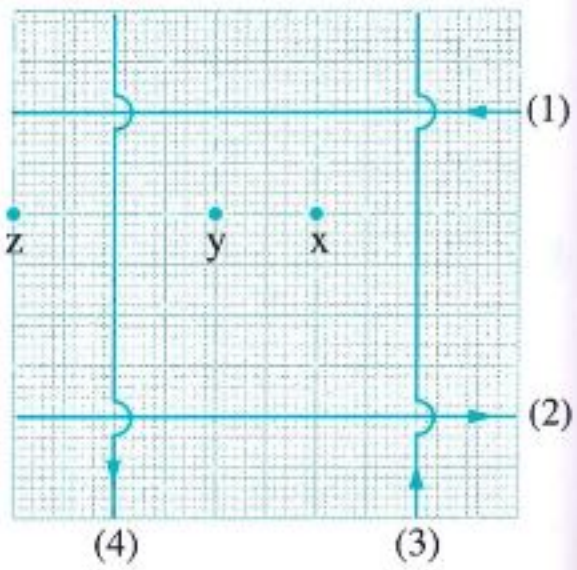
(a) zero
(b) $2\ B_o$
(c) $3\ B_o$
(d) $4\ B_o$

77 In the opposite figure, four very long straight parallel wires are placed perpendicular to the plane of the page at the vertices of a square, if all of them carry electric currents of the same intensity that flow in directions as shown in the figure, then the direction of the resultant magnetic flux density at point (m) is ..... .



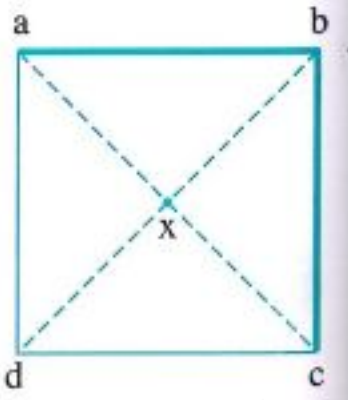
(a) perpendicular into the page
(b) perpendicular out of the page
(c) in the plane of the page to the right
(d) in the plane of the page to the left

78 The opposite diagram shows four long straight wires (1, 2, 3 and 4) in the same plane, each carrying an electric current of intensity I. Then the correct order of the points x, y and z in terms of the resultant magnetic flux density at each of them is ..... .



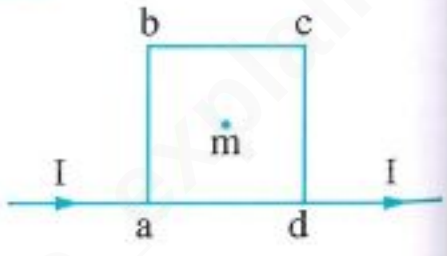
(a) $z < y < x$
(b) $z > y > x$
(c) $z < y = x$
(d) $z > y = x$

79 Two wires of the same metal abc, adc have the same length and different in the cross-sectional area, they are connected together to form a square as shown in the opposite figure, the two points which are connected to an electric source make the resultant magnetic flux density at point x equal to zero are ..... , ...



(a) a, d
(b) a, c
(c) a, b
(d) b, d

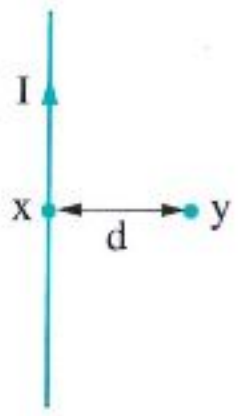
80 ✱ A wire of uniform cross-section is shaped in the form of a square abcd and an electric current passes through it as shown in the opposite figure. If the magnetic flux density at point (m) caused by the current passing through only segment (ab) of the wire equals (B_o), then the resultant magnetic flux density at point (m) equals ..... .



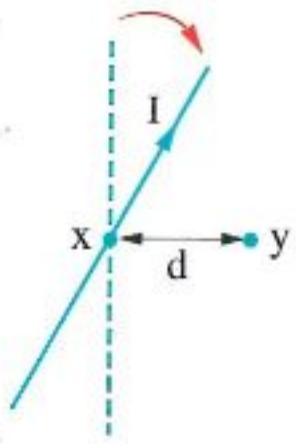
(a) zero
(b) B_o
(c) $2B_o$
(d) $4\ B_o$

https://t.me/to_explain1

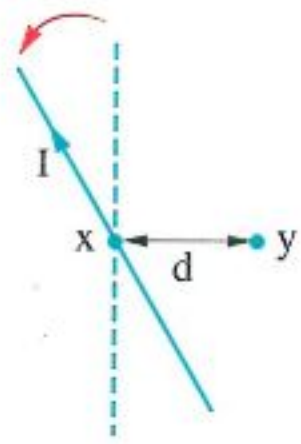
81 ✳ A long straight wire lies in the plane of the page, carrying an electric current of intensity I and away from which a point y is located at distance d as in figure (1) . If the wire is rotated in the plane of the page about an axis passing through point x by 30°, once in the clockwise direction as shown in figure (2), and another in the counter-clockwise direction as shown in figure (3).



(1)



(2)



(3)

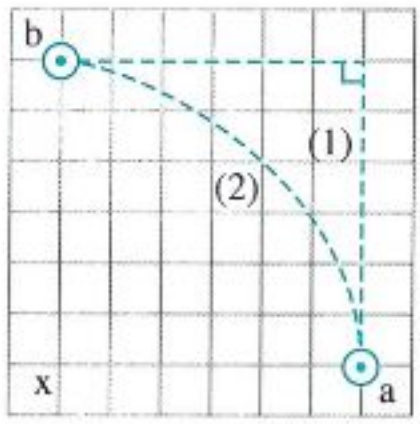
Then, the correct order for the magnitudes of the magnetic flux density at point (y) in the three figures is .....

ⓐ $B_1 = B_2 = B_3$ ⓑ $B_1 > B_2 = B_3$

ⓒ $B_2 > B_3 > B_1$ ⓓ $B_2 = B_3 > B_1$

---

82 A straight wire carries a direct electric current, is placed perpendicular to the page and it can be moved from position a to position b through two paths (1) or (2) (where path (2) is a circular path, its center is point x) as shown in the opposite figure, what happens to the value of the magnetic flux density at point x during the transmission of the wire through:



(i) path (1)?

ⓐ Increases. ⓑ Doesn't change.

ⓒ Increases then decreases. ⓓ Decreases then increases.

(ii) path (2)?

ⓐ Increases. ⓑ Doesn't change.

ⓒ Increases then decreases. ⓓ Decreases then increases.

Second Essay questions

Magnetic flux and flux density

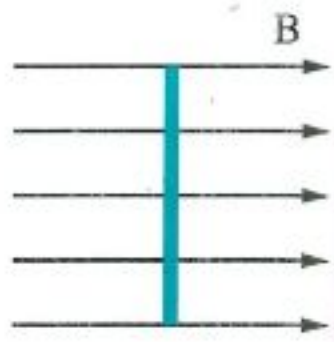
1 A straight wire of length 1 m is coiled to form a loop of one turn and placed perpendicular to a magnetic field of flux density 1 T. **Find** the magnitude of the magnetic flux that passes through the loop if it was:

(a) Circular. (b) Square.

https://t.me/to_explain1

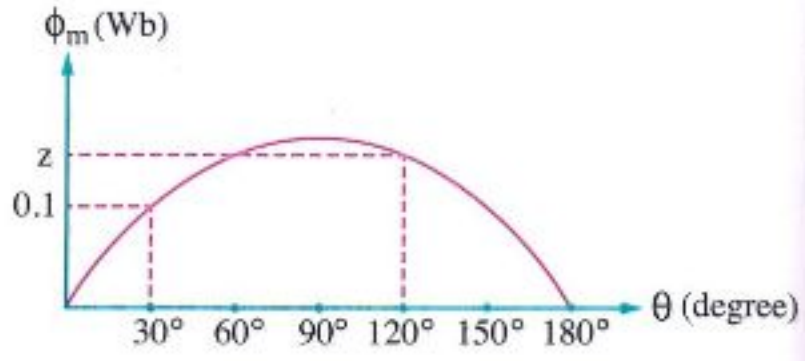
2 The opposite figure shows a lateral view of a coil that was placed in a uniform magnetic field, so if the value of the flux that is penetrating the coil is 4×10^{-2} Wb. **What** will be the least angle by which the coil rotates in the clockwise direction from the shown position in the figure so that the flux penetrating the coil becomes:

(a) 2×10^{-2} Wb? **(b)** -2×10^{-2} Wb?



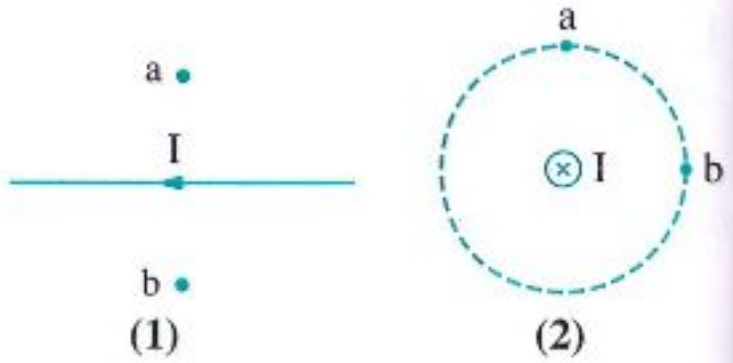
3 The opposite graph represents the relation between the magnetic flux (ϕ_m) that penetrates a coil while rotating with a uniform rate inside a magnetic field and the angle (θ) between the plane of the coil and the field.

Calculate the value of z.

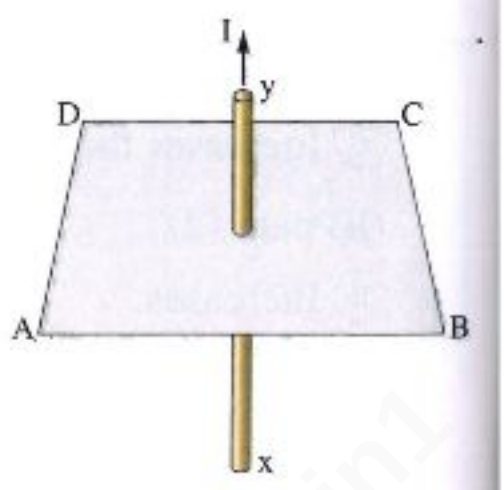


The magnetic field due to a current-carrying wire

4 **What** is the direction of the magnetic field due to the electric current (I) in each of the straight wires shown in figures (1), (2) at each of the points a, b?

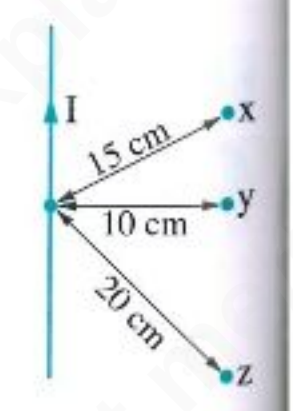


5 In the opposite figure, a vertical straight wire xy that carries an electric current penetrates a horizontal cardboard sheet. **Draw on the sheet** ABCD four of the lines of the magnetic field that arises due to the current in wire xy.



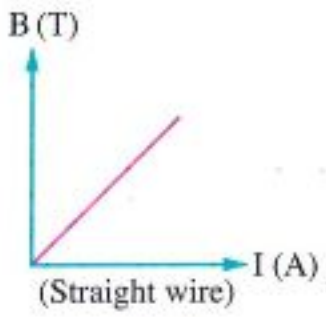
6 In the opposite figure, a very long straight wire carries an electric current where three points x, y, z lie on a parallel line beside it.

Compare the values of the magnetic flux densities at these points, **explaining your answer**.

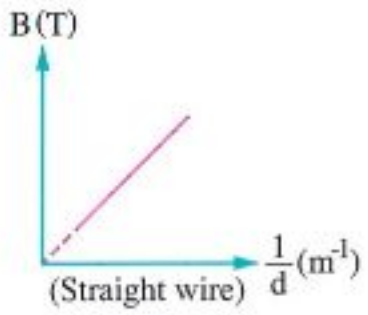


https://t.me/to_explain1

7 **Write the mathematical relations and the slope of the lines that are represented in the following graphs:**



(a)

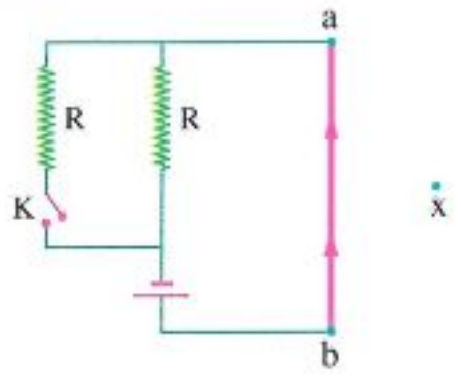


(b)

Where: (B) is the magnetic flux density, (I) is the electric current intensity in the wire, (d) is the distance between the point and the wire axis.

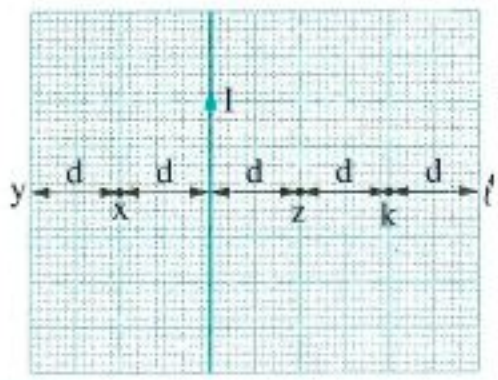
---

8 **How can you explain:** The value of the magnetic flux density at point x due to the current in wire ab increases when switch K gets closed in the opposite circuit.



---

9 In the opposite figure, if the magnetic flux density due to the flow of electric current (I) in the wire at point x equals B in a certain direction, **determine with explanation** the point at which the magnetic flux density becomes $\frac{B}{2}$ in the opposite direction.



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10 Figure (1) shows a compass that is placed in the plane of magnetic meridian below a straight wire. When an electric current passed in the wire, the compass needle was deflected to settle as in the figure (2). **Determine** the direction of the electric current passing in the wire.

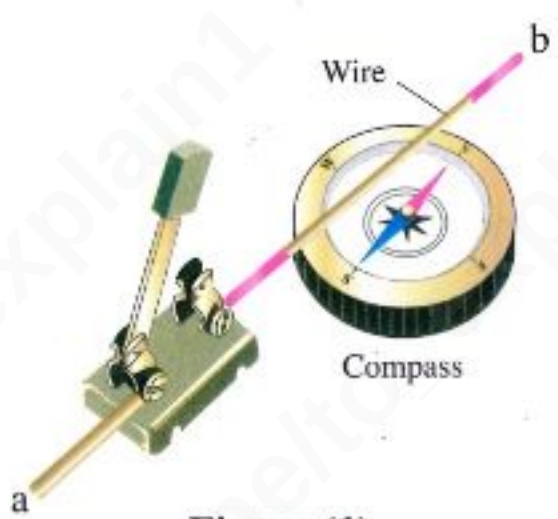


Figure (1)

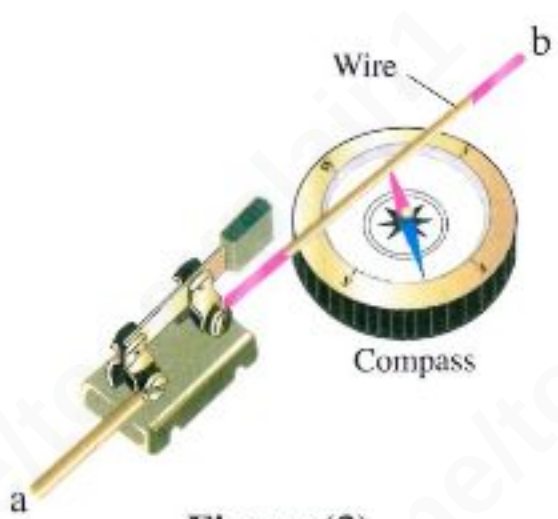


Figure (2)

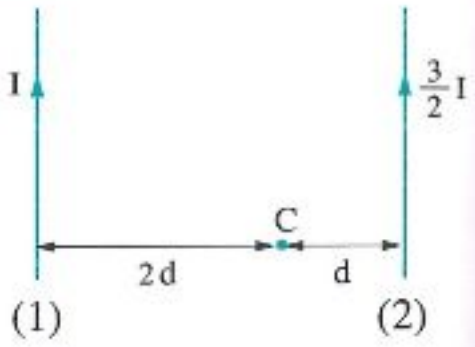
https://t.me/to_explain1

11 Two parallel straight wires (x, y) at 0.3 m apart, where wire x carries an electric current of intensity 2 A and wire y carries a current of intensity 3 A. **Calculate the distance between the neutral point and wire y, when the two currents are:**

(a) In the same direction. **(b)** In opposite directions.

---

12 Two parallel straight wires (1), (2), each of them carries an electric current as in the opposite figure. **Determine** the value of the resultant magnetic flux density at point C in terms of μ, d, I.



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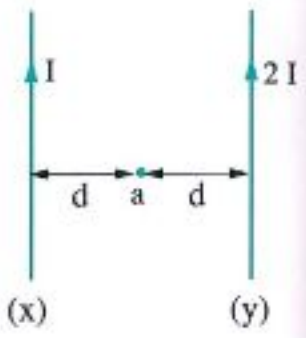
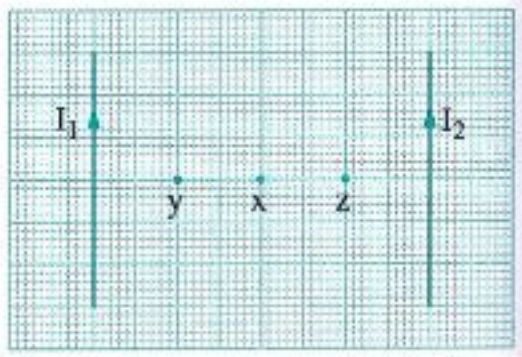
13 Two parallel straight wires (x, y), each of them carries an electric current as in the opposite figure. **Explain what happens to** the value of the magnetic flux density at point a when wire x gets moved a distance $\frac{1}{2}$ d towards wire y.



---

14 In the opposite figure, when the currents I_1, I_2 pass in the two long parallel straight wires, point x becomes neutral point. **How can the electric current intensity I_2 be changed to make the neutral point be:**

(a) at point y? **(b)** at point z?



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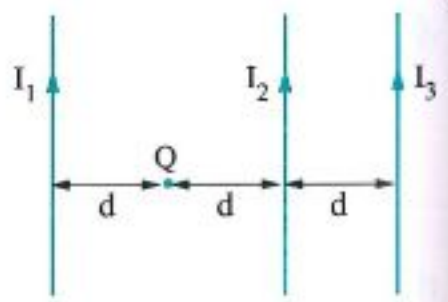
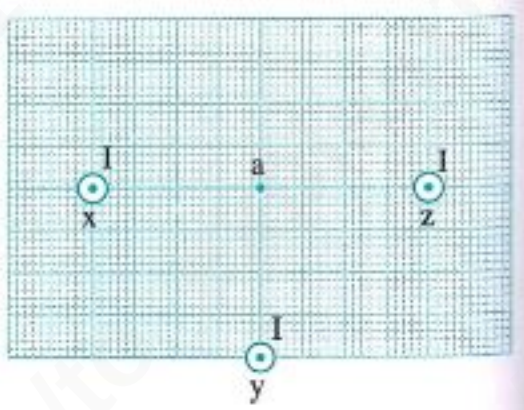
15 The opposite figure shows three long straight parallel wires that carry electric currents. If the net magnetic flux density at point Q was vanished, **prove that:** $(I_2 + I_3) > I_1$



---

16 In the opposite figure, three parallel straight wires x, y, z each of them carries an electric current of intensity I. If the magnetic flux density due to the current in wire x at point a equals B, **calculate** the value of the net magnetic flux density at point a in terms of B when the current vanishes in:

(a) wire y. **(b)** wire z.

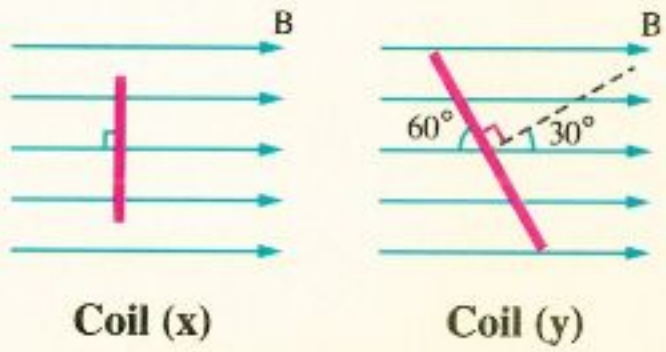


https://t.me/to_explain1

Questions of the Previous Years Exams ? on Lesson 1

The magnetic flux

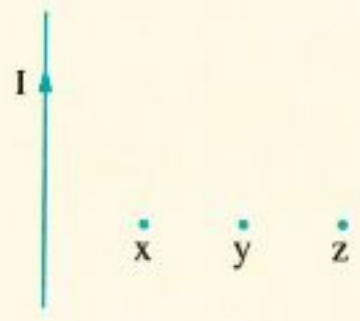
1 In the opposite diagram, two rectangular coils x and y, their areas respectively are A and 3A and are placed in a uniform magnetic field.
The ratio of the magnetic flux passing through each of them $\left(\frac{(\phi_m)_x}{(\phi_m)_y}\right)$ is ..... . *(Exp. 25)*



(a) $\frac{\sqrt{3}}{2}$ (b) $\frac{2\sqrt{3}}{9}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\frac{2\sqrt{3}}{5}$

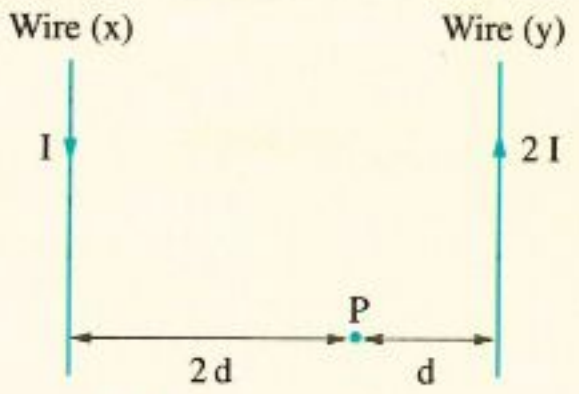
Straight wire

2 A long straight wire carries electric current of intensity I as in the figure, which one from the following expressions relates correctly the magnetic flux density (B) that is produced due to the current through the wire at the points x, y and z that lie in the same plane of the wire? *(Exp. June 21)*



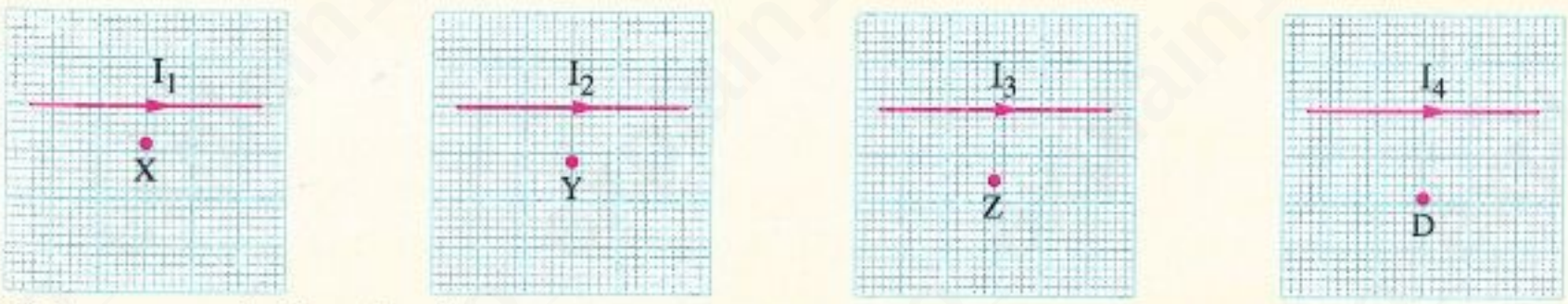
(a) $B_z > B_y$ (b) $B_y < B_x$ (c) $B_x < B_z$ (d) $B_y = B_z$

3 In the shown figure, the resultant magnetic flux density at point P due to the two electric currents that are passing through the two wires (x) and (y) is B_t, so if the direction of the passing current through wire (x) is reversed while keeping the current of (y) as it is, the resultant magnetic flux density at point P becomes ..... . *(Exp. June 21)*



(a) $\frac{3}{7} B_t$ (b) $\frac{2}{3} B_t$ (c) $\frac{3}{5} B_t$ (d) $\frac{3}{8} B_t$

4 The following figures show four straight wires that are carrying different currents (I_1, I_2, I_3 and I_4).



If the magnetic flux densities at the points (X, Y, Z and D) are equal, the greatest electric current intensity is ..... . *(1st session 21)*

(a) I_1 (b) I_4 (c) I_3 (d) I_2

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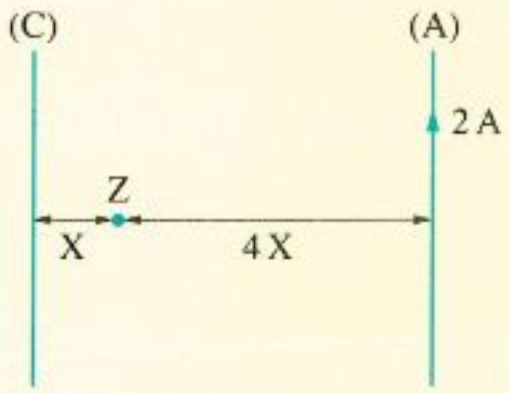
9 Two parallel long wires (X) and (Y), the normal distance between them is 0.5 m, the two wires are carrying currents in the same direction, the value of the current in wire X is (I) and that of wire Y is (3 I), so that the position of the neutral point is at a distance ..... .

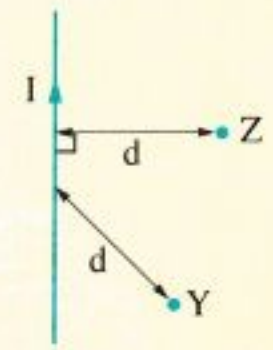
(a) 0.125 m from wire Y
(b) 0.25 m from wire Y
(c) 0.125 m from wire X
(d) 0.625 m from wire X *(Exp. 23)*

10 The figure represents two long straight current carrying parallel wires (A) and (C). Which of the following choices represents the intensity and the direction of the current in wire (C) that produces a neutral point at point (Z)? *(1st session 23)*



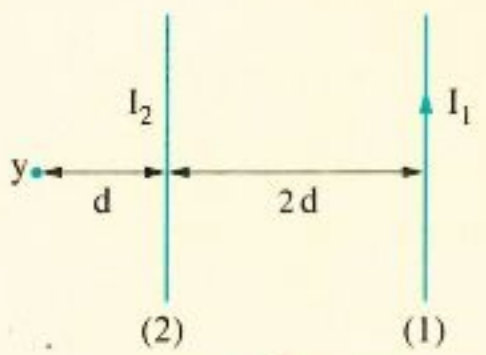
(a) 2 A, in the same direction of the current in wire (A).
(b) 0.5 A, in the same direction of the current in wire (A).
(c) 0.5 A, in opposite direction of the current in wire (A).
(d) 2 A, in opposite direction of the current in wire (A).

11 The figure illustrates a straight current-carrying wire. Which of the following choices represents correctly the relation between the magnetic flux densities (B_Y and B_Z) due to the current (I) in the wire at points (Y) and (Z) that lie in the same vertical plane with the wire? *(2nd session 23)*



(a) $B_Z = B_Y$ and in the opposite direction.
(b) $B_Z = B_Y$ and in the same direction.
(c) $B_Z > B_Y$ and in the opposite direction.
(d) $B_Z < B_Y$ and in the same direction.

12 The figure illustrates two parallel straight wires (1, 2) carrying currents (I_1, I_2) respectively. To make point (y) represent a neutral point for the two magnetic fields, the intensity and the direction of current I_2 must be ..... .



(a) $\frac{I_1}{2}$, upwards
(b) I_1, upwards
(c) $2\ I_1$, downwards
(d) $\frac{I_1}{3}$, downwards *(2nd session 23)*

13 An electric current passes through a very long straight wire, so a magnetic field of density (B) is produced at a point beside the wire. To decrease the magnetic flux density at the same point, it requires ..... .

(a) using another wire of smaller length connected to the same electric source
(b) using another wire of greater length connected to the same electric source
(c) using another thicker wire connected to the same electric source
(d) using another electric source of higher e.m.f *(1st session 24)*

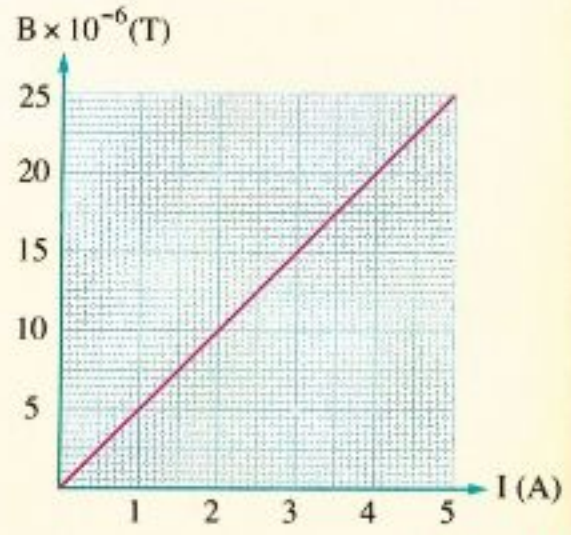
https://t.me/to_explain1

14 In the opposite figure, a straight wire carries an electric current, then the ratio between the magnetic flux density due to the current at the three points x, y, z ($B_z : B_y : B_x$) respectively is equal to ..... .

(a) 2 : 3 : 6 (b) 3 : 2 : 1

(c) 1 : 2 : 3 (d) 4 : 6 : 2 *(2nd session 24)*

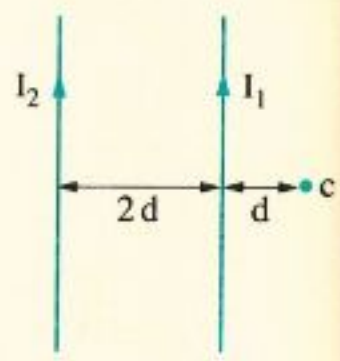
15 The opposite graph represents the relation between the magnetic flux density (B) generated by the current passing through a straight wire at a certain point and the intensity of this current (I). Therefore, the distance of that point from the axis of the wire equals ..... .

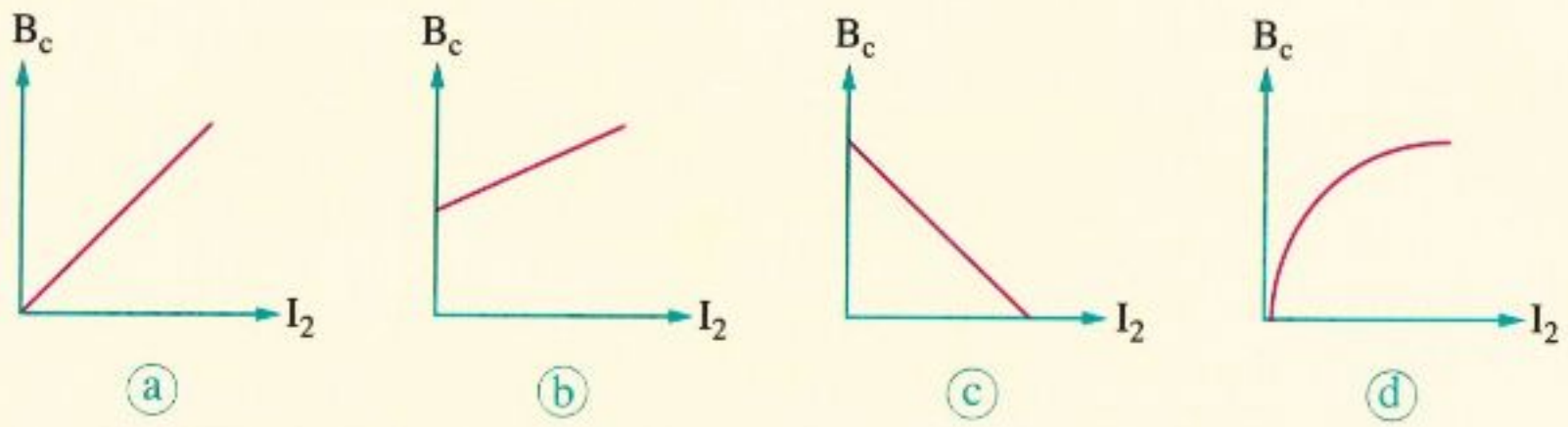


(a) 10 cm (b) 8 cm

(c) 6 cm (d) 4 cm *(Exp. 25)*

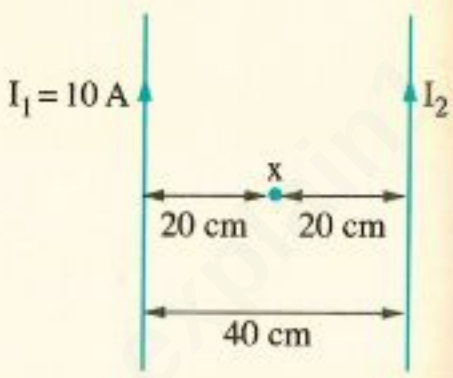
16 The opposite figure represents two long straight parallel wires carry electric current in the same direction, which of the following graphs represents the relation between the resultant of the magnetic flux density (B_c) of the two wires at point (c) and the current intensity (I_2)? *(Exp. 25)*





(a) (b) (c) (d)

17 In the opposite figure, two very long straight parallel wires lie in the plane of the page, if the resultant of the magnetic flux density at point (x) generated by the currents of the two wires is 2×10^{-5} T, so the electric current intensity passes through the second wire (I_2) equals ..... . *(Exp. 25)*



(a) 10 A (b) 20 A (c) 30 A (d) 40 A

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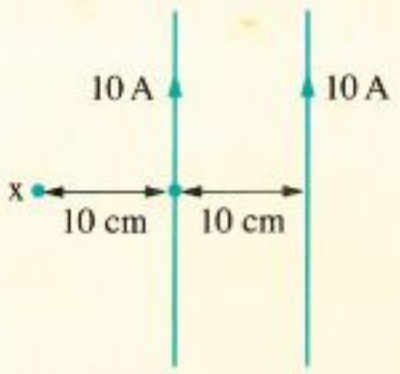
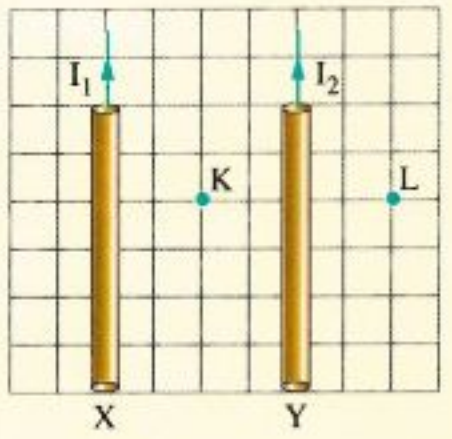
18 In the opposite figure, two very long straight parallel wires carry the same electric currents and are placed in the plane of the page, then the resultant of the magnetic flux density at point (x) equals ..... . *(Exp. 25)*



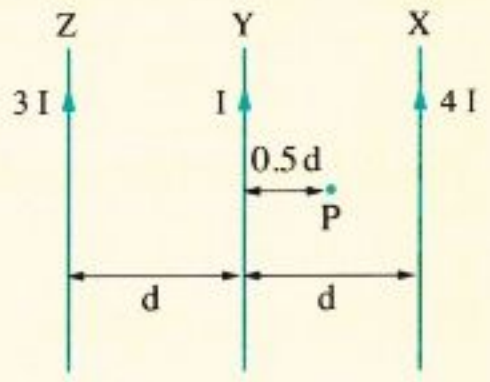
(a) 10^{-5} T
(b) 2×10^{-5} T
(c) 3×10^{-5} T
(d) 5×10^{-5} T

19 Two long straight parallel wires, each carry an electric current as shown in the opposite figure. If the direction of the current in wire (x) is reversed, then the magnitudes of the net magnetic flux density at points L and K, respectively, will be ..... . *(Exp. 25)*



(a) decreases, increases
(b) increases, decreases
(c) unchanged, unchanged
(d) decreases, decreases

20 Three long straight parallel wires X, Y and Z, each carry an electric current as shown in the opposite figure. If the magnetic flux density at point P due to the current in wire Y is equal to B, then the magnitude of the net magnetic flux density at point P is equal to ..... . *(Exp. 25)*



(a) B
(b) 2 B
(c) 4 B
(d) 8 B

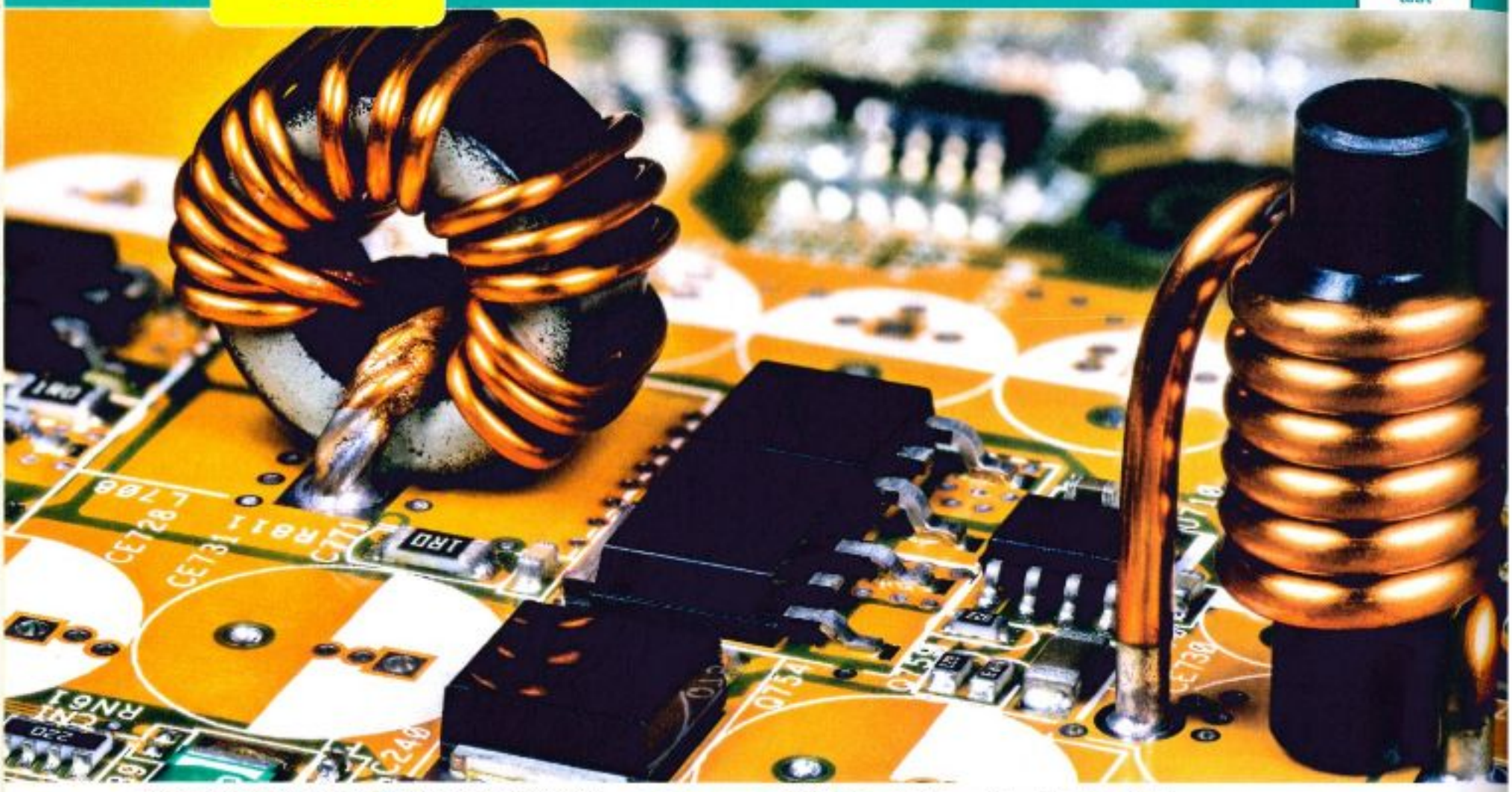
https://t.me/to_explain1

Chapter 2

Questions on Lesson Two

Following of the Magnetic Effect of the Electric Current

Interactive test



The questions signed by ✻ are answered in detail. ● Understand ○ Apply ∴ Higher Order Thinking Skills

Important guidelines

- **The magnetic flux density (B) at the center of a circular coil:** $B = \frac{\mu N I}{2 r}$

- **The number of turns in a circular coil:**

  If a wire of length ℓ is coiled to make a coil of radius r:

  $$N = \frac{\ell \text{ (length of the coil's wire)}}{2 \pi r \text{ (circumference of the turn)}}$$

  Where (N is either an integer or a rational number).

  If the coil is a part of a circle (arc) as shown in the figure:

  $$N = \frac{\theta}{360}$$

- **In the case of reshaping a circular coil where the number of turns is changed from N_1 to N_2 and connecting it to the same voltage:**

$$\because \frac{B_1}{B_2} = \frac{N_1 r_2}{N_2 r_1} \quad , \quad \frac{N_1}{N_2} = \frac{r_2}{r_1} \quad \therefore \frac{B_1}{B_2} = \frac{N_1^2}{N_2^2} = \frac{r_2^2}{r_1^2}$$

https://t.me/to_explain1

The net magnetic flux density at the common center of two coils

In one plane

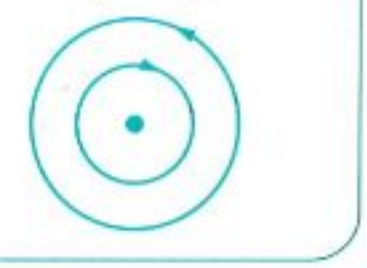
Two currents are in the same direction

$B_t = B_1 + B_2$

Two currents are in opposite directions

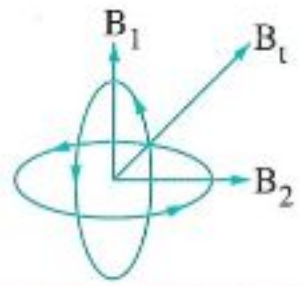
$B_t = B_1 - B_2$

$(B_1 > B_2)$



Perpendicular

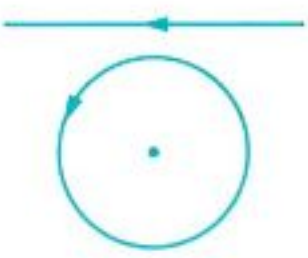
$B_t = \sqrt{B_1^2 + B_2^2}$



The net magnetic flux density in the case of a circular coil and a wire in the same plane carrying electric currents if the field of each of the wire and the coil are:

In the same direction

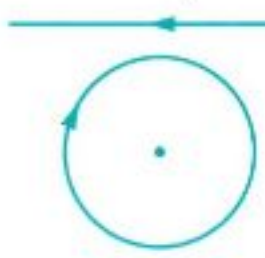
$B_t = B_{coil} + B_{wire}$



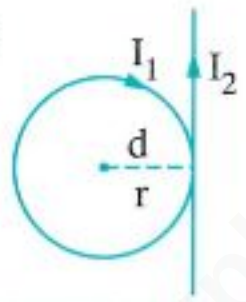
In two opposite directions

$B_t = B_{coil} - B_{wire} \quad (B_{coil} > B_{wire})$

$B_t = B_{wire} - B_{coil} \quad (B_{wire} > B_{coil})$



- **In the case of a circular coil tangent to a straight wire where the total magnetic flux at the center vanishes:** $B_{coil} = B_{wire}$



$$\frac{\mu I_1 N}{2r} = \frac{\mu I_2}{2\pi d} \qquad NI_1 = \frac{I_2}{\pi}$$

- **The magnetic flux density (B) at the center of a solenoid:** $B = \mu \frac{N I}{\ell} = \mu n I$

When the turns are tangent to each other along the coil, the length of the coil: $\ell = N \times 2\grave{r}$

(Where: n is the number of turns per unit length, $\grave{r}$ is the radius of the wire)

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- **When the turns of the circular coil are displaced uniformly away from each other, so it becomes a solenoid having the same number of turns and carrying the same electric current as the circular coil, we can compare between them according to the following relation:**

$$\frac{B_{circular}}{B_{solenoid}} = \frac{\ell_{solenoid}}{2\,r_{circular}}$$

The net flux density at the common center of two solenoid coils when the two currents are:

In the same direction	In two opposite directions
$B_t = B_1 + B_2$	$B_t = B_1 - B_2$ $(B_1 > B_2)$

- **If a wire is placed parallel or perpendicular to the axis of a solenoid and electric currents pass through each of them (the two fields are perpendicular), then net magnetic flux density at a point on the solenoid axis and at a certain distance from the straight wire is:**

$$B_t = \sqrt{B_{wire}^2 + B_{coil}^2}$$

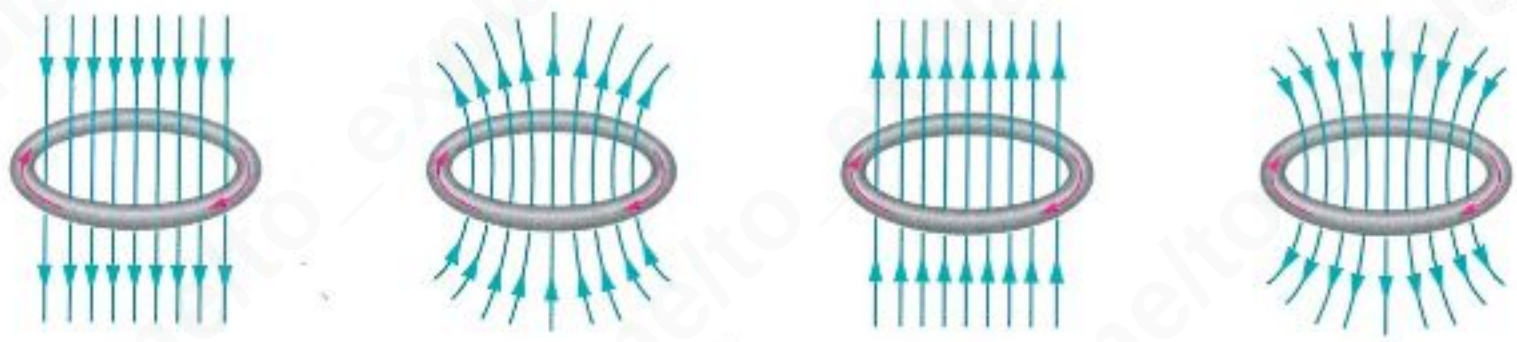
- **If a wire is put perpendicular to the axis of a solenoid but away from it by a distance d, the formed magnetic fluxes due to the two currents that pass in the wire and the solenoid are added or subtracted with applying Ampere's right hand rule.**

First Multiple choice questions

Use the following constants when needed: $\mu_{air} = 4\pi \times 10^{-7}$ Wb/A.m, $e = 1.6 \times 10^{-19}$ C

Circular coils

1 Which of the following figures correctly represents the magnetic flux lines pattern produced due to the flow of a direct electric current through a circular metallic ring?



(a) (b) (c) (d)

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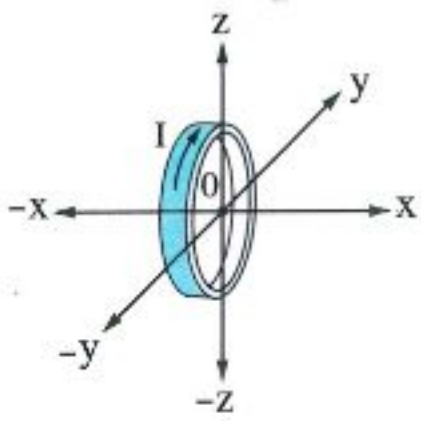
2 A circular metallic ring carries an electric current as shown in the opposite figure, which of the following directions represents the direction of the magnetic field that is formed due to the flow of the current in the ring?



(a) The positive direction of x-axis.

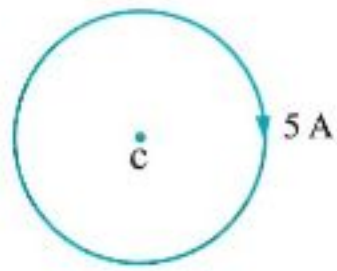
(b) The positive direction of z-axis.

(c) The negative direction of x-axis.

(d) The negative direction of y-axis.

---

3 In the opposite figure, a circular ring of radius 10 cm carries an electric current of intensity 5 A, then the magnetic flux density at the center of the ring (c) and its direction are ..... .



(Where: $\pi = 3.14$)

(a) 2.6×10^{-5} T, perpendicular out of the page

(b) 3.14×10^{-5} T, perpendicular out of the page

(c) 3.14×10^{-5} T, perpendicular into the page

(d) 2.6×10^{-5} T, perpendicular into the page

---

4 If the magnetic flux density at the center of a circular ring of radius 4π cm is 5×10^{-5} T and the magnetic permeability of air is $4\pi \times 10^{-7}$ Wb/A.m, so the electric current intensity through the ring is ..... .

(a) 7 A (b) 7.14 A (c) 10 A (d) 17 A

---

5 A circular coil carries an electric current that produces a magnetic field of density B at the center of the coil. When the electric current intensity is increased to the double and the radius of the coil is increased to the double with keeping the same number of turns, then the magnetic flux density at the center of the coil equals ..... .

(a) B (b) 2 B (c) $\frac{B}{2}$ (d) $\frac{B}{4}$

---

6 Two metallic rings (x and y) carry electric currents of intensities I and 2I respectively such that the magnetic flux densities at their centers are equal. The ratio between the diameters of the two rings $\left(\frac{d_x}{d_y}\right)$ equals ..... .

(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{1}{4}$ (d) $\frac{4}{1}$

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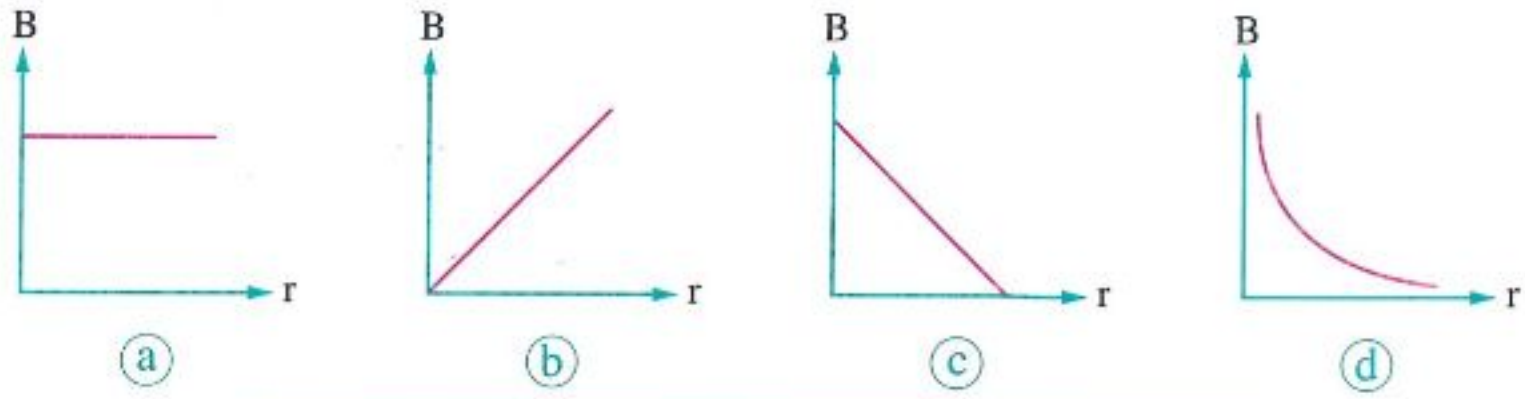
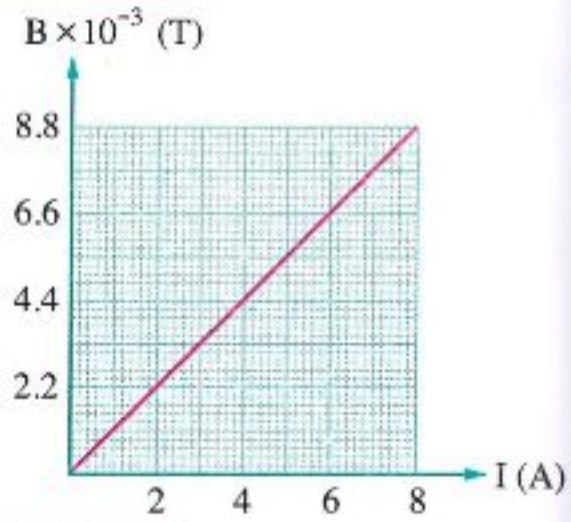
7 Multiple circular coils have the same number of turns and carry the same electric current, so which of the following graphs represents the relation between the magnitude of the magnetic flux density (B) at the center of each coil and the radius (r) of the coil?



(a) (b) (c) (d)

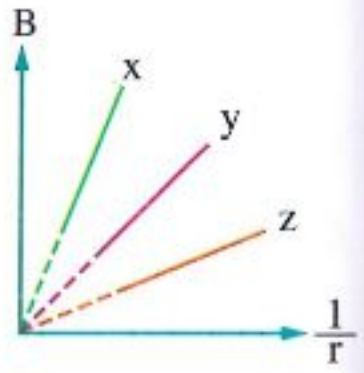
8 The opposite graph represents the relation between the magnetic flux density (B) at the center of a circular coil that consists of 350 turns and the current intensity (I) in the coil, so the diameter of the coil equals ..... .



(a) 10 cm (b) 20 cm

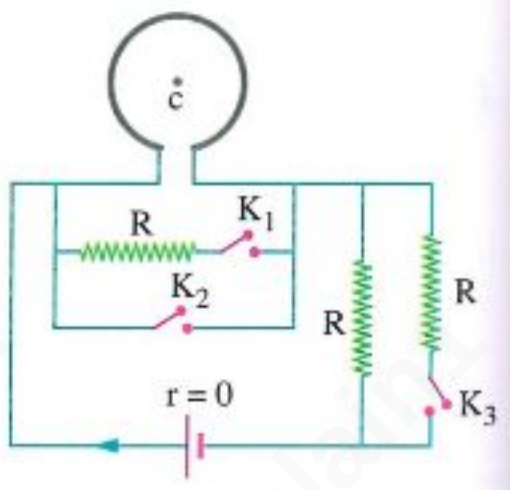
(c) 30 cm (d) 40 cm

9 Three groups of metallic rings (x, y and z) carry electric currents with intensities I_x, I_y and I_z respectively. The opposite graph represents the relation between the magnetic flux density (B) at the center of the ring and the reciprocal of its radius $\left(\frac{1}{r}\right)$. The correct order of the current intensities is ..... .



(a) $I_x < I_y < I_z$ (b) $I_x > I_y > I_z$ (c) $I_x > I_z > I_y$ (d) $I_x = I_y = I_z$

10 A wire of resistance R is wound as a circular coil of center c and it is connected to an electric circuit as shown in the opposite diagram. Which switches in the circuit cause an increase in the magnetic flux density at the center of the coil when closed, as a result of the current passing through it?



(a) Switch K_1 only. (b) Switch K_2 only.

(c) Switch K_3 only. (d) The three switches.

11 ✱ A circular coil of radius 10 cm was made of a wire of resistivity 10^{-6} Ω.m and cross-sectional area 0.4×10^{-4} m^2, if the coil is connected to an electric source of emf V_B whose internal resistance is negligible, the magnitude of the magnetic flux density at its center becomes 0.01 T. So, the emf of the electric source equals ..... .

(a) 10 V (b) 15 V (c) 20 V (d) 25 V

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12 A circular coil of radius r is connected across a voltage V, then the magnetic flux density at the center of the coil was B. When half of the coil's turns are removed, and the remaining part of the coil is connected to the same voltage V, the magnetic flux density at the coil's center ..... .

(a) remains B (b) becomes 2 B (c) becomes $\frac{B}{4}$ (d) becomes $\frac{B}{2}$

---

13 ✱ A copper wire of length 50.24 m and cross-sectional area 1.79×10^{-7} m^2 has been coiled in the form of a circular coil of radius 4 cm, then its terminals were connected to a direct current source of emf 12 V and internal resistance 1 Ω. Keeping in mind that the resistivity of copper is 1.79×10^{-8} Ω.m, so the magnetic flux density at the center of the coil equals ..... . (Take: $\pi = 3.14$)

(a) 3.125×10^{-4} T (b) 5.93×10^{-4} T (c) 6.25×10^{-3} T (d) 8.12×10^{-3} T

---

14 ✱ A wire of length ℓ is shaped into a circular coil with area A. When an electric current of intensity I passes through the coil, the magnetic flux density (B) at the center of the coil can be determined from the relation ; .....

(a) $B = \frac{\mu I \ell}{A}$ (b) $B = 4 \times \frac{\mu I \ell}{A}$ (c) $B = \frac{1}{2} \times \frac{\mu I \ell}{A}$ (d) $B = \frac{1}{4} \times \frac{\mu I \ell}{A}$

---

15 ✱ A straight wire of length 31.4 m is coiled in the form of a circular coil of face area 3.14 cm^2 and an electric current of 1 A is set up through it, then the magnetic flux density at the center of the coil equals ..... . (Take: $\pi = 3.14$)

(a) 1.57×10^{-2} T (b) 3.14×10^{-2} T (c) 6.28×10^{-2} T (d) 9.42×10^{-2} T

---

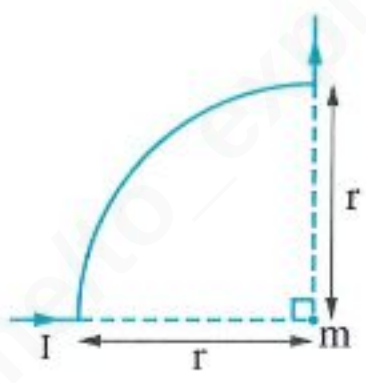
16 A straight wire of length 120 cm carries an electric current of intensity 5 A, so at a point at a distance 5 cm away from mid-point of the wire, the magnetic flux density was B. If the wire is reshaped into a circular coil with a radius 9.55 cm where the same current passed through it, the magnetic flux density at the center of the coil ..... . (Take: $\pi = 3.14$)

(a) exceeds B by 8.6×10^{-5} T (b) exceeds B by 4.6×10^{-5} T

(c) becomes less than B by 8.6×10^{-5} T (d) becomes less than B by 4.6×10^{-5} T

---

17 In the opposite figure, a part of a long straight wire is bent to form a quarter of a circle, then a current of intensity I is set up through it, so the magnetic flux density at point m equals ..... .



(a) $\frac{\mu I}{2r}$ (b) $\frac{\mu I}{4r}$ (c) $\frac{\mu I}{6r}$ (d) $\frac{\mu I}{8r}$

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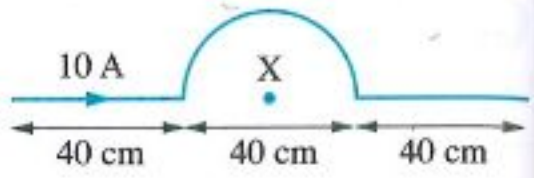
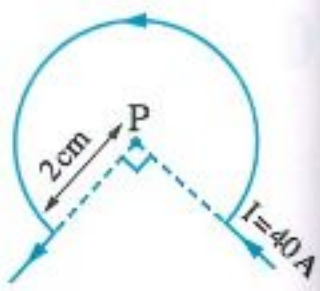
18 ✱ In the opposite figure, a part of a long wire is bent to form half a circle of diameter 40 cm, then a current of intensity 10 A is set up through the wire, the magnetic flux density at point X equals ..... .



(a) 3.14×10^{-5} T (b) 6.28×10^{-5} T (c) 1.57×10^{-5} T (d) 2.826×10^{-4} T

---

19 ✱ In the opposite figure:



(i) The magnetic flux density at point P equals ..... .

(a) 9.43×10^{-5} T (b) 6.28×10^{-5} T

(c) 3.14×10^{-5} T (d) 9.43×10^{-4} T

(ii) The direction of the magnetic flux at point P is ..... .

(a) perpendicular into the page

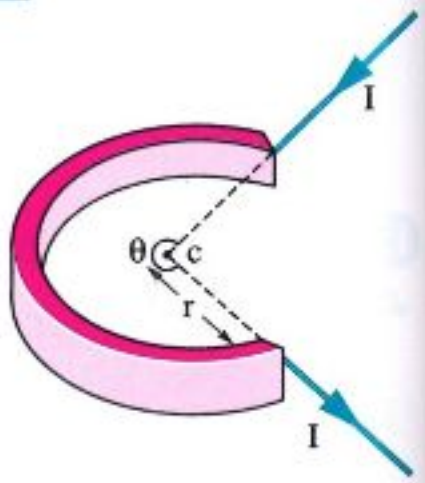
(b) perpendicular out of the page

(c) parallel to the plane of the page and rightwards

(d) parallel to the plane of the page and leftwards

---

20 The opposite figure represents a part of a circular metallic ring of radius (r) is placed on a horizontal surface and carries an electric current of intensity I, if the angle (θ) was measured in degrees, then the magnetic flux density at center (c) is determined from the relation; .....



(a) $B = \frac{\mu I \theta}{r}$ (b) $B = \frac{\mu I \theta}{360\, r}$

(c) $B = \frac{\mu I \theta}{2 \pi r}$ (d) $B = \frac{\mu I \theta}{720\, r}$

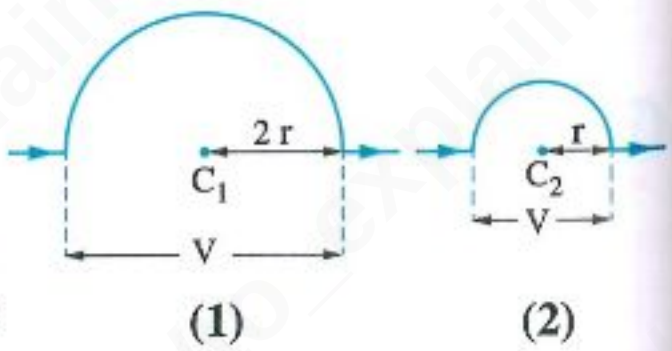
---

21 ✱ If an electric current passes through a wire of length 26.4 cm which is curved as an arc of a circle of radius 5.6 cm, a magnetic flux of density 8.25×10^{-6} T at the center of this circle is formed, so the intensity of the passing electric current equals ..... .

(a) 1.5 A (b) 0.98 A (c) 0.75 A (d) 0.49 A

---

22 ✱ In the opposite figure, two metallic wires are bent to form two half rings of different radii, the two wires have the same cross-sectional areas and are made of a material of large resistivity, when the same potential difference is applied across each of them, the magnetic flux density at C_1 equals B, hence at C_2, it equals ..... .



(a) $\frac{B}{2}$ (b) 2 B (c) 3 B (d) 4 B

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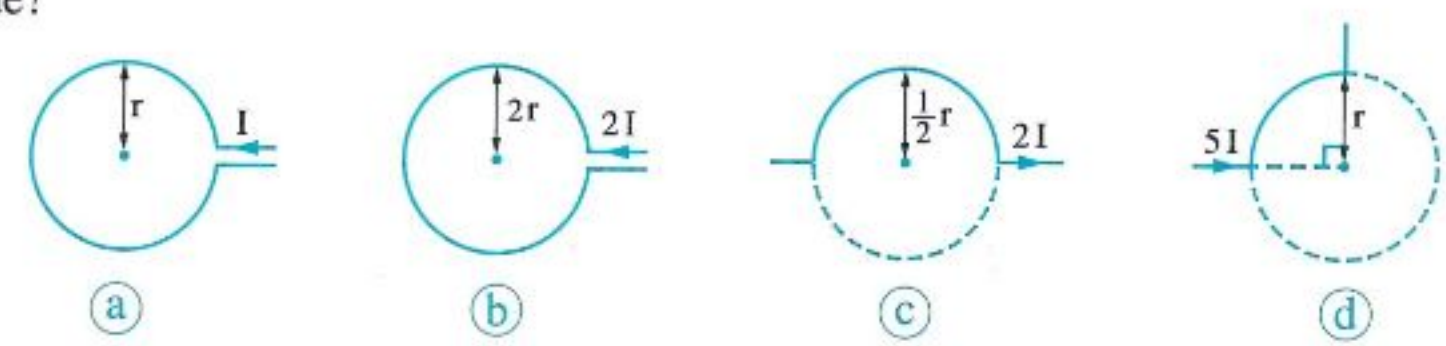
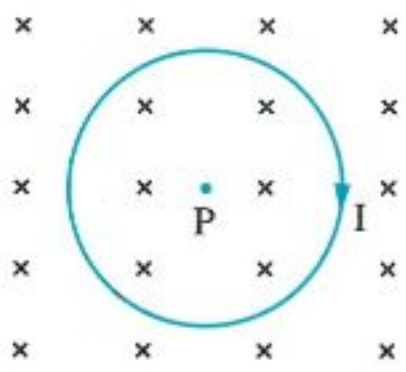
23 ✱ In which of the following coils, the magnetic flux density at its center has the largest value?



ⓐ ⓑ ⓒ ⓓ

---

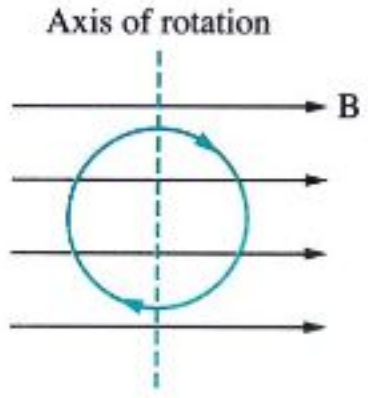
24 The opposite figure represents a circular coil of radius 8 cm that consists of 14 turns which is placed in the plane of the page and carries an electric current of intensity 12 A. If an external uniform magnetic field of flux density 10^{-5} T is directed perpendicular into the plane of the coil, so the magnitude and the direction of the net magnetic flux density at the center of the coil (P) are ..... , ...



	The magnitude of the net magnetic flux density at the center of the coil	The direction of the net magnetic flux density at the center of the coil
ⓐ	1.33×10^{-3} T	perpendicular into the page
ⓑ	1.33×10^{-3} T	perpendicular out of the page
ⓒ	3.13×10^{-3} T	perpendicular into the page
ⓓ	3.13×10^{-3} T	perpendicular out of the page

---

25 In the opposite figure, when a current-carrying circular coil was placed parallel to a uniform magnetic field of flux density B, the resultant magnetic flux density at the center of the coil was $\sqrt{5}$ B, so when the coil rotates 90°, the resultant magnetic flux density at the center of the coil could be ..... .

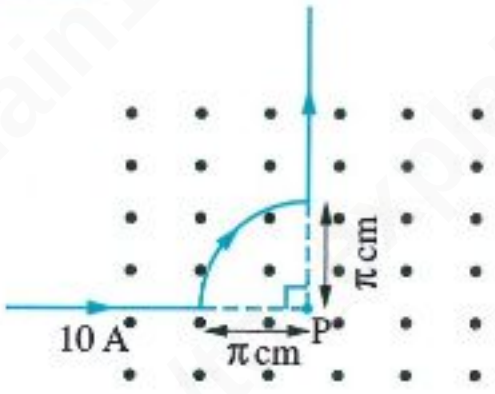


ⓐ B or 2 B ⓑ B or 5 B

ⓒ B or 3 B ⓓ zero or B

---

26 ✱ In the opposite figure, a part of a straight wire is reshaped in the form of quarter of a circle and placed in the plane of the page. If an external magnetic field of flux density 6×10^{-6} T that is directed perpendicular out of the page affects the wire, then the net magnetic flux density at its center P equals ..... .



ⓐ 11×10^{-5} T ⓑ 5.6×10^{-5} T ⓒ 4.4×10^{-5} T ⓓ 0

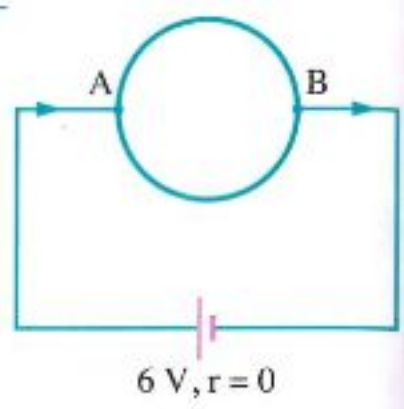
https://t.me/to_explain1

27 ✱ A circular ring of radius 5 cm carries an electric current of 10 A. If the ring is bent such that each half ring becomes perpendicular to the other half, the net magnetic flux density at the center becomes ..... .

(a) 8.9×10^{-5} T (b) 7.3×10^{-5} T (c) 13.21×10^{-6} T (d) 12.5×10^{-6} T

---

28 ✱ A straight wire of resistance 48 Ω is wound as a closed ring of diameter 0.1 m, then a battery of 6 V whose internal resistance is negligible is connected across a diameter of the ring as in the opposite figure, so:



(i) The electric current intensity that passes through the wire of the ring equals ..... .

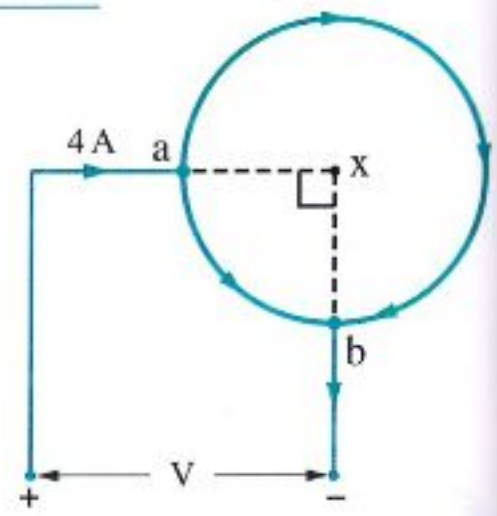
(a) 0.75 A (b) 0.25 A (c) 0.36 A (d) 0.41 A

(ii) The magnetic flux density at the center of the ring equals ..... .

(a) 0 (b) $\pi \mu$ T (c) $2 \pi \mu$ T (d) $3 \pi \mu$ T

---

29 ✱ In the opposite figure, a metallic ring of center x is connected to an electric source via two points (a, b) as shown in the opposite figure, so that an electric current passes through the ring, hence the net magnetic flux density at the center of the ring equals ..... .

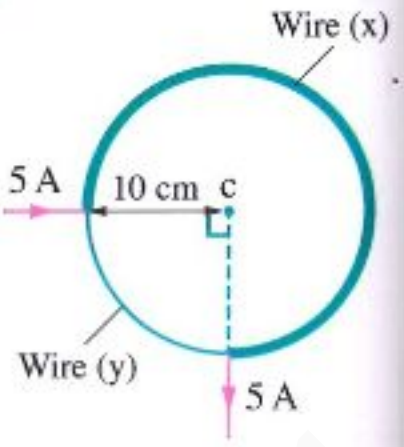


(a) $\frac{3 \mu}{8 r}$ (b) $\frac{6 \mu}{8 r}$

(c) $\frac{4 \mu}{8 r}$ (d) 0

---

30 Two wires x, y of the same metal, the cross-sectional area of wire (x) is doubled that of wire (y), they are connected together to form a metallic circular ring and an electric current of intensity 5 A passed through it as shown in the opposite figure, then the magnetic flux density at the center (c) equals ..... .

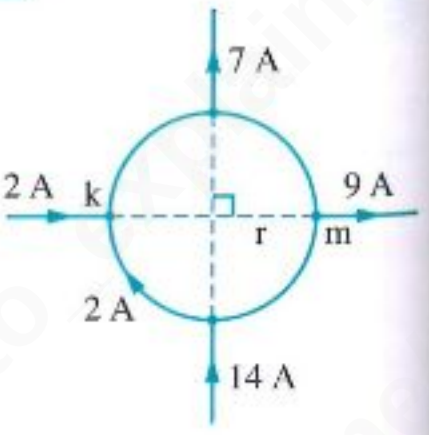


(a) 1.26×10^{-5} T (b) 7.54×10^{-6} T

(c) 4.71×10^{-6} T (d) 3.77×10^{-6} T

---

31 An electric current is set up into a metallic circular ring through multiple paths as shown in the opposite figure, so the direction of the magnetic flux density at the center of the ring will be ..... .



(a) perpendicular into the plane of the ring

(b) perpendicular out of the plane of the ring

(c) rightward towards point m

(d) leftward towards point k

https://t.me/to_explain1

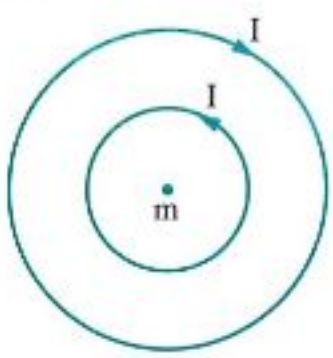
32 A coil that has a one turn of wire is carrying an electric current of intensity I, then the same wire of that coil is recoiled as a circular coil of 4 turns while the intensity of the passing electric current becomes $\frac{I}{2}$, so the ratio between the magnetic flux density at the center of the coil in the first case to that in the second case equals ..... .

(a) $\frac{4}{9}$ (b) $\frac{9}{4}$ (c) $\frac{1}{8}$ (d) $\frac{8}{1}$

33 ✱ According to Bohr's model of the hydrogen atom, the electron rotates around the nucleus in a circular orbit of radius 5.3×10^{-11} m with a frequency of 6.6×10^{15} Hz, hence the magnetic flux density at the center of the orbit due to the rotation of the electron equals ..... .

(a) 12.52 T (b) 8.48 T (c) 5.65 T (d) 4.24 T

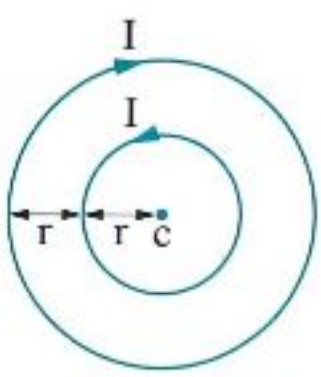
34 Two concentric metallic rings are placed in the same plane, both carry an electric current of intensity I as in the figure. So the direction of the produced magnetic flux at the center point m is ..... .



(a) to the right (b) to the left

(c) into the page (d) out of the page

35 Two concentric metallic rings are placed in the same plane, both carry an electric current of the same intensity I and in opposite directions as shown in the opposite figure, which of the following changes would lead to a reversal in the direction of the resultant magnetic flux density at the center of the two rings (c) ?



(a) Reducing the current in the inner ring to $\frac{2}{3}$ I

(b) Reducing the current in the inner ring to $\frac{1}{2}$ I

(c) Increasing the current in the outer ring to 2 I

(d) Increasing the current in the outer ring to 3 I

36 ✱ Two concentric circular coils are lying in the same plane. The two coils have 400 turns and 500 turns, their radii are 20 cm and 10 cm respectively and they are carrying electric currents in the same direction of intensities 7 A and 10 A respectively, so:

(i) The magnetic flux density at the concentric center of the two coils equals ..... .

(a) 16.3×10^{-3} T (b) 32.6×10^{-3} T (c) 40.2×10^{-3} T (d) 81.5×10^{-3} T

(ii) The magnetic flux density at the concentric center of the two coils, when one of them is rotated about the concentric center:

(1) by an angle of 180° to be overturned, equals ..... .

(a) 22.6×10^{-3} T (b) 45.3×10^{-3} T (c) 67.8×10^{-3} T (d) 90.4×10^{-3} T

(2) by an angle of 90° to be perpendicular to the other coil, equals ..... .

(a) 18.5×10^{-3} T (b) 32.6×10^{-3} T (c) 65.2×10^{-3} T (d) 97.8×10^{-3} T

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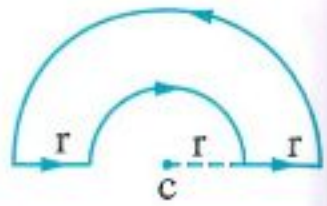
37 ✱ Two concentric circular coils that are lying in the same plane carry two electric currents of equal intensities and opposite directions, if the diameter of the first is 10 cm and it has 100 turns and the diameter of the second is 20 cm, hence the number of turns of the second coil that makes the magnetic flux density at their center vanish, equals ..... .

(a) 50 turns (b) 100 turns (c) 150 turns (d) 200 turns

---

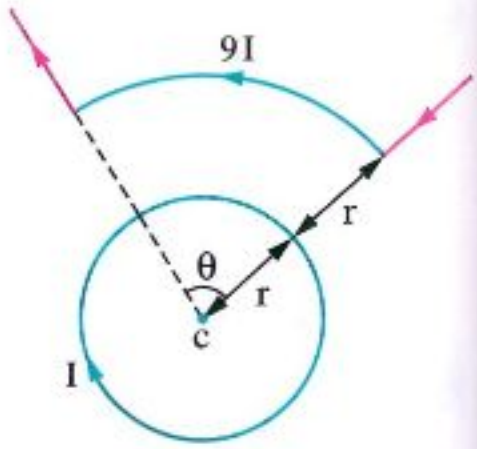
38 In the opposite figure, if an electric current of intensity 1 A passes through the wires, then the resultant magnetic flux density that is produced at point c is ..... .



(a) $\frac{\mu}{5\,r}$ (b) $\frac{\mu}{2\,r}$ (c) $\frac{\mu}{4\,r}$ (d) $\frac{\mu}{8\,r}$

---

39 A circular ring and a part of another circular ring are lying concentrically in the same plane, the radii of them respectively are r, 2r when two electric currents of intensities I, 9I pass through them as shown in the opposite figure, if the resultant of the magnetic flux density at center (c) equals zero, then the angle (θ) is equal to ..... .



(a) 60° (b) 80°

(c) 90° (d) 95°

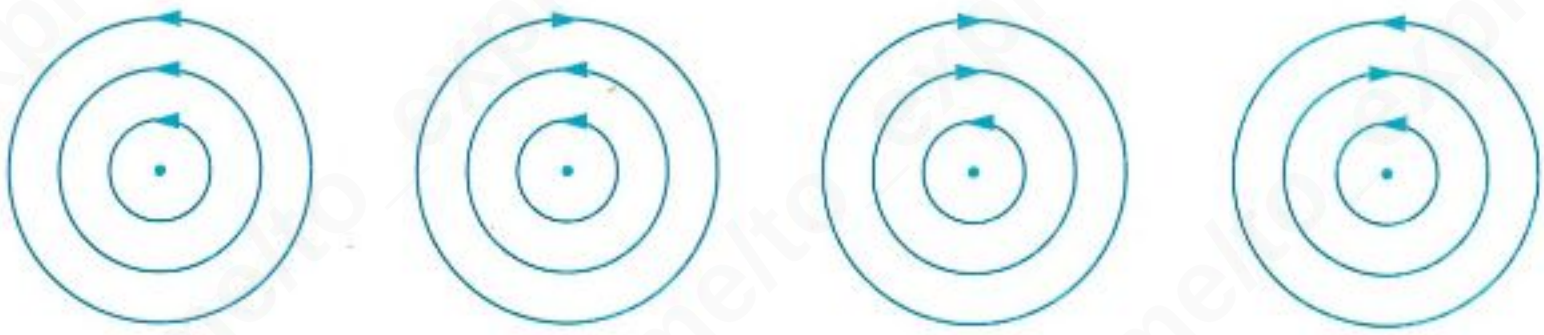
---

40 ✱ Two circular coils are lying concentrically in the same plane where the diameter of the first is double that of the second and both of them carry electric currents of the same intensity and in the same direction, hence at their center B_1 (of the external coil) < B_2 (of the internal coil) and when the current is reversed in the external coil, the magnetic flux density at the center decreases to its half, so the ratio between the number of turns of the two coils $\left(\frac{N_1}{N_2}\right)$ equals ..... .

(a) $\frac{4}{5}$ (b) $\frac{6}{11}$ (c) $\frac{2}{3}$ (d) $\frac{9}{8}$

---

41 In each of the following figures, there are three concentric metallic rings are in the same plane, carrying electric currents of the same intensity. In which of these figures is the magnetic flux density at the center the least?



(a) (b) (c) (d)

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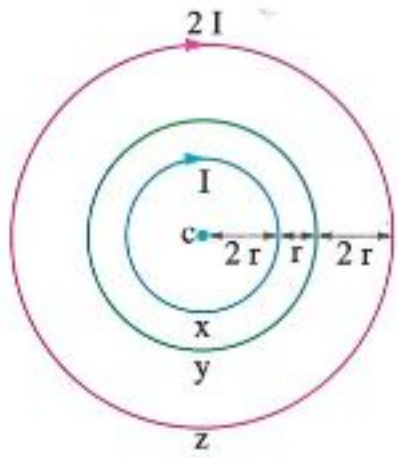
42 ✳ Three concentric rings x, y and z of center c, all in the same plane and each of them carries an electric current as in the opposite figure. If the net magnetic flux density at the center (c) equals zero, then the intensity and the direction of the electric current that passes in the ring y are ..... .



(a) 1.5 I, in the clockwise direction

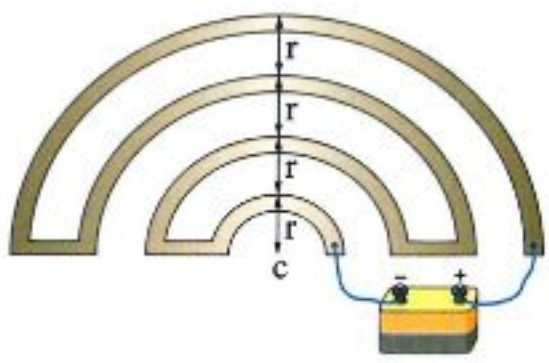
(b) 1.5 I, in the anti-clockwise direction

(c) 2.7 I, in the clockwise direction

(d) 2.7 I, in the anti-clockwise direction

---

43 Four semi-circular metallic rings are connected together to a battery as shown in the opposite figure, then the direction of the resultant magnetic flux at the common center (c) is ..... .



(a) perpendicular to the page and outward

(b) perpendicular to the page and inward

(c) in the plane of the page and rightward

(d) in the plane of the page and leftward

---

44 A long straight wire carrying an electric current of intensity I generates a magnetic flux of density B at a point perpendicular to the wire at a distance d. If the same current (I) passes through a circular loop, producing the same magnetic flux density B at its center, the radius of the loop is ..... .

(a) greater than d

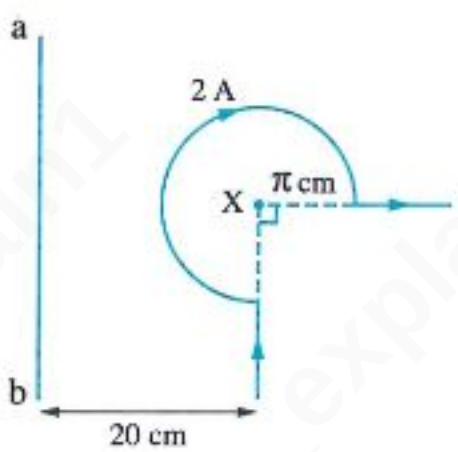
(b) less than d

(c) equal to d

(d) indeterminable

---

45 The opposite figure shows a very long straight wire that carries an electric current of intensity I. The wire is placed in the same plane with a part of a metallic ring and at a distance 20 cm from the center (X) of the ring. So, the magnitude and the direction of the current I that makes the magnetic flux density at the center of the ring equals zero are ..... .



(a) 15 A, from a to b

(b) 30 A, from a to b

(c) 15 A, from b to a

(d) 30 A, from b to a

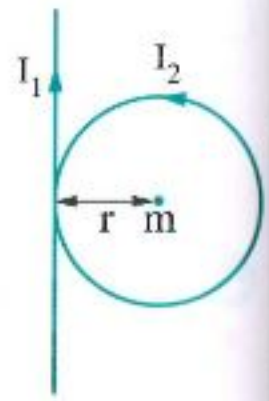
https://t.me/to_explain1

46 ✱ A long straight wire is placed vertically tangent to a circular coil of one turn that is lying in the plane of the magnetic meridian of the Earth and carries a current of intensity 0.42 A. A free movable magnetic needle is placed in the horizontal plane at the center of the coil. So, the intensity of the electric current which when passes in the wire causes no deflection in the needle, equals ..... .

(a) 0.96 A (b) 1.07 A (c) 1.32 A (d) 2.56 A

---

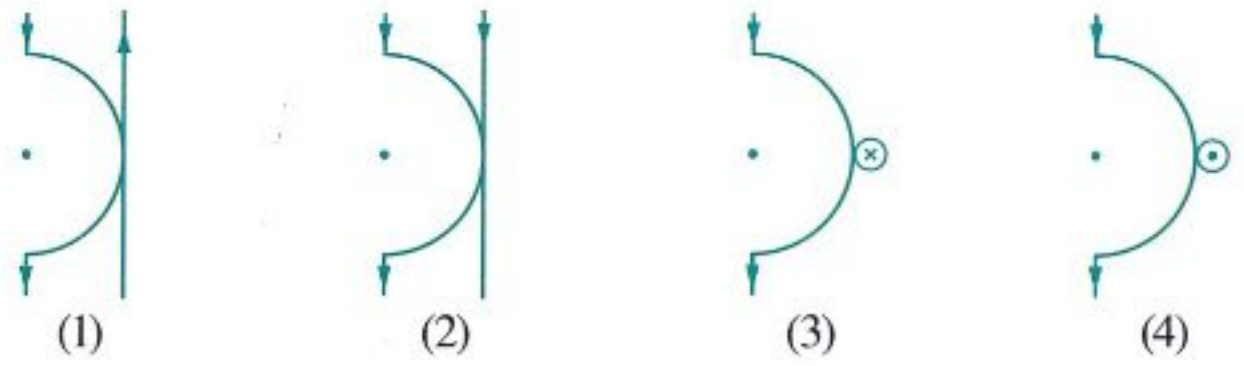
47 In the opposite figure, a long straight wire is tangent to a circular coil where both of the wire and the coil are in the same plane and isolated from each other and both carry electric currents that flow as shown in the figure, so the net magnetic flux density at the center of the circular coil was equal to zero. If the coil is overturned, the net magnetic flux density at its center becomes ..... .



(a) $\frac{B_{coil}}{2}$ (b) B_{coil} (c) B_{wire} (d) $2\,B_{wire}$

---

48 An insulated straight wire carry an electric current of intensity I, if the wire is placed tangent to a semi-circular ring either parallel to its plane or perpendicular to it and it carries an electric current of intensity I in the shown direction of the following figures.



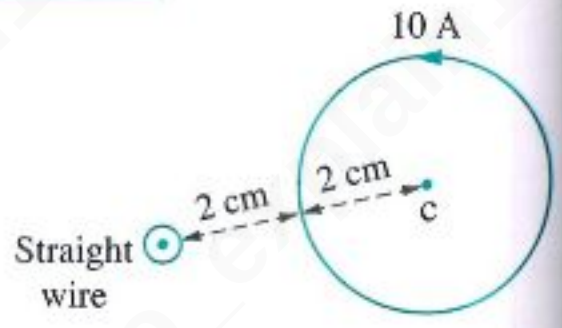
So, the correct order for the values of the magnetic flux density at the center of the semi-circular ring at that cases is .....

(a) $B_4 > B_2 > B_3 > B_1$ (b) $B_1 > B_3 = B_4 > B_2$

(c) $B_2 > B_3 = B_4 > B_1$ (d) $B_3 = B_4 > B_2 > B_1$

---

49 The opposite figure represents a metallic ring, if a long straight wire is placed near to and perpendicular to its plane and an electric current of intensity 10 A passes through each of them. Then the resultant magnetic flux density at the center (c) of the ring is approximately equal to ..... .



(a) 10^{-4} T (b) 2.6×10^{-4} T (c) 3.2×10^{-4} T (d) 3.6×10^{-4} T

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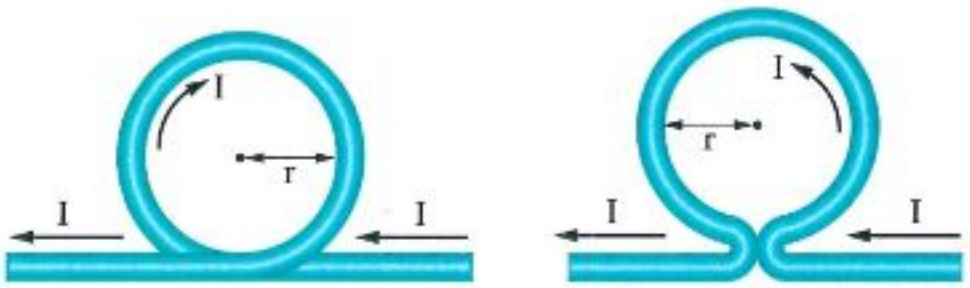
50 An insulated long wire carries an electric current of intensity I, a part of it was wrapped in the form of a circular ring of radius r by two ways as shown in the following two figures:

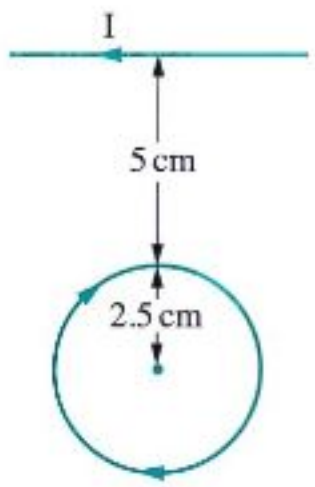


Then, the ratio between the resultant of the magnetic flux density at the center of the ring in both cases $\left(\frac{B_1}{B_2}\right)$ is ..... .

(a) $\frac{1}{1}$ (b) $\frac{\pi + 1}{\pi}$ (c) $\frac{1}{\pi - 1}$ (d) $\frac{\pi + 1}{\pi - 1}$

---

51 ✱ A circular ring of radius 2.5 cm that carries an electric current of 3 A is placed at a distance of 5 cm from a straight wire that carries an electric current I as in the figure, so:



(i) The intensity of I that makes the magnetic flux density at the center of the circular coil vanish equals ..... .

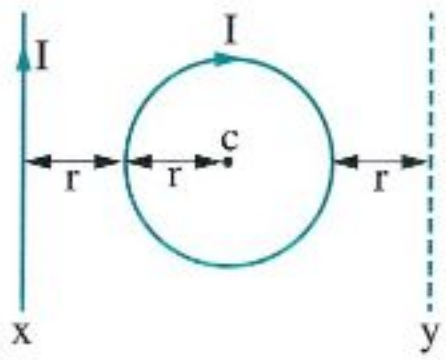
(a) 35.64 A (b) 28.29 A
(c) 23.79 A (d) 20.81 A

(ii) The magnetic flux density at the center of the ring if the direction of current I is reversed equals ..... .

(a) 7.54×10^{-3} T (b) 3.79×10^{-3} T (c) 1.51×10^{-4} T (d) 2.24×10^{-4} T

---

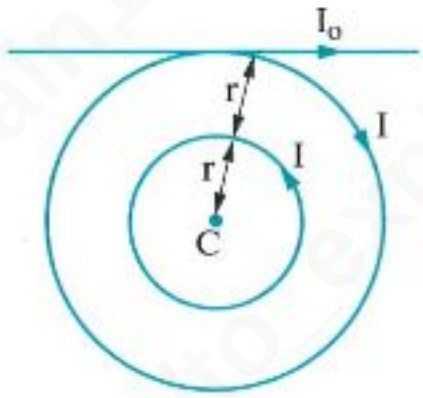
52 ✱ The opposite figure shows a circular ring and a straight wire which is placed at position x in the same plane of the ring where both carry electric currents of intensity I, so the resultant magnetic flux density at the center of the ring c is B. If the wire is moved to position y, the magnetic flux density at point c becomes ..... .



(a) 2 B (b) B (c) 0.73 B (d) 1.38 B

---

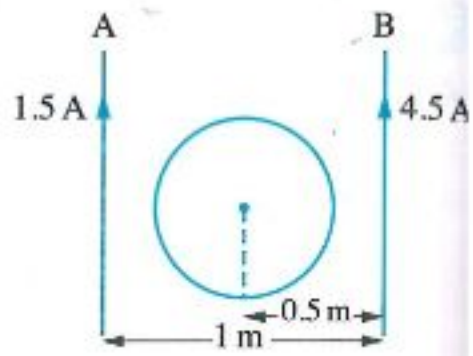
53 Two concentric rings are in the same plane of radii r, 2 r carry electric currents of intensity I in two opposite directions and a long straight wire is placed tangent to the external ring parallel to its plane and it carries an electric current of intensity I_o as shown in the opposite figure, if the resultant of the magnetic flux density at the center (C) of the two rings equals zero, then the ratio between intensities of the current $\left(\frac{I_o}{I}\right)$ equals ..... .



(a) π (b) $\frac{1}{\pi}$ (c) 2π (d) $\frac{1}{2\pi}$

https://t.me/to_explain1

54 ✱ Two straight parallel wires A and B are at a distance 1 m apart and carry electric currents of intensities 1.5 A and 4.5 A respectively in the same direction. A one turn coil of radius 10 π cm is placed in the same plane of the two wires where its center is at a distance of 0.5 m apart from wire A as shown in the opposite figure. So, the magnitude and the direction of the passing current in the circular coil that make the magnetic flux density at its center equals zero are ..... .



ⓐ 0.3 A, in the clockwise direction

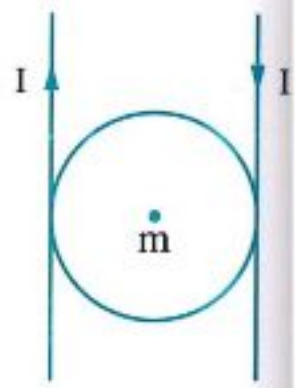
ⓑ 0.6 A, in the clockwise direction

ⓒ 0.3 A, in the anti-clockwise direction

ⓓ 0.6 A, in the anti-clockwise direction

---

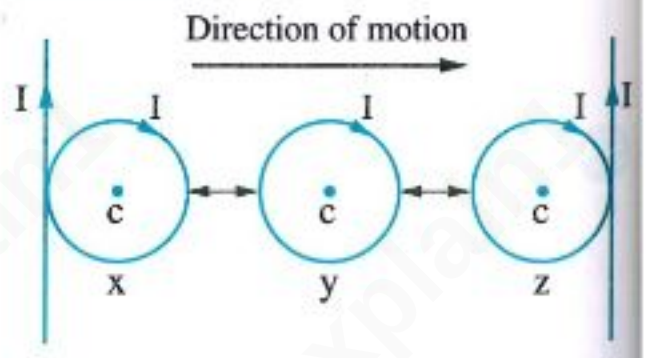
55 In the opposite figure, the magnetic flux density due to each one of the two straight wires at the center of the circular coil (m) is B. If the resultant of the magnetic flux density at the center of the circular coil (m) is equal to zero, then ..... .



	The direction of the current in the coil	The magnitude of the magnetic flux density due to the flow of the current in the coil
ⓐ	in the clockwise direction	$\frac{B}{2}$
ⓑ	in the anti-clockwise direction	$\frac{B}{2}$
ⓒ	in the clockwise direction	2 B
ⓓ	in the anti-clockwise direction	2 B

---

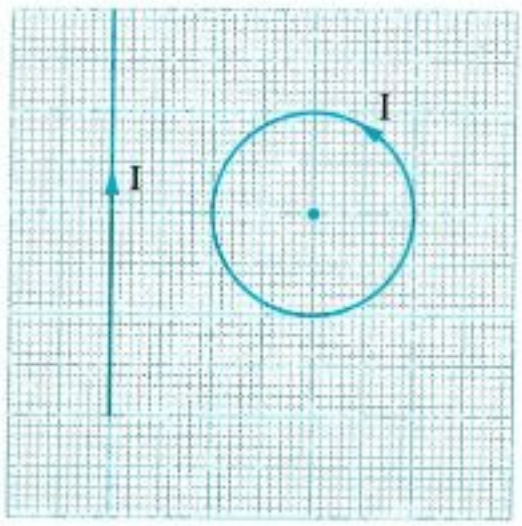
56 A metallic ring carries an electric current of intensity I and moves between two straight wires that carry electric currents of intensity I and are placed in the same plane of the ring as shown in the opposite figure, what is the correct order for the resultant of the magnetic flux density at the center (c) of the ring when it is fixed in each of the three positions shown in the figure?



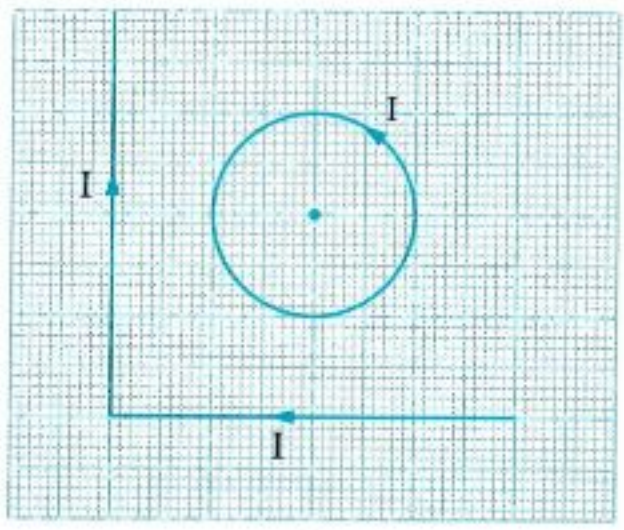
ⓐ $B_z > B_y > B_x$ ⓑ $B_x > B_y > B_z$ ⓒ $B_x > B_z > B_y$ ⓓ $B_z = B_y = B_x$

https://t.me/to_explain1

57 A metallic ring of radius r carries an electric current of intensity I and a long straight wire carries an electric current of intensity I is placed at a distance 2r from the center of the ring in the same plane of the ring as shown in the figure (1). If the wire is bent and carried the same electric current as in figure (2):



(1)



(2)

What happens to the magnitude and the direction of the net magnetic flux density at the center of the ring?

(a) Its magnitude increases and remains in the same direction.

(b) Its magnitude increases and its direction reverses.

(c) Its magnitude decreases and remains in the same direction.

(d) Its magnitude decreases and its direction reverses.

Solenoids

58 The formed magnetic field due to the flow of an electric current in a solenoid is distinguished from that of a bar magnet by the possibility of controlling ..... .

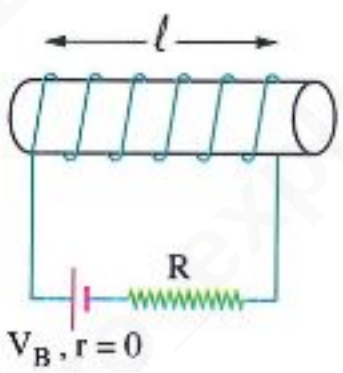
(a) the magnetic polarity only

(b) the magnetic flux density only

(c) the direction of the magnetic field only

(d) the polarity, density and direction of the magnetic field

59 From the opposite figure, which of the following methods doubles the magnetic field strength inside the solenoid when the other factors are kept constant?



(a) Increasing the length (ℓ) of the coil to the double.

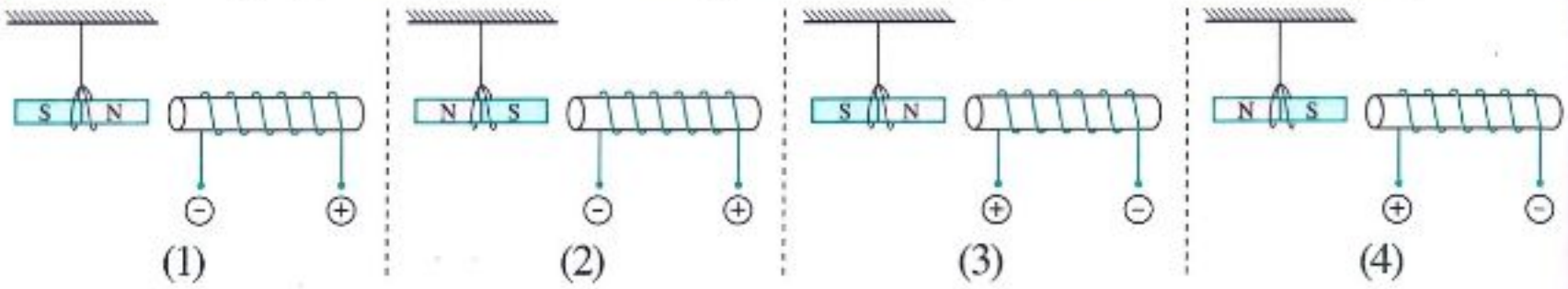
(b) Increasing the electromotive force (V_B) to the double.

(c) Decreasing the number of turns of the coil (N) to its half.

(d) Increasing the electric resistance of resistor R to the double.

https://t.me/to_explain1

60 In the following figures, a permanent bar magnet is freely hung next to a current-carrying solenoid:

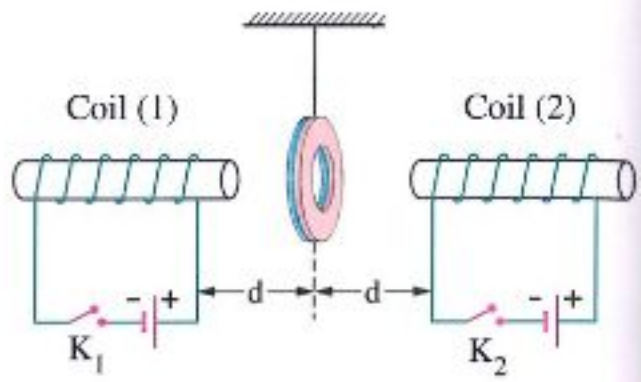


In which two figures of them, the bar magnet gets attracted to the solenoid?

ⓐ (1), (2) ⓑ (3), (4) ⓒ (1), (3) ⓓ (2), (3)

---

61 Two identical solenoids (1), (2), both are connected to a battery of electromotive force (V_B) of negligible internal resistance and a switch, a ring magnet was hanged at equal distances between two coils as shown in the opposite figure, after closing the two switches K_1, K_2 together, then the magnet ..... .

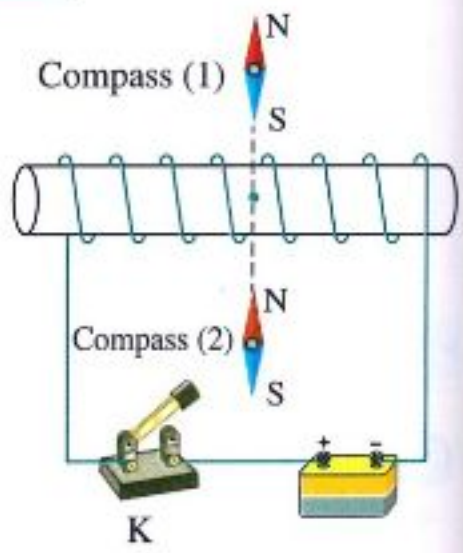


ⓐ attracts to coil (1) ⓑ attracts to coil (2)

ⓒ rotates around its axis ⓓ remains constant

---

62 Two compasses (1), (2) are placed at the two sides of a solenoid which is connected to a battery and a switch (K), if the two needles are settled by the effect of the magnetic field of the Earth as shown in the opposite figure, which of the following diagrams represents the position in which the two needles settled when the switch K is closed?



	Compass (1)	Compass (2)
ⓐ	N S	N S
ⓑ	N S	N S
ⓒ	N S	N S
ⓓ	N S	N S

---

63 ✱ A solenoid of length 20 cm which has 200 turns carries an electric current of 0.5 A, so the magnetic flux density at its center, if: (Take: $\mu_{iron} = 2 \times 10^{-3}$ Wb/A.m, $\pi = 3.14$)

(i) The core medium is air, equals ..... .

ⓐ 8.93×10^{-5} T ⓑ 3.11×10^{-4} T ⓒ 6.28×10^{-4} T ⓓ 7.92×10^{-5} T

(ii) An iron rod is inserted inside the coil, equals ..... .

ⓐ 0.5 T ⓑ 0.25 T ⓒ 0.75 T ⓓ 1 T

https://t.me/to_explain1

64 ✱ A solenoid of length 0.22 m and cross-sectional area 25×10^{-4} m^2 consists of 300 turns. An electric current passes through the solenoid so that a magnetic flux density at its center becomes 1.2×10^{-3} Wb/m^2, hence:

(i) The electric current intensity equals ..... .

(a) 0.3 A (b) 0.5 A (c) 0.7 A (d) 1.1 A

(ii) The total magnetic flux through a cross-section of the solenoid equals ..... .

(a) 3×10^{-6} Wb (b) 5×10^{-6} Wb (c) 9×10^{-6} Wb (d) 18×10^{-6} Wb

---

65 ✱ A solenoid of length 0.6 m carries an electric current of 10 A, hence the magnetic flux density that is produced at its center equals 0.05 T, so:

(i) The number of turns per unit length of the solenoid equals ..... .

(a) 2388.5 turns/m (b) 3679.4 turns/m (c) 3977.3 turns/m (d) 5123.5 turns/m

(ii) The number of turns of the solenoid equals ..... .

(a) 1194.5 turns (b) 2386.4 turns (c) 3582.7 turns (d) 8359.3 turns

---

66 A solenoid of N turns has a length of 50 cm and the resistance of each one turn is 0.01 Ω. The solenoid is connected to an electric source whose emf is 2 V that has a negligible internal resistance, so:

(i) The magnetic flux density at its center equals ..... .

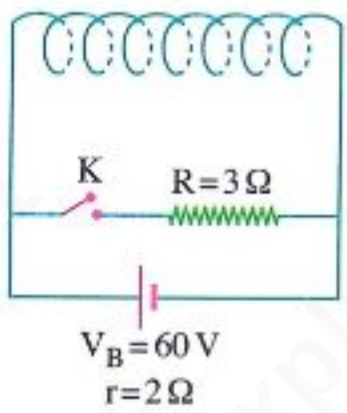
(a) 2.15×10^{-3} T (b) 4.11×10^{-3} T (c) 3.17×10^{-4} T (d) 5.03×10^{-4} T

(ii) The magnetic flux density, if half of the number of the solenoid turns has been cut off and its other half is connected to the same source, becomes ..... .

(a) 1.01×10^{-3} T (b) 3.09×10^{-3} T (c) 2.17×10^{-4} T (d) 7.18×10^{-4} T

---

67 ✱ A solenoid of length 20 cm, number of turns 100 turns and resistance 6 Ω is inserted in the electric circuit as shown in the opposite figure, hence the magnetic flux density at its center in the case of:



(i) opening switch K equals ..... .

(a) 3.14×10^{-3} T (b) 4.71×10^{-3} T

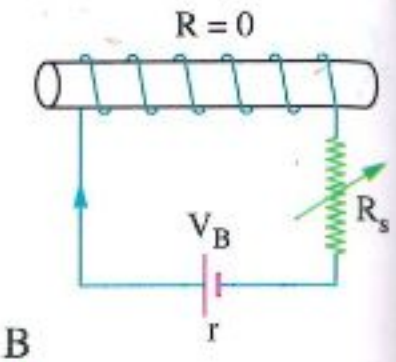
(c) 6.22×10^{-3} T (d) 9.78×10^{-3} T

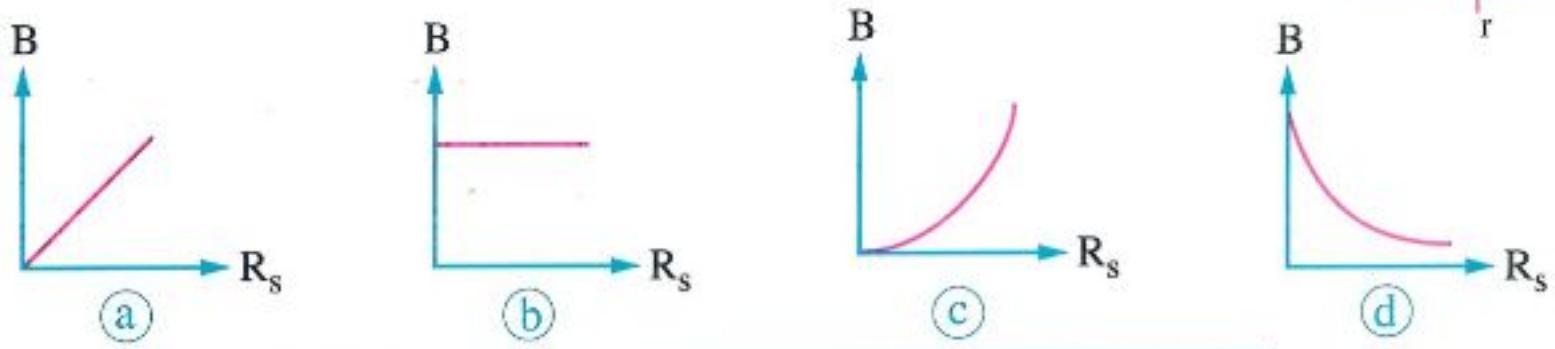
(ii) closing switch K equals ..... .

(a) 3.14×10^{-3} T (b) 5.19×10^{-3} T (c) 6.03×10^{-3} T (d) 7.16×10^{-3} T

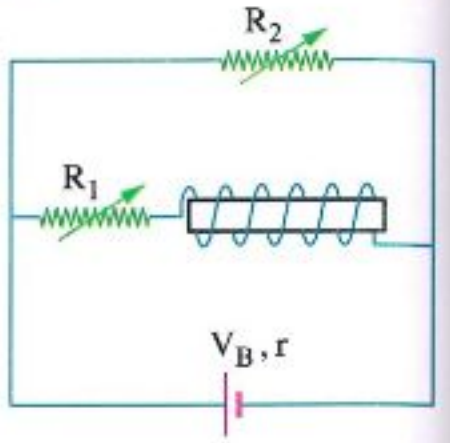
https://t.me/to_explain1

68 The opposite figure shows a solenoid of negligible resistance connected in an electric circuit, so which of the following graphs represents the variation of the magnetic field (B) at the center of the solenoid versus the value of the variable resistance (R_s)?





69 ✱ In the opposite electric circuit, what happens to the magnitude of the magnetic flux density inside the solenoid due to an electric current passes through the coil when increasing the value of:



(i) resistance R_1?

(a) Increases. (b) Decreases.

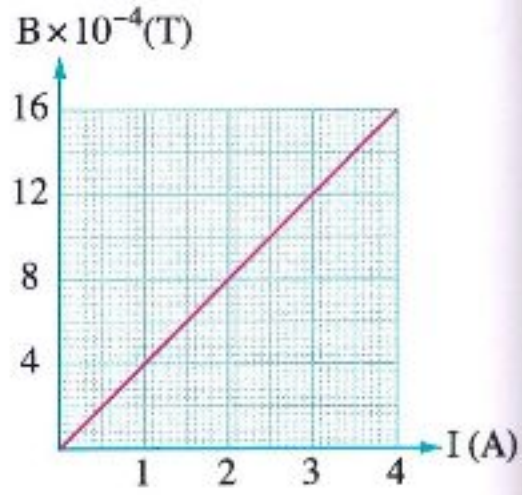
(c) Remains unchanged. (d) Indeterminable.

(ii) resistance R_2?

(a) Increases. (b) Decreases.

(c) Remains unchanged. (d) Indeterminable.

70 The opposite graph represents the relation between the magnetic flux density (B) at the center of a solenoid and the current intensity (I) that flows in the solenoid. So, the number of turns per meter for this solenoid equals ..... .



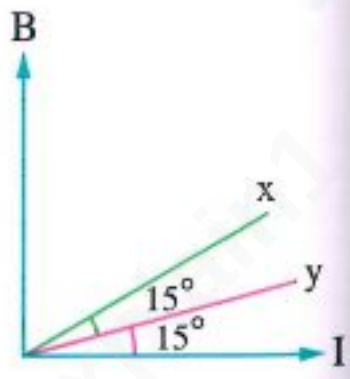
(a) 215.2 turns/meter

(b) 250.5 turns/meter

(c) 318.18 turns/meter

(d) 341.4 turns/meter

71 Two solenoids x and y have the same number of turns, but their cores are made of two different materials. Solenoid y is four times longer than the solenoid x, and both carry electric currents. The opposite graph represents the relation between the magnetic flux density (B) at the center of each solenoid along its axis and the current intensity (I) passing through it. Which of the two solenoid cores has the material with the greater magnetic permeability?



(a) The core of solenoid x (b) The core of solenoid y

(c) The magnetic permeability of the materials used in the cores of the two solenoids are equal.

(d) The answer can't be determined.

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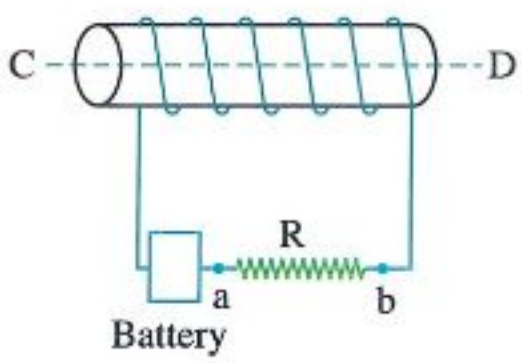
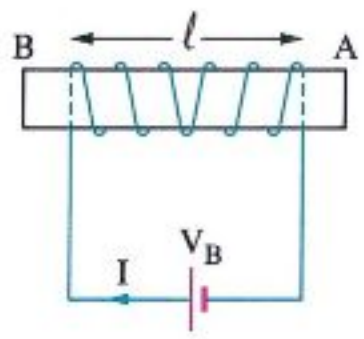
72 In the opposite figure, a solenoid of length 10π cm whose number of turns is 500 turns, is connected to a battery and a resistor R in series, hence a south pole is formed at end D of the solenoid where the magnetic flux density at its center is 2.4×10^{-2} T, so the intensity and the direction of the current in the resistor R are ..... .



(a) 12 A, from a to b
(b) 12 A, from b to a
(c) 24 A, from a to b
(d) 24 A, from b to a

---

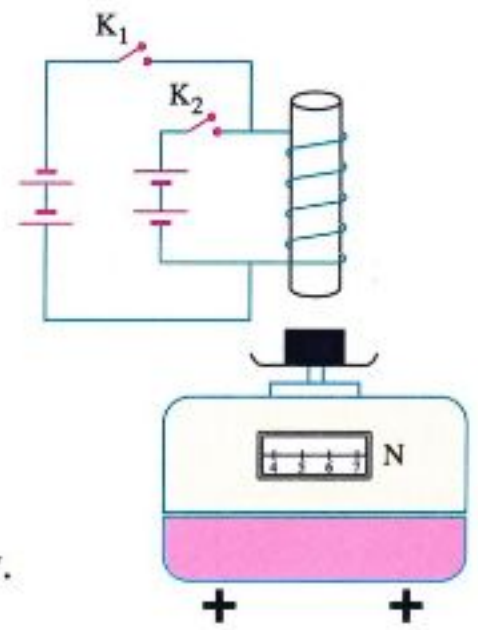
73 In the opposite figure, a wire is wound to form a long solenoid and then it is connected to a battery, so the formed poles at terminals A, B respectively are ..... .



(a) north, north
(b) north, south
(c) south, north
(d) south, south

---

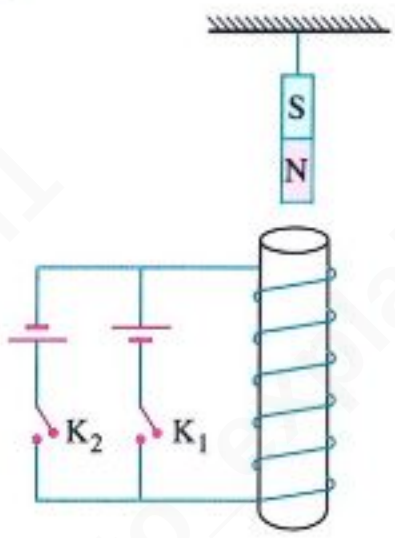
74 In the opposite figure, a coil is fixed above a piece of soft iron that is placed on the pan of a scale which gives a reading value w, what happens to the reading of the scale when one of the two switches K_1 or K_2 is closed while keeping the other one open?



(a) Increases in both cases than w.
(b) Decreases in both cases than w.
(c) Increases in one case than w and decreases in the other than w.
(d) Remains w in both cases.

---

75 In the opposite diagram, a solenoid of resistance R is connected to two identical batteries through two switches K_1, K_2 . A magnet is freely hanged by a thread above the solenoid. Which of the following actions would reduce the tension in the thread?



(a) Closing switch K_1 only.
(b) Closing switch K_2 only.
(c) Closing the two switches K_1, K_2 together.
(d) The answer can't be determined.

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76 ✱ An insulated wire of diameter 0.2 cm is coiled around an iron rod of permeability 2×10^{-3} Wb/A.m such that the turns of wire are tangent to each other along the rod, so if an electric current of 1 A passes through the turns of wire, the magnetic flux density at its center equals ..... .

(a) 0.5 T (b) 1 T (c) 1.2 T (d) 1.5 T

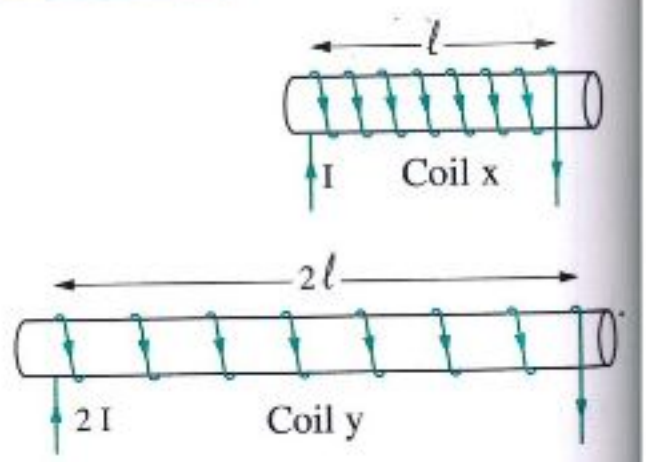
77 ✱ A uniformly coiled solenoid of length ℓ and number of turns N is cut into two parts x and y of lengths ℓ_1 and $3\ell_1$ respectively and each of them is connected to the same electric potential difference, so the ratio between the magnetic flux densities $\left(\frac{B_x}{B_y}\right)$ at the centers of the two coils equals ..... .

(a) $\frac{1}{1}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{3}{1}$

78 Two solenoids are identical, the first one is made of copper wire and the second is made of aluminum wire and each of them was connected separately one at a time to the same battery, so the magnetic flux densities at the center of each of them due to the flow of an electric current in them were B_1 and B_2 respectively, then .....
(Where the resistivity of copper is less than the resistivity of aluminum)

(a) $B_1 > B_2$ (b) $B_1 < B_2$ (c) $B_1 = B_2 = 0$ (d) $B_1 = B_2 \neq 0$

79 If two solenoids (x and y) that have the same number of turns, carry direct electric currents as shown in the opposite figure, then the ratio of the produced magnetic flux densities at the axis inside each of them $\left(\frac{B_x}{B_y}\right)$ equals ..... .



(a) $\frac{2}{1}$ (b) $\frac{1}{4}$
(c) $\frac{1}{1}$ (d) $\frac{1}{2}$

80 ✱ Two solenoids X,Y of the same length and the same number of turns are made of two copper wires of different cross-sectional areas and they are connected to two sources of the same voltage, if the ratio of the magnetic flux densities at the center of each of them is $\frac{B_X}{B_Y} = \frac{9}{1}$, which of the following choices is correct?

(a) The cross-sectional area of wire X is three times that of wire Y
(b) The cross-sectional area of wire X is nine times that of wire Y
(c) The resistance of wire X is three times that of wire Y
(d) The resistance of wire X is double that of wire Y

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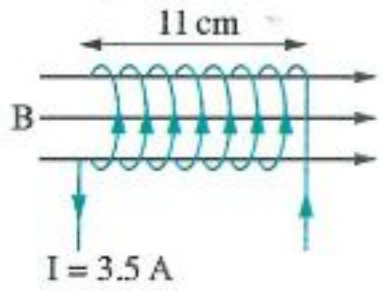
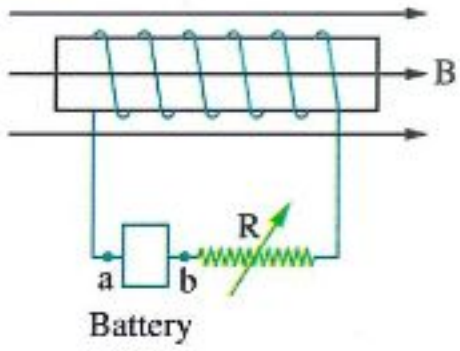
81 ✱ The opposite figure shows a solenoid of 60 turns that carries an electric current. If this coil is placed completely in an external magnetic field of flux density 5.2×10^{-3} T whose direction is parallel to the axis of the solenoid and to the right of the page, then at the center of the solenoid, the net magnetic flux density and its direction are ..... .



(a) 2.8×10^{-3} T, in the direction of the external field
(b) 2.8×10^{-3} T, opposite to the direction of the external field
(c) 7.6×10^{-3} T, opposite to the direction of the external field
(d) 7.6×10^{-3} T, in the direction of the external field

---

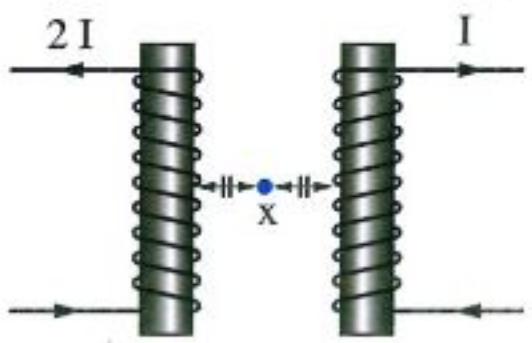
82 ✱ In the opposite figure, a solenoid of length 1.1 m whose number of turns is 210 turns is placed in an external magnetic field of flux density 1.2×10^{-3} T that is parallel to the solenoid axis, so the electric current that should flow through the circuit and the poles of the battery, that make the resultant magnetic flux density at the center of the solenoid becomes zero, are ..... .



	The electric current that passes through the circuit	The poles of the battery
(a)	8 A	a is +ve pole, b is –ve pole
(b)	8 A	a is –ve pole, b is +ve pole
(c)	5 A	a is +ve pole, b is –ve pole
(d)	5 A	a is –ve pole, b is +ve pole

---

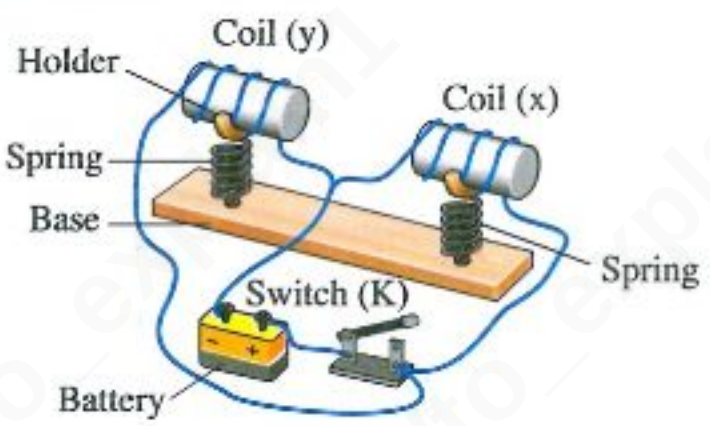
83 In the opposite figure, two identical solenoids, each of them carries an electric current, are placed near to each other where their axes are parallel, so the net magnetic field due to them at point x is directed ..... .



(a) into the page (b) out of the page
(c) upwards (d) downwards

---

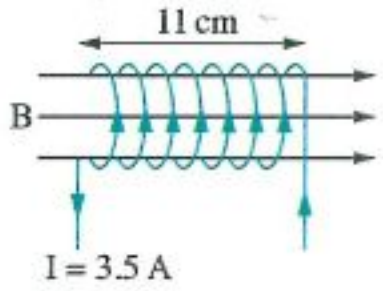
84 A student designed a device to study the magnetic field produced due to the flow of an electric current through two identical solenoids x, y as in the opposite figure, what do you expect to happen when the switch (K) is closed?



(a) Repulsion between two coils.
(b) Attraction between two coils.
(c) No magnetic force is generated between two coils.
(d) The two coils vibrate vertically.

https://t.me/to_explain1

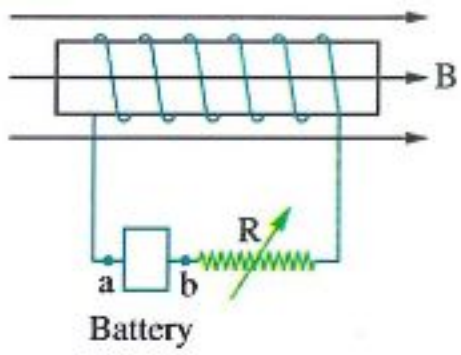
81 ✱ The opposite figure shows a solenoid of 60 turns that carries an electric current. If this coil is placed completely in an external magnetic field of flux density 5.2×10^{-3} T whose direction is parallel to the axis of the solenoid and to the right of the page, then at the center of the solenoid, the net magnetic flux density and its direction are ..... .



(a) 2.8×10^{-3} T, in the direction of the external field
(b) 2.8×10^{-3} T, opposite to the direction of the external field
(c) 7.6×10^{-3} T, opposite to the direction of the external field
(d) 7.6×10^{-3} T, in the direction of the external field

---

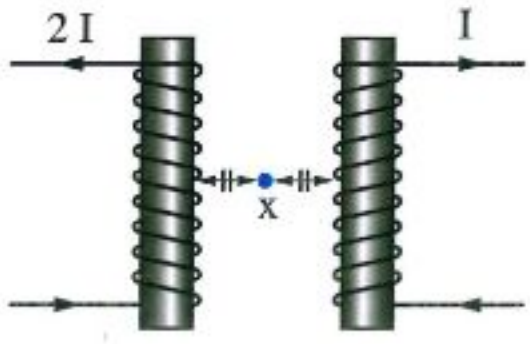
82 ✱ In the opposite figure, a solenoid of length 1.1 m whose number of turns is 210 turns is placed in an external magnetic field of flux density 1.2×10^{-3} T that is parallel to the solenoid axis, so the electric current that should flow through the circuit and the poles of the battery, that make the resultant magnetic flux density at the center of the solenoid becomes zero, are ..... .



	The electric current that passes through the circuit	The poles of the battery
(a)	8 A	a is +ve pole, b is –ve pole
(b)	8 A	a is –ve pole, b is +ve pole
(c)	5 A	a is +ve pole, b is –ve pole
(d)	5 A	a is –ve pole, b is +ve pole

---

83 In the opposite figure, two identical solenoids, each of them carries an electric current, are placed near to each other where their axes are parallel, so the net magnetic field due to them at point x is directed ..... .



(a) into the page (b) out of the page
(c) upwards (d) downwards

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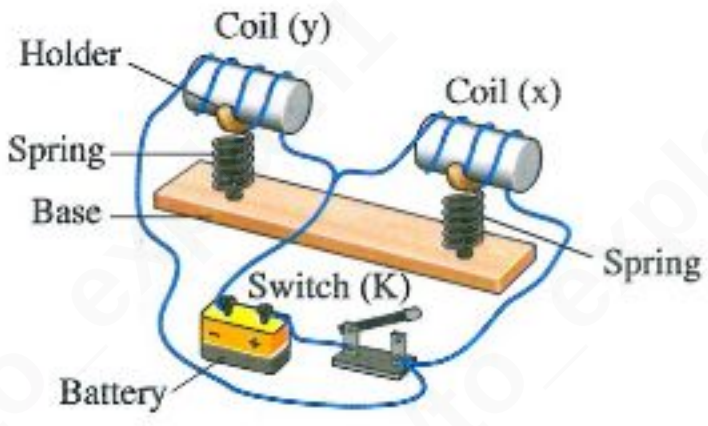
84 A student designed a device to study the magnetic field produced due to the flow of an electric current through two identical solenoids x, y as in the opposite figure, what do you expect to happen when the switch (K) is closed?



(a) Repulsion between two coils.
(b) Attraction between two coils.
(c) No magnetic force is generated between two coils.
(d) The two coils vibrate vertically.

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85 ✱ Two solenoids are put one inside the other where their axes coincide with each other. Each unit of length of the first solenoid contains 10 turns and that of the second solenoid contains 20 turns, so if the passing electric current in the first one is 2 A while that in the second one is 4 A, the magnetic flux density at a point on the axis inside them:

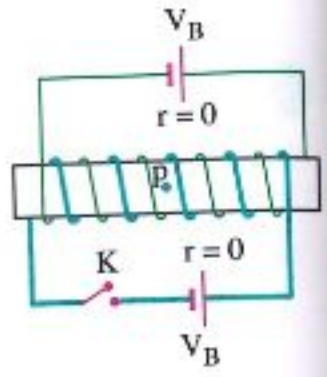
(i) when the two electric currents are in the same direction equals ..... .

(a) 125.71×10^{-6} T (b) 432.7×10^{-5} T (c) 79.7×10^{-4} T (d) 45.31×10^{-3} T

(ii) when the two electric currents are in opposite directions equals ..... .

(a) 96.41×10^{-6} T (b) 85.7×10^{-6} T (c) 75.43×10^{-6} T (d) 41.8×10^{-6} T

86 The opposite figure shows two identical solenoids, so after closing switch K, the net magnetic flux density at their common center (point p) ..... .



(a) increases (b) decreases

(c) doesn't change (d) becomes zero

87 A circular coil of N turns and radius r carries electric current I, hence the magnetic flux density at its center is B. If its turns are displaced uniformly away from each other to become a solenoid of length 20 r while carrying the same current, so the magnetic flux density at its center becomes ..... .

(a) $\frac{B}{20}$ (b) $\frac{B}{10}$ (c) $\frac{B}{40}$ (d) B

88 A circular coil of radius 2.2 cm carries an electric current, hence a magnetic flux of density B is produced at its center, so if its turns are drawn away uniformly from each other till it becomes 110 cm long, the magnetic flux density at its center will equal ..... .

(a) B (b) 2 B (c) 0.5 B (d) 0.04 B

89 ✱ A solenoid of diameter 10 cm and length 200 cm carries an electric current that produces a magnetic flux of density 4×10^{-6} T at its center, so if its turns are compressed uniformly till it becomes a circular coil, the magnetic flux density at the coil's center in this case becomes ..... .

(a) 2.75×10^{-3} T (b) 4.5×10^{-3} T (c) 8×10^{-5} T (d) 13×10^{-3} T

90 ✱ A solenoid of length 50 cm and number of turns 100 turns carries an electric current of 2 A. A circular coil is placed exactly at the middle of the solenoid such that the circular coil and the solenoid become coaxial. If the number of turns of the circular coil is 20 turns while its radius is 15 cm and it carries electric current of 1 A, the magnetic flux density at the center of the circular coil, if the two currents are:

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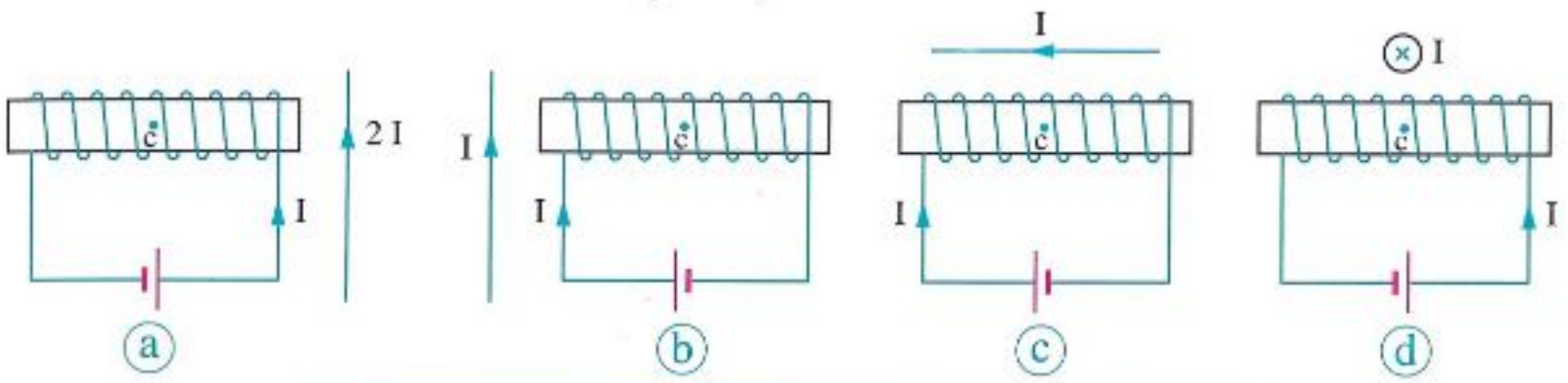
(i) In the same direction, equals ..... .

(a) 3.32×10^{-4} T (b) 4.19×10^{-4} T (c) 5.87×10^{-4} T (d) 6.93×10^{-4} T

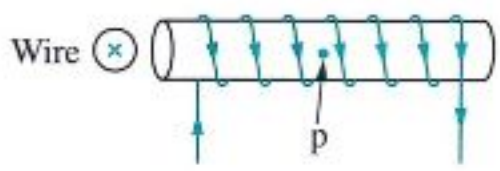
(ii) In opposite directions, equals ..... .

(a) 4.19×10^{-4} T (b) 9.73×10^{-3} T (c) 8.62×10^{-4} T (d) 12.5×10^{-4} T

91 In which of the following figures, the net magnetic flux density at the center of the solenoid (point c) is leftwards and parallel to the plane of the page?

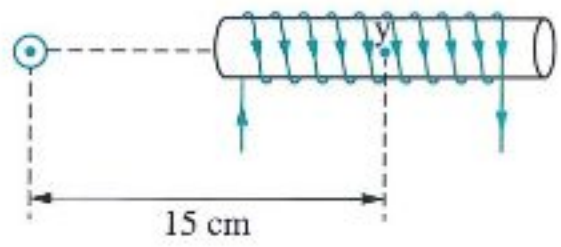


92 ✱ In the opposite figure, a solenoid carries an electric current that generates a magnetic flux density B at its center (point p) and beside the solenoid there is a straight wire that is perpendicular to the plane of the page where it carries a current that generates a magnetic flux density B at point p. So, the total magnetic flux density at point p is ..... .



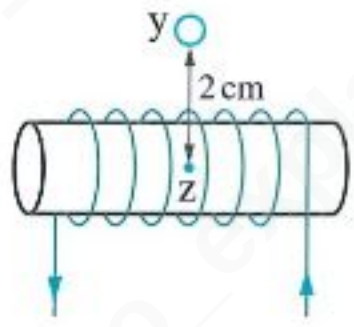
(a) zero (b) B (c) $\sqrt{2}$ B (d) 2 B

93 ✱ A straight wire carrying electric current of 15 A is placed perpendicular to the axis of a solenoid of 10 turns whose length is 15 cm which carries an electric current of $\frac{7}{22}$ A as shown in the opposite figure, so the magnetic flux density at point y which is at a distance 15 cm from the wire equals ..... .



(a) 11.5×10^{-3} T (b) 3.34×10^{-5} T (c) 5.67×10^{-4} T (d) 9.7×10^{-6} T

94 ✱ A straight wire (y) is perpendicular to the plane of the page at a distance 2 cm from the axis of a solenoid that consists of 50 turns/m and carries a current of intensity 1.4 A as in the opposite figure, so the net magnetic flux density at the center of the solenoid (point z) vanishes, when the direction and the intensity of the current that passes in the wire are ..... .



(a) perpendicular into the page, 2.2 A (b) perpendicular into the page, 6.6 A

(c) perpendicular out of the page, 8.8 A (d) perpendicular out of the page, 4.4 A

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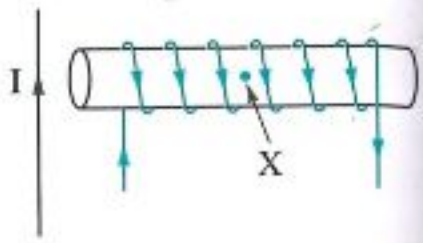
95 ✱ In the opposite figure, when an electric current passes through the solenoid, it generates a magnetic flux density of 3×10^{-6} T at the center of the solenoid (at point X). If a straight wire is placed close to one of the solenoid ends and in the same plane of its axis where an electric current passes through it and generates a magnetic flux density of 4×10^{-6} T at point X, so the resultant magnetic flux density at point X is ..... .

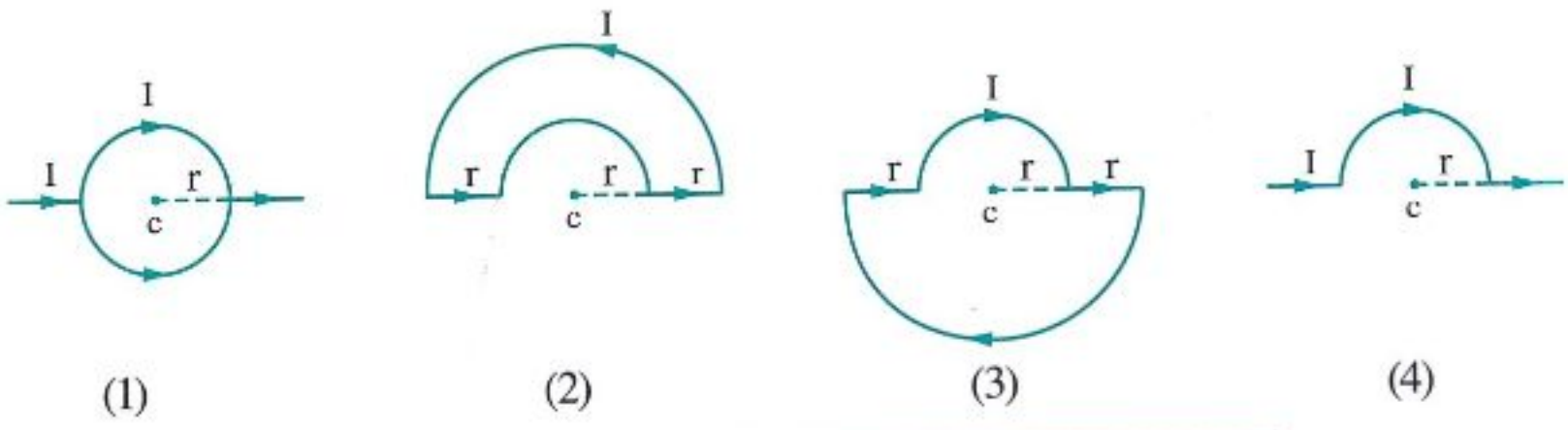


(a) 10^{-6} T (b) 5×10^{-6} T (c) 7×10^{-6} T (d) 12×10^{-6} T

Second Essay questions

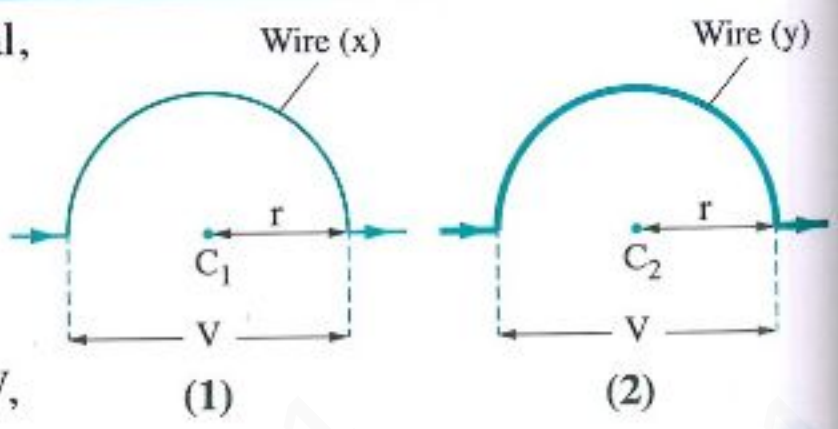
Circular coils

1 Many wires are shaped as the following figures and electric current passes in each of them. **Arrange in ascending order the magnetic flux density B at center (c) in each case.**



(1) (2) (3) (4)

2 Two wires (x, y) are made of the same material, the ratio between their cross-sectional areas respectively is $\frac{1}{2}$. The two wires are shaped so each one becomes a semi-circular ring (1), (2) as in the opposite figure. If the potential difference across the ends of each of them is V, **then calculate** the ratio between the magnetic flux densities $\left(\frac{B_x}{B_y}\right)$ at the centers C_1, C_2

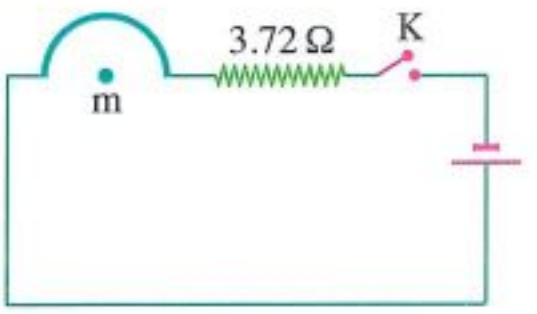


3 An electric current is set up in a circular coil of number of turns N_1, so a magnetic flux of density B_1 is formed at its center. When the coil is recoiled to be a circular coil of number of turns N_2 in which the same current intensity is set up, the magnetic flux density at its center becomes B_2. **Prove that:** $\frac{B_1}{B_2} = \left(\frac{N_1}{N_2}\right)^2$

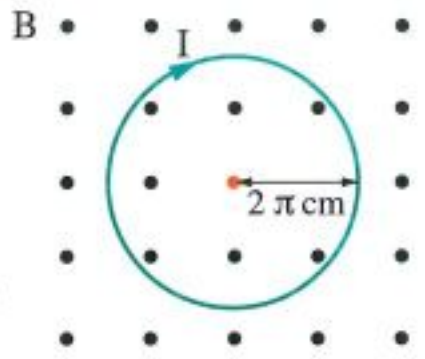
https://t.me/to_explain1

4 A circular coil of radius 3.14 cm where the resistance of one turn of it is 2 Ω, its terminals are connected to a DC source of potential difference 4 V. **Calculate** the magnetic flux density at the center of the coil.

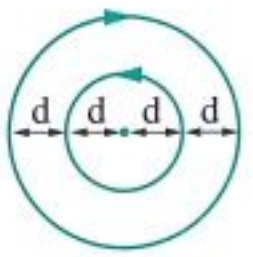
5 In the opposite figure, a wire of resistance R in the form of half a circular ring of radius 3.14 cm, connected in series with a resistor of 3.72 Ω and a source of emf 24 V with internal resistance of 2 Ω where the connecting wires are of negligible resistance. When the switch K was closed, the magnetic flux density at the center of the half circular ring (m) due to the flow of current through it was 2.4×10^{-5} T, **calculate** the resistance of the wire (R). (Where: $\pi = 3.14$)



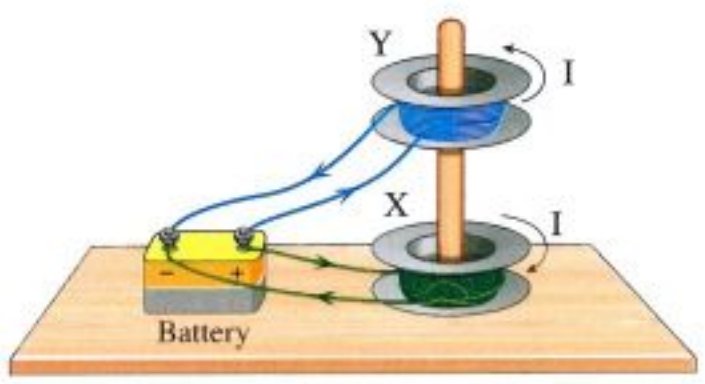
6 An external magnetic flux (B) of flux density 6×10^{-5} T acts perpendicularly on the plane of a metal ring of radius 2 π cm that carries electric current of intensity I, in the direction which is shown in the opposite figure. If the net magnetic flux density at the center of the ring is 4×10^{-5} T and its direction is in the direction of the external magnetic field B. **Calculate** the current intensity I.



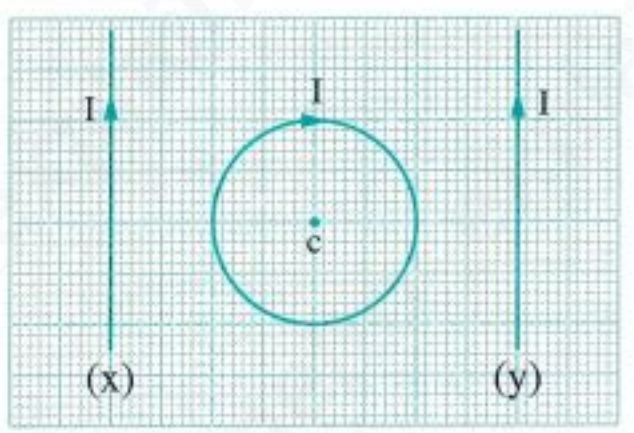
7 Two concentric metallic rings in the same plane carry the same electric current intensity (I) as in the opposite figure. **What** change is required in the current intensity of the inner ring to make the common center point a neutral point?
Explain your answer.



8 Two circular coils X, Y are identical, coil Y is placed free to move above coil X and each of them carries electric current of intensity I whose directions when viewed from the upper face of the two coils are as shown in the opposite figure. **Explain why** coil Y didn't fall and remained suspended.



9 A metallic ring carries an electric current I, where two straight wires are placed in its plane and carry the same current I as in the opposite figure. **Explain what happens** to the magnitude of the net magnetic flux density at the center of the ring (c), if the electric current intensity has increased to double in:
(a) wire x only. (b) wire y only.



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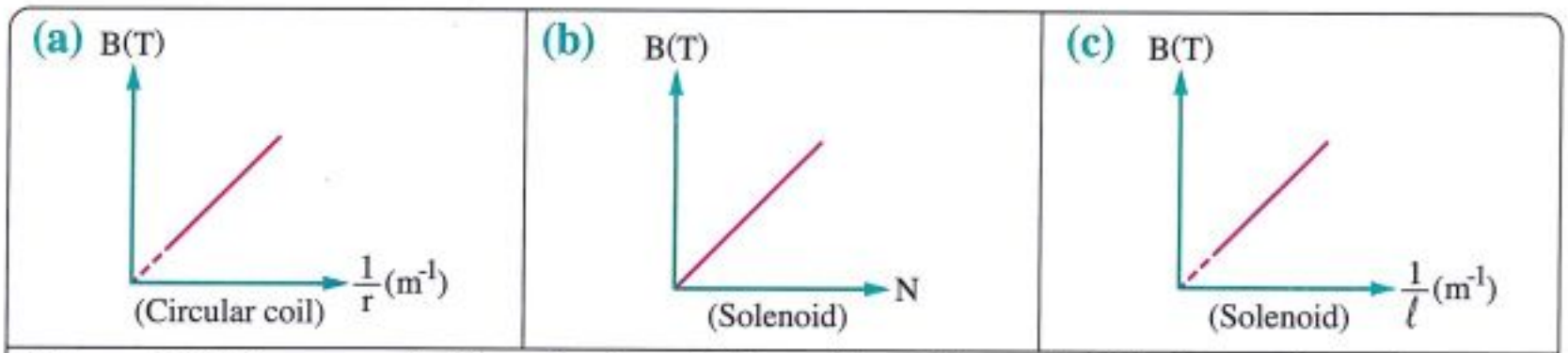
Solenoids

10 The resistance of one turn of a solenoid of length ℓ is R. The ends of the solenoid are connected to a DC electric source of potential difference V. **Prove that** the magnetic flux density at the center of the solenoid is calculated from the relation; $B = \frac{\mu V}{\ell R}$

11 A solenoid with an air core carries a DC electric current, **mention four suggestions** each of them individually leads to increasing the magnetic flux density at the center of a solenoid.

12 **Write the mathematical relation and the equivalent of the slope of the line for each of the following graphs:**



(Where: B is the magnetic flux density, r is the radius of the coil, N is the number of turns and ℓ is the length of the solenoid)

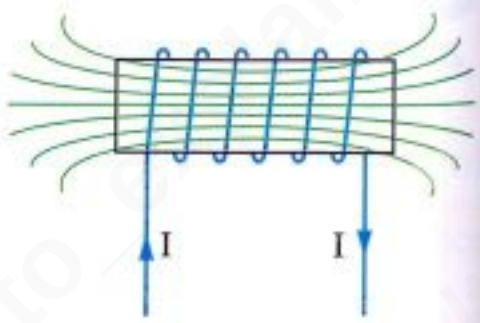
13 A solenoid of resistance R is tightly coiled such that its turns are touching each other, its terminals are connected to a battery of negligible internal resistance. **How does** the net magnetic flux density at the center of the solenoid get affected after doing the following changes:

(a) Moving the solenoid turns uniformly away from each other.

(b) Reshaping the turns of the coil by increasing their diameter to be double while keeping them touching each other.

(c) Connecting a similar coil in series along with the axis of the first coil to become one coil while keeping all of the turns touching each other, then connecting its free ends to the same battery.

14 The opposite figure illustrates the magnetic field formed due to an electric current in a solenoid:



(a) **Determine with arrows, on the figure** the direction of the magnetic flux lines.

(b) **Why** is the magnetic flux density outside the ends of the coil less than that at its center?

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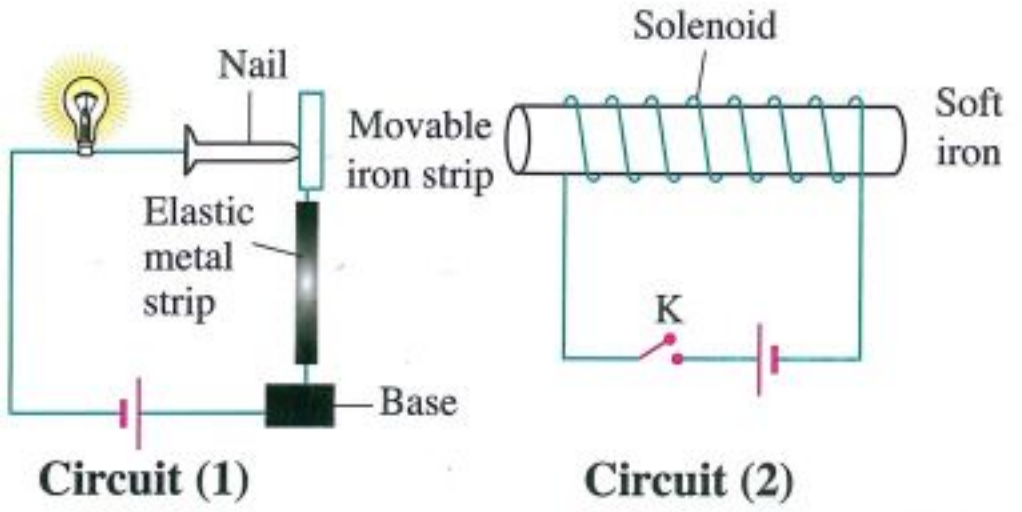
15 In the following figure, **explain why** the electric bulb turns off in circuit (1) when the switch K is closed in circuit (2).



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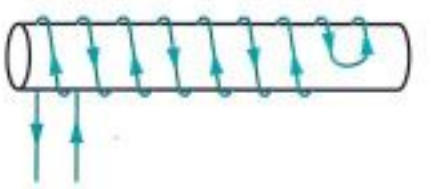
16 In the opposite figure, a solenoid carries an electric current and coiled on an iron bar. **Explain why** the iron bar is not magnetized.



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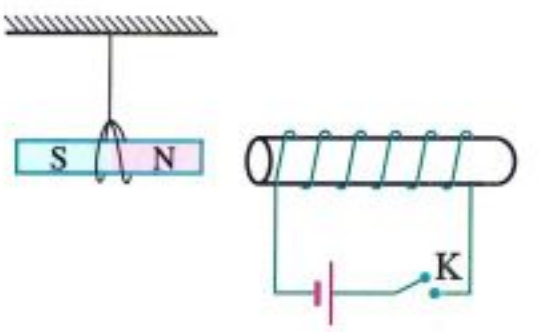
17 In the opposite figure:

A solenoid is coiled around a plastic cylinder and connected to an electric source where a freely swinging magnet is suspended near them as shown in the figure:



(a) **What** is the type of the magnetic force which is acting on the N pole of the magnet when the switch (K) is closed?

(b) **What will happen to** the magnitude of the magnetic force when the plastic cylinder is replaced by a cylinder made of soft iron then the switch is closed?

(c) **What will happen to** the type of the magnetic force when the terminals of the electric source are reversed then the switch is closed?

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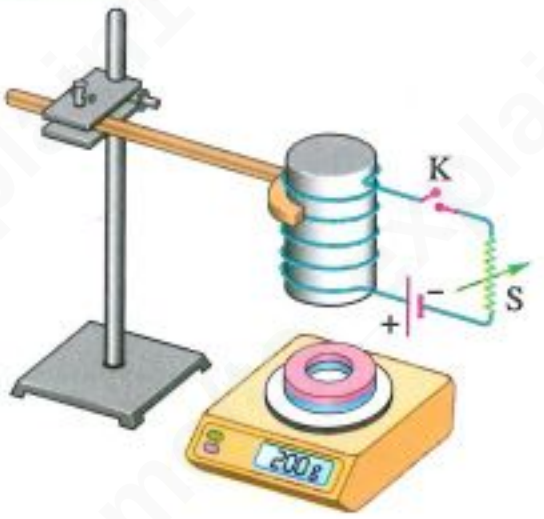
18 In the opposite figure, a solenoid is connected to a switch (K), a variable resistor (S) and an electric cell. The coil is fixed above a balance pan on which a short magnet is placed such that its upper face is a north pole. **Explain what happens to** the reading of the balance after closing the switch (K).



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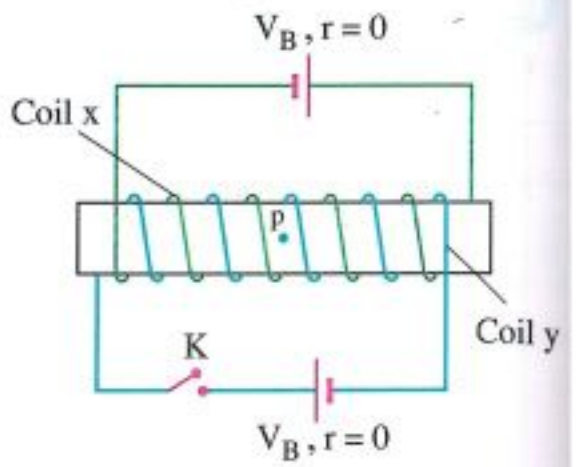
19 The opposite electric circuit illustrates two similar solenoids x, y but solenoid x is made of aluminum, while y is made of copper. Since the resistivity of aluminum is greater than that of copper, **what happens to** the net magnetic flux density at center of the two solenoids (point p) when closing the switch K which is connected to coil y?



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20 A circular coil of diameter 12 cm, carries an electric current that produces a magnetic field at its center. The turns of the coil are displaced uniformly from each other to become a solenoid that carries the same electric current. So, the magnetic flux density at its center has become $\frac{1}{4}$ that at the center of the circular coil. **Calculate** the length of the solenoid.

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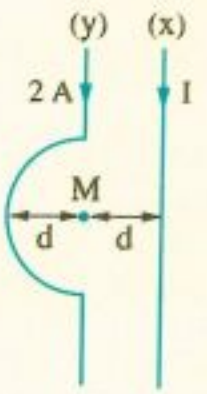
Questions of the Previous Years Exams ? on Lesson 2

Circular coil

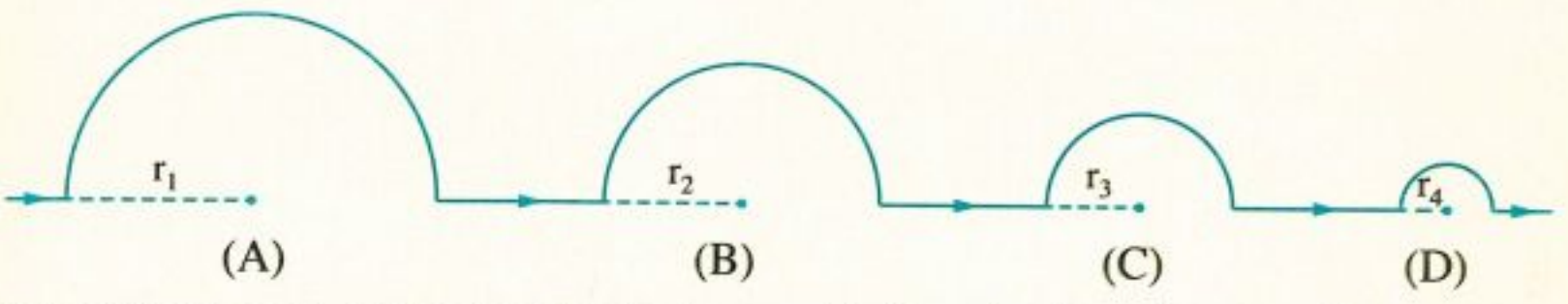
1 The figure illustrates two current-carrying conductors (x) and (y). A current of intensity I passes through conductor (x) while a current of intensity (2 A) passes through conductor (y). Then, the current (I) that causes the magnetic flux density at point M to be zero is ..... . *(Exp. May 21)*



(a) $\frac{\pi}{2}$ A (b) $\frac{\pi}{4}$ A

(c) 2π A (d) π A

2 The figure illustrates a wire in the form of semi-circles connected together and connected to a cell.



Which of these semi-circles has the least magnetic flux density at its center?

(a) A (b) B (c) C (d) D *(Exp. May 21)*

3 A straight wire was wound in the form of a circular coil of N turns and a current of intensity I was set up in it. If it is reformed so that the number of turns becomes $\frac{N}{4}$ and the same current intensity is set up in it, the magnetic flux density at its center will be ..... of its initial value. *(Exp. June 21)*

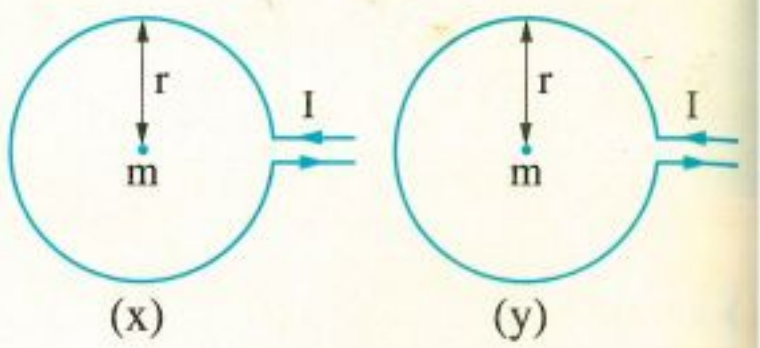
(a) $\frac{1}{16}$ (b) 16 times (c) 4 times (d) $\frac{1}{4}$

4 A straight wire was wound to form a circular coil of N turns, through which a current of intensity I was flowing to form a magnetic flux of density B at the center of the coil. If the same wire was rewound so that the number of turns became $\frac{2N}{3}$ and the same current intensity I got flowing through it, the magnetic flux density at its center would become ..... . *(1^{st} session 21)*

(a) $\frac{2}{3}$ B (b) $\frac{2}{9}$ B (c) $\frac{1}{9}$ B (d) $\frac{4}{9}$ B

https://t.me/to_explain1

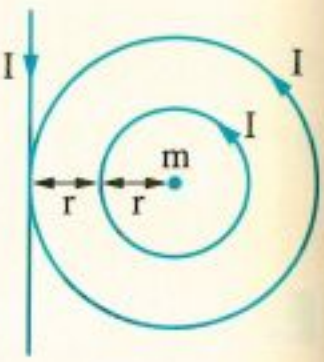
5 In the opposite figure, two circular coils (x) and (y) having the same diameter while electric currents of the same intensity (I) pass through each of them. If the number of turns of coil (x) is double the number of turns of coil (y), which of the following relations represents correctly the relation between the produced magnetic flux densities (B) at the center of each coil?



(1st session 21)

(a) $B_{(x)} = 2\,B_{(y)}$ (b) $B_{(x)} = B_{(y)}$ (c) $B_{(x)} = \frac{1}{2}\,B_{(y)}$ (d) $B_{(x)} = 4\,B_{(y)}$

6 A current-carrying straight wire is put tangent to the outer ring of two concentric rings that carry electric currents in the same direction. If all of them are in the same plane and carry currents that have intensity I as shown in the figure, the resulting magnetic flux density at the common center (m) due to the three currents equals .....



(1st session 21)

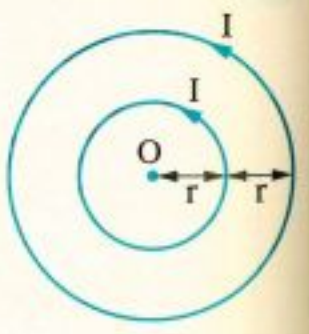
(a) $\frac{0.83\ \mu I}{r}$ (b) $\frac{0.67\ \mu I}{r}$ (c) $\frac{0.54\ \mu I}{r}$ (d) $\frac{0.42\ \mu I}{r}$

7 A circular coil of number of turns N and radius r carries a current of intensity I, so a magnetic field of flux density B_1 is generated at its center. If the coil is connected to another electric source such that a current of intensity which equals three times its intensity in the first case passes through it, a magnetic field of flux density B_2 is generated at its center. So, ...

(2nd session 21)

(a) $B_2 = 3\,B_1$ (b) $B_2 = B_1$ (c) $B_2 = \frac{1}{3}\,B_1$ (d) $B_2 = \frac{3}{2}\,B_1$

8 Two concentric rings both carry electric current I at the same direction as shown in the figure, producing magnetic field of flux density B at the common center (O). If the direction of the passing current through one ring only is reversed keeping the other current as it is, so the resultant magnetic flux density at (O) becomes ..... .



(2nd session 21)

(a) $\frac{B}{2}$ (b) $\frac{B}{4}$ (c) $\frac{B}{3}$ (d) $\frac{B}{5}$

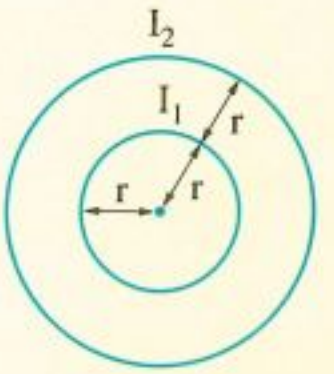
9 A circular coil of number of turns (N) and radius (r) is carrying an electric current of intensity (I), so a magnetic field of flux density (B) is generated at its center. If the coil is cut such as a quarter of its turns are removed and the same current (I) is set to pass through it. So, the magnetic flux density at the center of the coil in the second case equals ..... .

(1st session 22)

(a) B (b) $\frac{3}{4}$ B (c) $\frac{3}{2}$ B (d) $\frac{4}{3}$ B

https://t.me/to_explain1

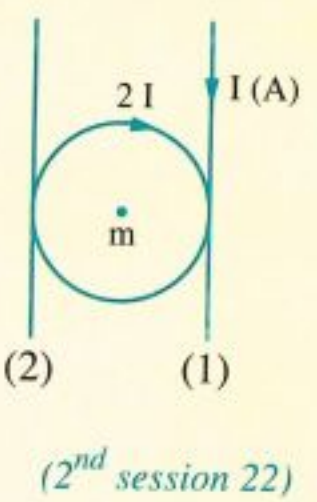
10 The figure illustrates two concentric circular coils of same number of turns and having different radii, each coil produces magnetic flux of density (B) at the common center due to the electric current passing through each of them (I_1, I_2) as shown. Which of the following choices correctly represents the relation between the values of (I_1 and I_2), their directions and also the magnitude of the resultant magnetic flux density (B_t) at the common center?



(2nd session 22)

	The relation between the values of I_1, I_2 and their directions	B_t
(a)	$I_1 = I_2$, in the same direction	2 B
(b)	$I_2 = 2\ I_1$, in the opposite direction	zero
(c)	$I_2 = I_1$, in the opposite direction	zero
(d)	$I_2 = \frac{1}{2}\ I_1$, in the same direction	2 B

11 A metallic ring was carrying electric current of intensity (2 I), a magnetic flux of density (B) was generated at the center of the ring (m). If two straight current-carrying wires (1) and (2) were placed tangent to the ring and in the same plane as in figure.
So, to make the resultant magnetic flux density due to the three electric currents has the same value (B) at the center (m), the electric current intensity that passes in the wire (2) = ... and its direction ..... .

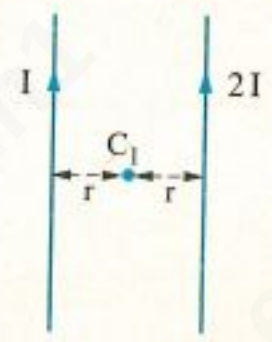


(2nd session 22)

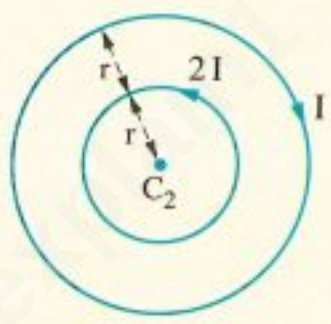
(a) (I), to the top of the page
(b) (I), to the bottom of the page
(c) (2 I), to the bottom of the page
(d) (2 I), to the top of the page

12 Using the data illustrated in both figures (1) and (2). Which of the following relations represents correctly the relation between the net magnetic flux densities (B) at points C_1 and C_2?

(1st session 23)



Two long parallel straight wires
(1)

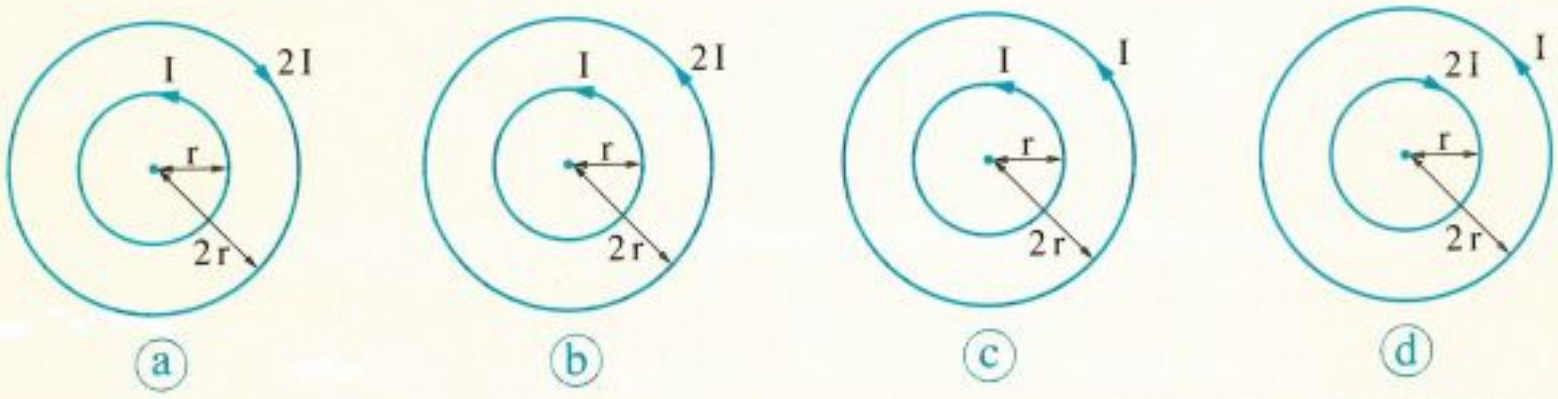


Two metallic coaxial rings
(2)

(a) $B_{C_1} = B_{C_2} = 0$
(b) $B_{C_1} > B_{C_2}$
(c) $B_{C_1} = B_{C_2} \neq 0$
(d) $B_{C_1} < B_{C_2}$

https://t.me/to_explain1

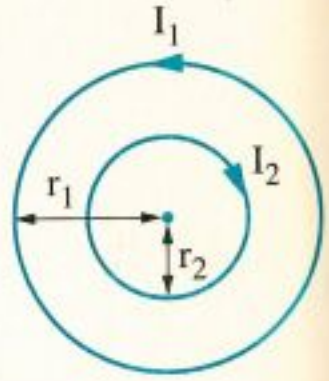
13 Each of the following figures represents two concentric metallic rings in the same plane carrying electric currents. In which one of them the resultant magnetic flux density at the common center is higher? *(2nd session 23)*



14 A circular coil has a number of turns (100 turns). A current of intensity (5 A) passes through the coil, if the radius of the coil is 2π cm, then the magnetic flux density at the center of the coil = ... *(2nd session 24)*

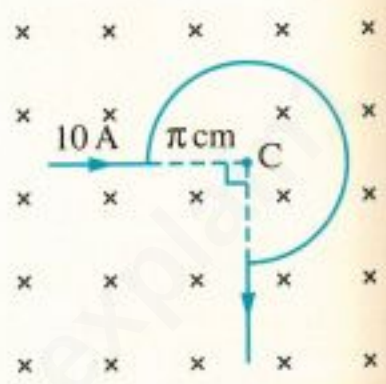
(a) 2×10^{-3} T (b) 2 T (c) 5 T (d) 5×10^{-3} T

15 In the opposite diagram, two concentric circular coils lie in the plane of the page. The outer coil has a radius of 20 cm, consists of 100 turns, and carries a current of intensity 4 A in the direction shown in the figure. The inner coil has a radius of 10 cm, consists of 50 turns, and carries a current of intensity 2A in the direction shown in the figure. Then the resultant magnetic flux density at their common center equals ..... . *(Exp. 25)*



(a) 6.28×10^{-4} T (b) 8.42×10^{-4} T
(c) 7.36×10^{-5} T (d) 9.63×10^{-5} T

16 A straight wire is reshaped as shown in the opposite diagram. If the radius of the circular section is π cm, and the wire carries an electric current of intensity 10 A, then it is placed in an external magnetic field perpendicular to its plane, and the magnetic flux density is 1.5×10^{-4} T. Then the resultant magnetic flux density at the center (C) equals ..... . *(Exp. 25)*



(a) 0 (b) 3×10^{-4} T
(c) 3.5×10^{-4} T (d) 4.5×10^{-4} T

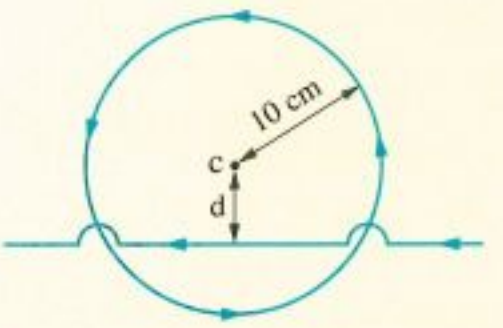
https://t.me/to_explain1

17 A circular coil of 50 turns carries a current of 1.4 A. Its axis is aligned with the Earth's magnetic field, which has a magnetic flux density of 5×10^{-5} T. If the coil is overturned, the total magnetic flux density at the center of the circular coil becomes double what it was initially. Then the radius of the coil is equal to ..... . *(Exp. 25)*

(Knowing that: the magnetic field generated by the current in the circular coil is greater than the Earth's magnetic field, the magnetic permeability = 12.56×10^{-7} Wb/A.m)

(a) 2.93 m (b) 8.8 m (c) 0.88 m (d) 0.293 m

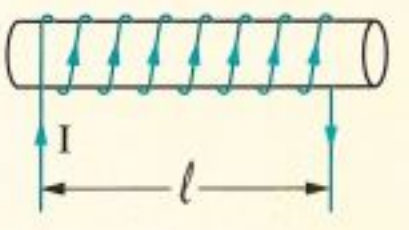
18 In the opposite figure, an insulated circular ring carries an electric current of intensity (I), and a long insulated straight wire also carries a current of intensity (I). Both are in the same plane. If the net magnetic flux density at the center of the ring (c) is vanished, then the distance (d) equals ..... . *(Exp. 25)*



(a) 3.14 cm (b) 6.28 cm (c) 3.18 cm (d) 5 cm

Solenoid

19 The figure illustrates a solenoid of length ℓ, cross-sectional area A and number of turns N through which a current I passes, if its turns are displaced apart so that its length gets increased to 3 ℓ, the magnetic flux density along its axis ..... . *(Exp. May 21)*

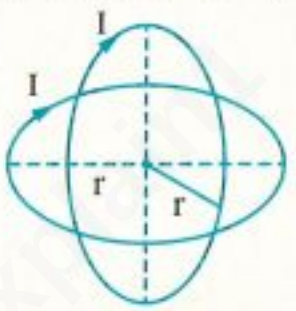


(a) decreases to $\frac{1}{3}$ of its initial value (b) decreases to $\frac{1}{6}$ of its initial value

(c) decreases to $\frac{1}{9}$ of its initial value (d) decreases to $\frac{1}{12}$ of its initial value

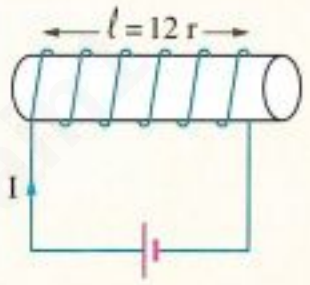
20 In the figure, a group of electric conductors, each is carrying an electric current (I).

Two perpendicular rings have the same diameter (2 r)



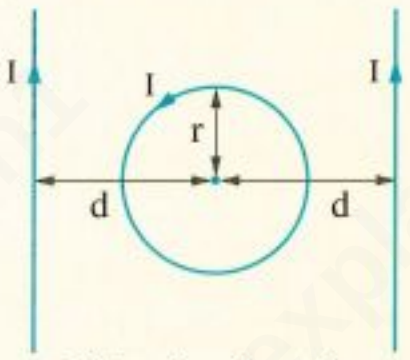
Magnetic flux density at the center of the two rings = (X)

Solenoid, its no. of turns (N = 6) and its length (ℓ = 12 r)



Magnetic flux density on the axis inside the solenoid = (Y)

Ring of radius (r)



Magnetic flux density at the center of the ring = (Z)

Which of the following mathematical relation is correct? *(1st session 22)*

(a) Z > Y (b) X = Z (c) Y < X (d) X = Y

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21 A solenoid of length 20 cm consists of 100 turns and its radius is 0.1 m carries a current of 4.9 A. Knowing that the permeability of the medium inside the coil is $\frac{88}{7} \times 10^{-7}$ Wb/A.m, the magnetic flux lines that penetrate the face of the coil equals ..... .

(Exp. 23)

(Given that: $\pi = \frac{22}{7}$)

(a) 6.166×10^{-6} Wb (b) 30.8×10^{-4} Wb

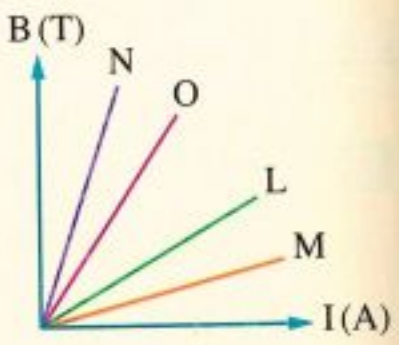
(c) 6.166×10^{-3} Wb (d) 9.68×10^{-5} Wb

22 A solenoid made of insulated copper wire carrying an electric current (I) and the magnetic flux density along its axis is (B), if the turns are displaced uniformly away from each other, so the magnetic flux density along its axis is decreased to $(\frac{B}{4})$. If we have to increase the current intensity by 3 A to return the value of magnetic flux density to its initial value (B), then the current intensity (I) is ..... .

(Exp. 23)

(a) 1 A (b) 2 A (c) 3 A (d) 4 A

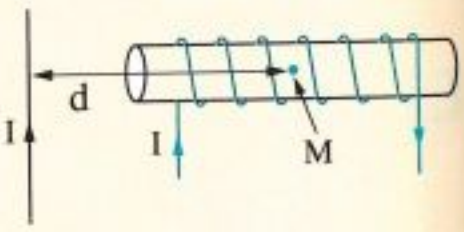
23 The graph represents the relation between the magnetic flux density (B) at the mid-point of the axis of a number of spiral coils (L, M, N and O) and the current intensity (I) passing through them, if you know that all the coils have the same number of turns and their cores have the same magnetic permeability, then the coil that has the smallest length is coil ..... .



(1st session 23)

(a) N (b) L (c) M (d) O

24 The opposite figure represents a solenoid of (N) number of turns and length (ℓ), the current intensity passing through it is (I). If a copper wire that carries a current (I) is placed in the plane of the solenoid and the direction of the electric current of the wire is perpendicular to the axis of the solenoid, the resultant of the magnetic flux density at point (M) is equal to ..... .



(1st session 24)

(a) $\sqrt{B^2_{solenoid} - B^2_{wire}}$ (b) $B^2_{solenoid} - B^2_{wire}$

(c) $\sqrt{B^2_{wire} + B^2_{solenoid}}$ (d) $B^2_{wire} + B^2_{solenoid}$

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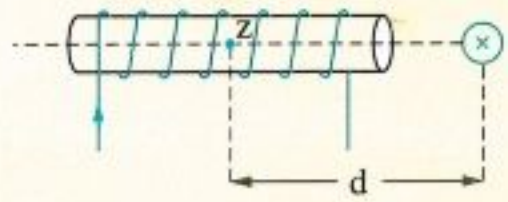
25 The opposite figure represents a solenoid and a straight wire, each carrying an electric current. The wire is placed at a distance d from point z , which is at the midpoint of the solenoid. If the magnitudes of magnetic flux density at point z due to the current through the solenoid only and the current through the wire only are B and $\frac{4}{3}$ B respectively, and the net magnetic flux density at point z due to both the solenoid and the wire currents is B_1, then when the distance between the wire and point z increases to 2d, the net magnetic flux density at point z becomes B_2 , then ..... *(1st session 24)*



(a) $B_2 = 1.4\ B_1$ (b) $B_2 = 0.72\ B_1$ (c) $B_2 = 1.6\ B_1$ (d) $B_2 = 0.5\ B_1$

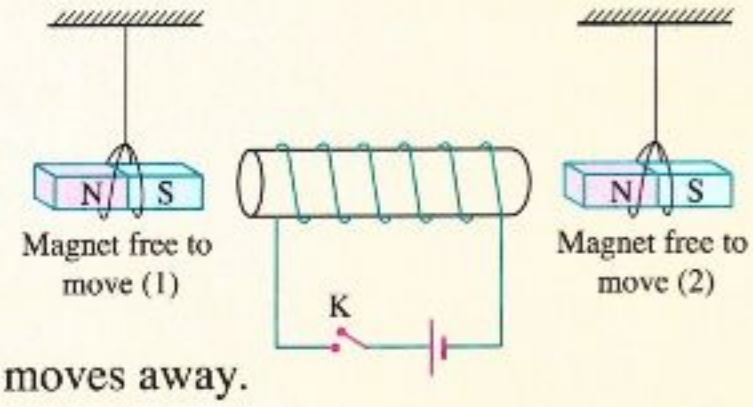
26 From the opposite figure, when the switch (K) is closed? *(1st session 24)*

(a) Magnet (2) approaches a coil while magnet (1) moves away.

(b) Magnets (1) and (2) approach a coil.

(c) Magnet (1) approaches a coil while magnet (2) moves away.

(d) Magnets (1) and (2) move away.



27 A solenoid has a number of turns 14 turns and a length 22 cm carrying an electric current 2 A, then the magnetic flux density at the mid-point of its axis ..... . *(2nd session 24)*

($\mu = \frac{88}{7} \times 10^{-7}$ T.m/A)

(a) 16×10^{-7} T (b) 1.6×10^{-4} T (c) 8×10^{-4} T (d) 8×10^{-7} T

28 In the opposite figure, if the magnetic flux density resulted from each of wire X, wire Y and the solenoid one at a time at point A is B. Then, which of the following choices represents the resultant magnetic flux density at the same point, when the current is reversed in one of the two wires? *(2nd session 24)*

(a) $\sqrt{3}$ B (b) 5 B (c) $\sqrt{5}$ B (d) 3 B

29 A long solenoid contains 5 turns per cm of its length and a circular coil of radius $\frac{\pi}{5}$ cm and consists of 10 turns is wound around the midpoint of the solenoid and the two coils are concentric and coaxial as shown in the opposite figure, if an electric current of intensity 4 A passes through each of the two coils, the magnetic flux density at the common center (m) equals ..... . *(Exp. 25)*

(a) 4×10^{-3} T (b) 2.5×10^{-3} T (c) 1.5×10^{-3} T (d) 6.5×10^{-3} T

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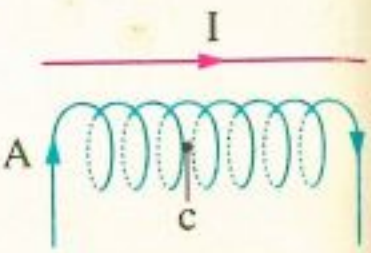
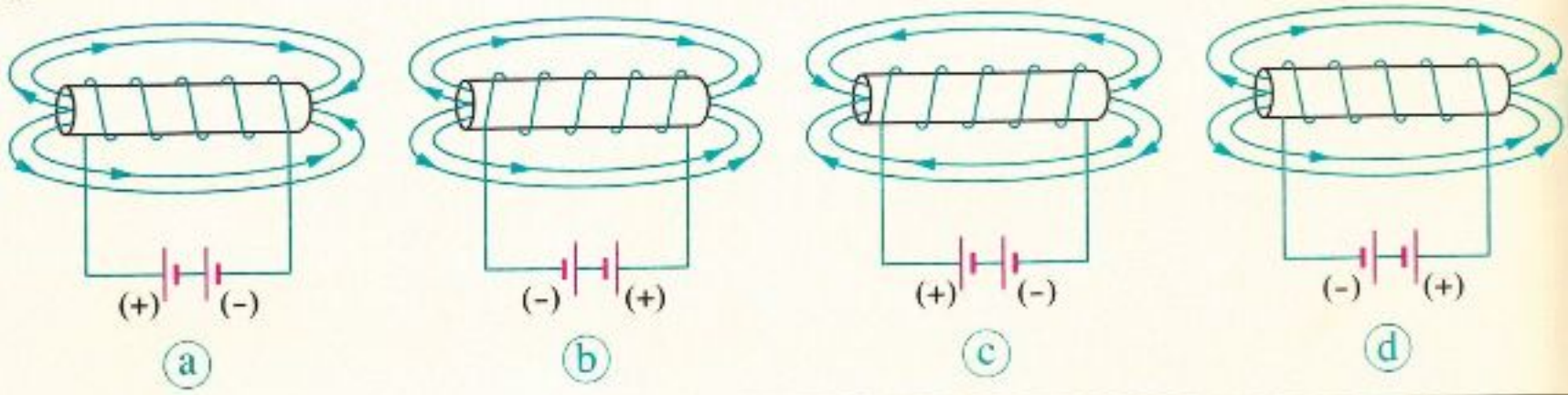
30 In the opposite diagram, a solenoid contains 300 turns per meter and carries a current of intensity 1.75 A. A straight wire is placed near to the coil and parallel to the solenoid's axis. If the magnetic flux density resulting from the electric current in the straight wire at point (c) which located at the midpoint of the solenoid's axis, is 2.33×10^{-4} T, then the net magnetic flux density at point (c) is approximately equal to ..... . *(Exp. 25)*

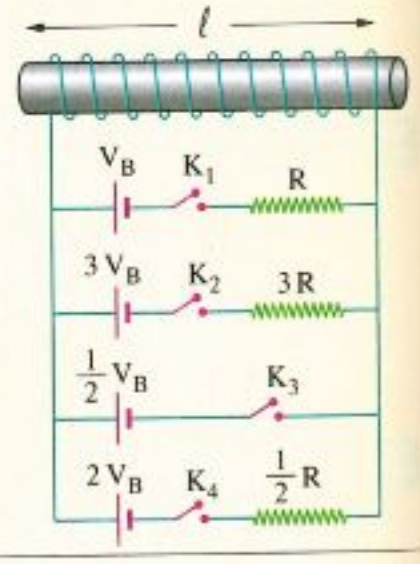


(a) 4.27×10^{-4} T (b) 6.44×10^{-4} T (c) 7×10^{-4} T (d) 8.93×10^{-4} T

31 Which of the following figures correctly describes the direction of the magnetic field generated by an electric current passing through a solenoid? *(Exp. 25)*

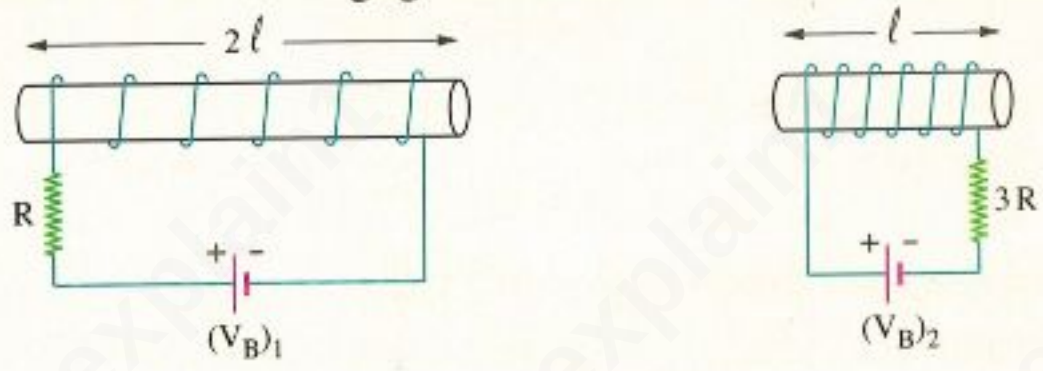


32 A solenoid with a resistance of 0.5 R is connected in an electric circuit as shown in the opposite figure. The magnetic flux density at the center of the solenoid is having its maximum value after switch ..... only is closed. *(Exp.25)*



(a) K_1 (b) K_2
(c) K_3 (d) K_4

33 The following figure shows two insulated solenoids with negligible resistance, each having the same number of turns and wound around a magnetic core of the same type. Each is connected to an electric source of negligible internal resistance and an electric resistance.



Given that: the magnetic flux density at the midpoint along the axis of each solenoid is equal, and that the length of each solenoid is much greater than its diameter, then the ratio of the electromotive forces (emf) of the two sources $\left(\frac{V_{B1}}{V_{B2}}\right)$ equals ..... . *(Exp. 25)*

(a) $\frac{2}{3}$ (b) $\frac{1}{12}$ (c) $\frac{1}{4}$ (d) $\frac{1}{2}$

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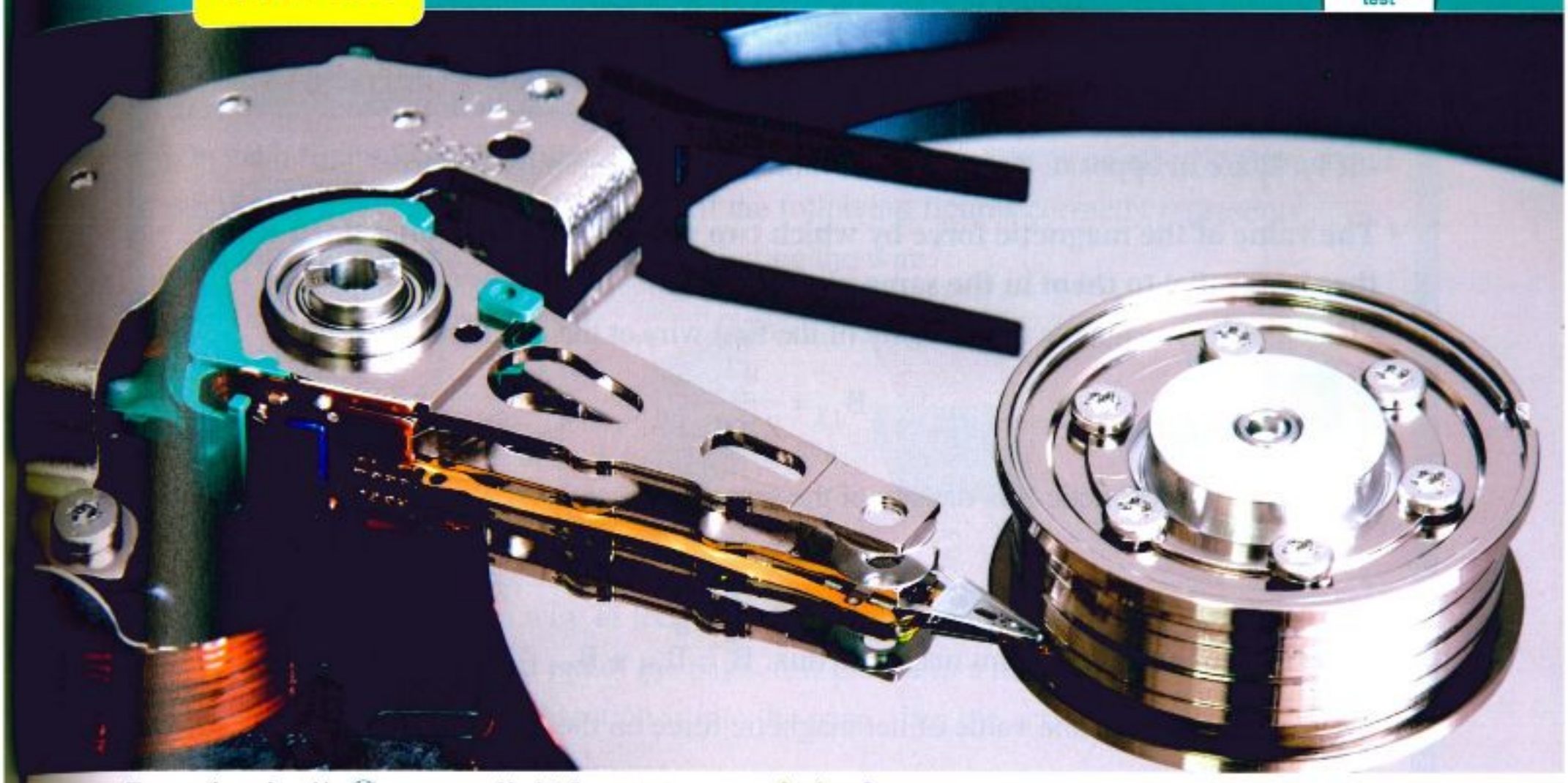
Chapter 2

Questions on Lesson Three

- The Magnetic Force
- The Torque

Interactive test



The questions signed by ✳ are answered in detail. ● Understand ○ Apply Higher Order Thinking Skills

Important guidelines

- **The value of the magnetic force (F) due to a uniform magnetic field acting on a current-carrying straight wire:**

$$F = BI\ell \sin\theta$$

(Where: θ is the angle confined between the direction of the field and the current through the wire)

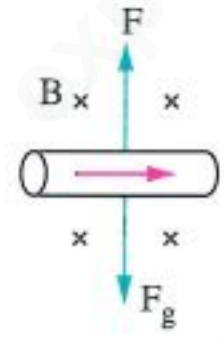
(a) If the wire is parallel to the direction of the magnetic flux:

$F = BI\ell \sin 0 = 0$ (The acting force on the wire vanishes)

(b) If the wire is perpendicular to the direction of the magnetic flux:

$F = BI\ell \sin 90 = BI\ell$ (The acting force on the wire has its maximum value)

- **A current-carrying wire that is placed perpendicular to a magnetic field can be balanced horizontally under the effect of its weight (F_g) downwards and the magnetic force (F) upwards when:**



$\because F = F_g$ $\therefore BI\ell = mg$

$BI\ell = \rho V_{ol} g$ $\therefore BI\ell = \rho A\ell g$ $BI = \rho\pi r^2 g$

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- **The mutual magnetic force between two parallel wires, the distance between them is d and they are carrying two electric currents I_1 and I_2:**

$$F = \mu \frac{I_1 I_2 \ell}{2 \pi d}$$

- If I_1, I_2 are in the same direction, the mutual force is an attraction force.
- If I_1, I_2 are in opposite directions, the mutual force is a repulsion force.

- **The value of the magnetic force by which two parallel wires act on a third wire that is parallel to them in the same plane:**

- Calculate the magnetic flux density of the first wire at the third wire position:

$$B_{13} = \frac{\mu I_1}{2 \pi d_{13}}$$

- Calculate the magnetic flux density of the second wire at the third wire position:

$$B_{23} = \frac{\mu I_2}{2 \pi d_{23}}$$

- Then calculate the resultant magnetic flux: $B_t = B_{13} \pm B_{23}$
- After that calculate the value of net magnetic force on the third wire: $F = B_t I_3 \ell_3$

Another method:

- Calculate the value of the mutual magnetic force between the first and the third wire:

$$F_{13} = \frac{\mu I_1 I_3 \ell}{2 \pi d_{13}}$$

- Calculate the value of the mutual magnetic force between the second and the third wire:

$$F_{23} = \frac{\mu I_2 I_3 \ell}{2 \pi d_{23}}$$

- Calculate the net magnetic force acting on the third wire:

$$F = F_{13} \pm F_{23}$$

The torque acting on a current-carrying coil if the plane of the coil is:

- Inclined to the field: $\tau = BIAN \sin \theta$
- Perpendicular to the field: $\tau = 0$
- Parallel to the field: $\tau = BIAN$

Where: θ is the angle between the flux lines and the normal to the coil

- **The magnetic dipole moment of a coil:** $|\overrightarrow{m_d}| = IAN = \frac{\tau}{B \sin \theta}$

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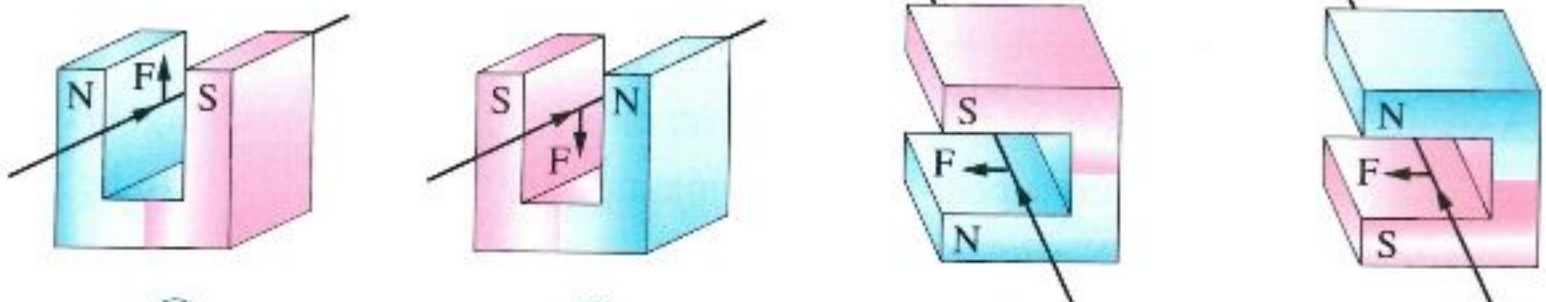
First Multiple choice questions

Use the following constant if needed: $\mu_{air} = 4\pi \times 10^{-7}$ Wb/A.m

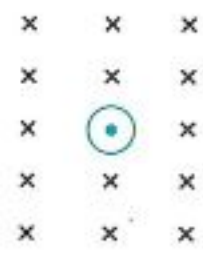
The force affecting a wire

1 In each figure from the following figures, a straight wire carries an electric current and is placed in a magnetic field, which of the following figures correctly represents the direction of the magnetic force affecting the wire?



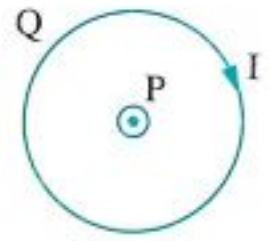
(a) (b) (c) (d)

2 In the opposite figure, a wire of length (ℓ) is carrying an electric current (I) that is directed out of the page. It is placed in a magnetic field of density B whose direction is into the page, then the acting magnetic force on it equals ..... .



(a) $BI\ell$ (b) $\frac{1}{2} BI\ell$ (c) $\sqrt{2}\,BI\ell$ (d) 0

3 A circular coil (Q) carries an electric current of intensity (I). A straight long wire (P) is placed in the center of the circular coil and perpendicular to its plane as in the opposite figure. If an electric current whose direction is out of the page passes in the wire, then the wire (P) is ..... .



(a) affected by a magnetic force in a direction out of the page
(b) affected by a magnetic force into the page
(c) not affected by any magnetic force
(d) affected by a magnetic force in the plane of the page

4 A wire that carries an electric current of intensity 10 A is placed perpendicular to a magnetic field of density 0.1 T, so the acting magnetic force on a unit of length of the wire equals ..... .

(a) 1 N/m (b) 2.5 N/m (c) 3 N/m (d) 4.6 N/m

5 * A wire of length 10 cm is carrying an electric current of 5 A while being placed in a magnetic field of flux density 1 Wb/m^2, hence the magnetic force affecting the wire, when it makes an angle with the direction of the magnetic flux that equals:

(i) 0°, will be ..... .

(a) 0.3 N (b) 0.11 N (c) 0 (d) 0.7 N

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(ii) 45°, will be ..... .

(a) 0.354 N (b) 0.631 N (c) 0.891 N (d) 0.913 N

(iii) 90°, will be ..... .

(a) 0.25 N (b) 0.5 N (c) 0.7 N (d) 1 N

(iv) 135°, will be ..... .

(a) 0.221 N (b) 0.354 N (c) 0.496 N (d) 0.532 N

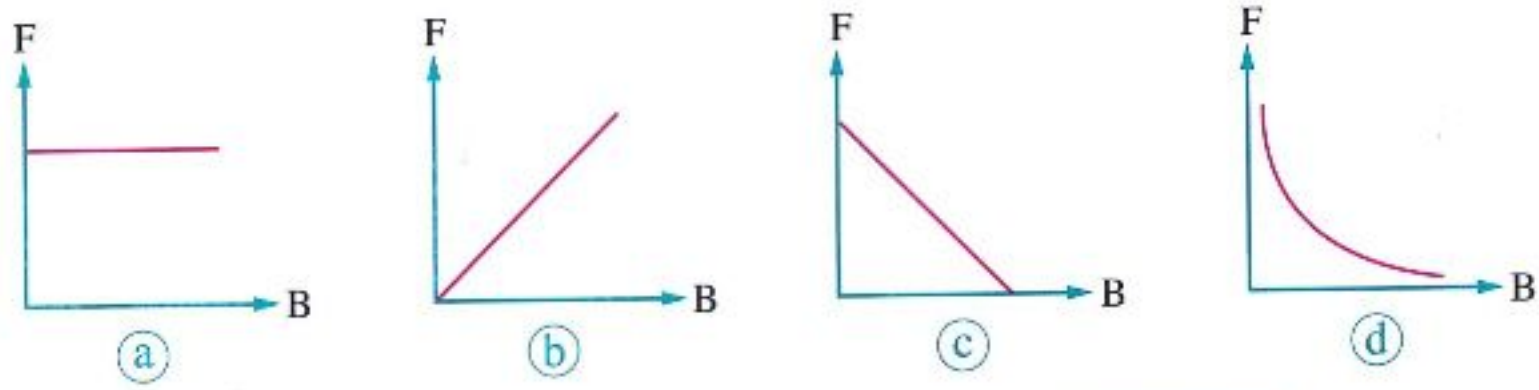
(v) 180°, will be ..... .

(a) 0 (b) 0.25 N (c) 0.5 N (d) 1 N

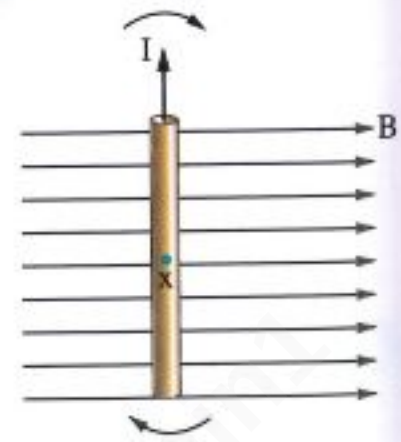
6 ✱ A straight wire of length 30 cm is carrying an electric current of intensity 4 A, hence the angle at which this wire is positioned in a magnetic flux of density 5 T to be affected by a magnetic force of 3 N equals ..... .

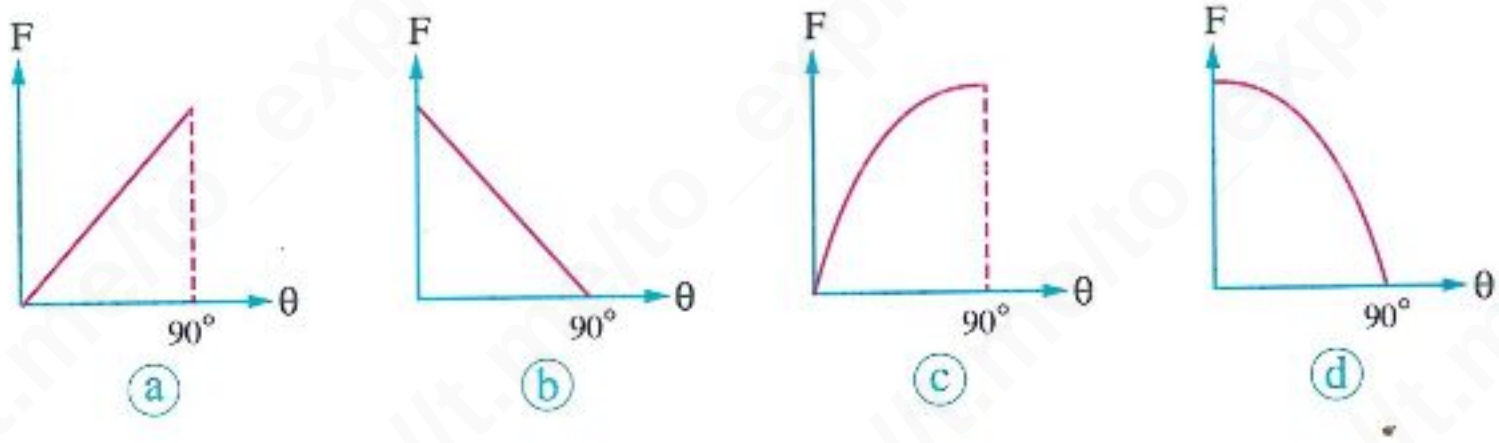
(a) 30° (b) 45° (c) 60° (d) 90°

7 A straight current-carrying wire is placed perpendicular to a uniform magnetic field of a uniformly changeable flux density (B), so the graph which represents the relation between the magnetic force (F) on the wire and the magnetic flux density (B) is ..... .



8 In the opposite diagram, a straight wire which carries an electric current (I) is placed perpendicular to a uniform magnetic flux B, if the wire is rotated by an angle of 90° about an axis perpendicular to the length of the wire at point x, then the graph that represents the relation between the magnetic force (F) affecting the wire and the angle of rotation (θ) is ..... .





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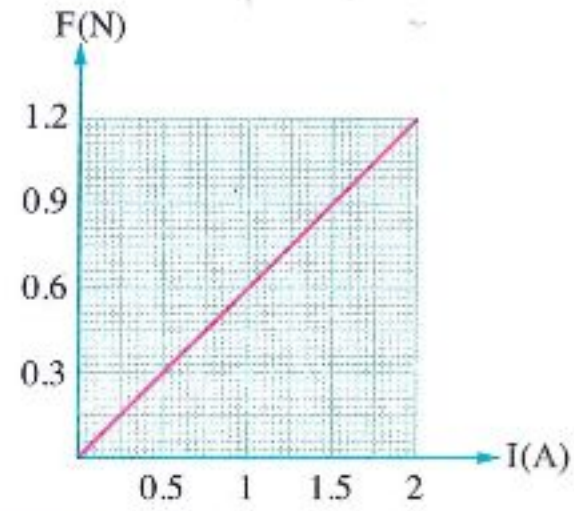
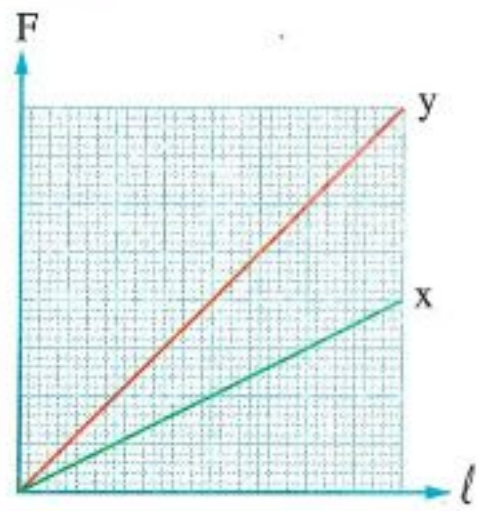
9 The opposite graph represents the relation between the magnetic force (F) which acts on a straight wire of length 60 cm due to a uniform magnetic field and the current intensity (I) which passes in that wire. The magnetic flux density that acts on the wire equals ..... .



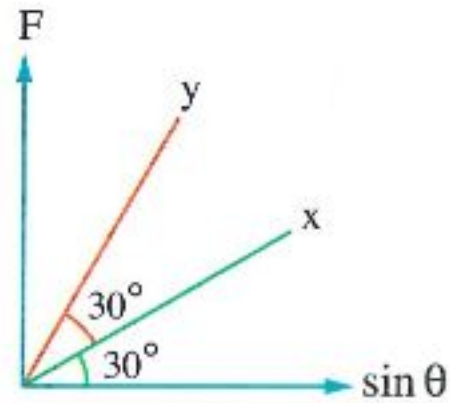
(a) 0.01 T (b) 0.1 T
(c) 1 T (d) 1.01 T

10 Two groups of wires, x and y, carrying electric currents of the same intensity (I) and are placed in a uniform magnetic field of flux density B. The wires in group x are inclined at an acute angle (θ) to the direction of the magnetic field, while the wires in group y are placed perpendicularly to the direction of the field. The opposite graph represents the relation between the magnetic force (F) acting on each wire and its length (ℓ). Then the angle (θ) equals .....



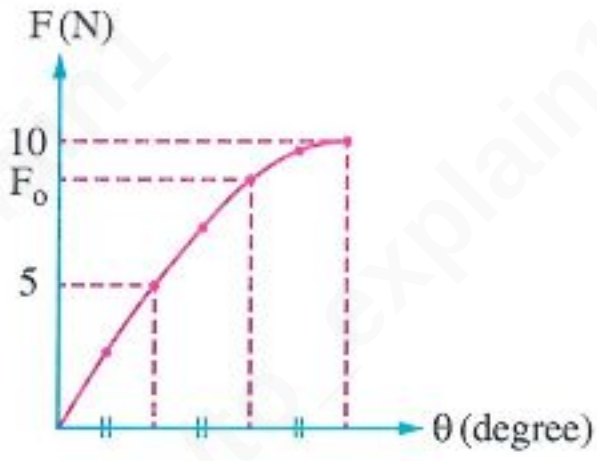
(a) 15° (b) 30° (c) 45° (d) 60°

11 Two wires x and y, of the same length carry electric currents of intensities I_x and I_y respectively. They are rotated in the same uniform magnetic field. The opposite graph represents the relation between the magnitude of the magnetic force (F) acting on each wire of the two wires and the sine of the angle between the wire and the direction of the magnetic field (sin θ). The ratio $(\frac{I_x}{I_y})$ is equal to ..... .



(a) $\frac{1}{\sqrt{3}}$ (b) $\sqrt{3}$ (c) $\frac{1}{3}$ (d) 3

12 A straight wire carrying an electric current is rotated in a uniform magnetic field. The opposite graph represents the relation between the magnetic force (F) acting on the wire and the angle of rotation (θ) of the wire during a quarter cycle from the parallel position to the field. The magnitude of the force (F_o) shown on the graph equals ..... .



(a) $5\sqrt{2}$ N (b) 7.5 N (c) 8 N (d) $5\sqrt{3}$ N

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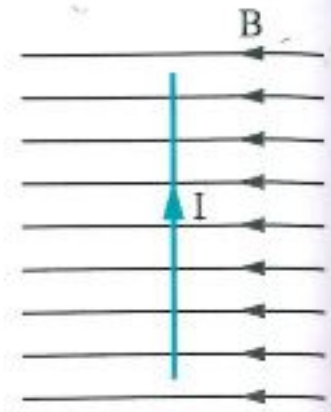
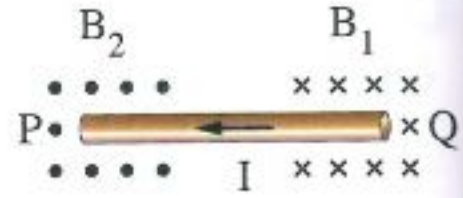
13 A wire of length 2 m carries an electric current of intensity 5 A perpendicular to a magnetic flux density of 0.4 T and its direction as in the opposite figure, so the value of the magnetic force which is acting on the wire and its direction are ..... .



(a) 2 N, out of the page
(b) 2 N, into the page
(c) 4 N, out of the page
(d) 4 N, into the page

14 The opposite figure represents a straight wire PQ which is free to move. If the wire is in the plane of the page and it carries an electric current of intensity I while two uniform magnetic fields are acting on its terminals, then which of the following choices shows the directions of motion of the terminals of the wire?



	The direction of motion of terminal P	The direction of motion of terminal Q
(a)	Perpendicular out of the page	Perpendicular into the page
(b)	Perpendicular into the page	Perpendicular out of the page
(c)	In the plane of the page upwards	In the plane of the page downwards
(d)	In the plane of the page downwards	In the plane of the page upwards

15 The following figures show a wire that carries an electric current of intensity (I) in different positions in a uniform magnetic field, so the wire which is affected by the maximum magnetic force is in the position ..... .

(1) (2) (3)

(a) (1)
(b) (2)
(c) (3)
(d) all of them are affected by the same magnitude of force

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16 ✱ The following figures illustrate three wires, each of them carries a direct electric current while being in a uniform magnetic field:

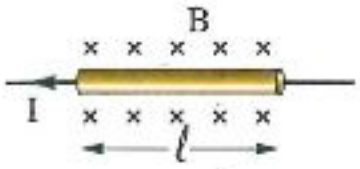


Figure (1)

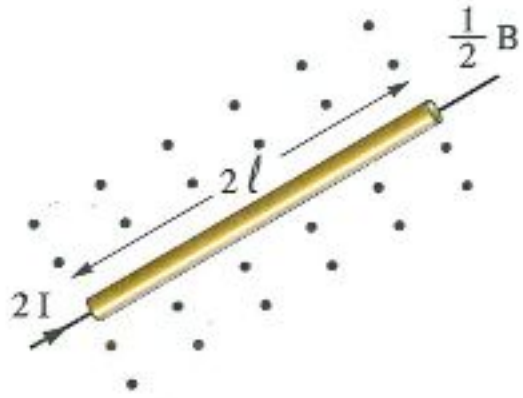


Figure (2)

Figure (3)

Which of the following represents the relation between the magnitudes of the magnetic forces which act on the wires?

(a) $F_1 > F_2 > F_3$ (b) $F_2 > F_1 > F_3$ (c) $F_3 > F_2 > F_1$ (d) $F_3 > F_1 > F_2$

17 A straight wire carries an electric current of intensity I is placed in three uniform magnetic fields of the same magnetic flux density but in different directions, as shown in the figures below.

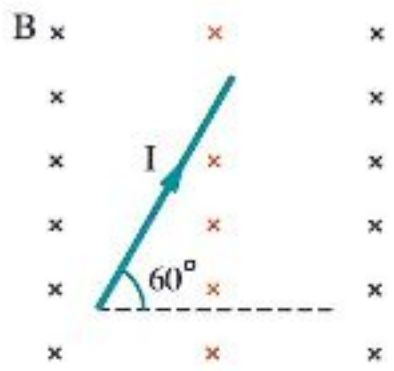


Figure (1)

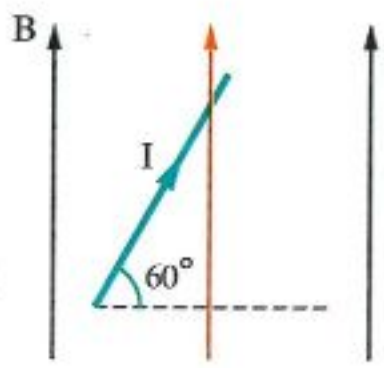


Figure (2)

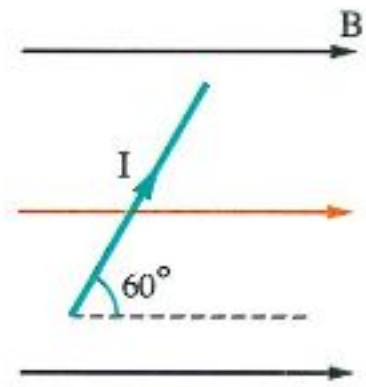
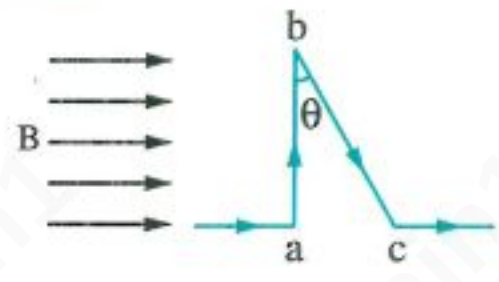


Figure (3)

Then, the correct order of the figures in terms of the magnitude of the magnetic force acting on the wire is ..... .

(a) (1) = (2) = (3) (b) (1) > (2) > (3) (c) (1) > (3) > (2) (d) (2) > (3) > (1)

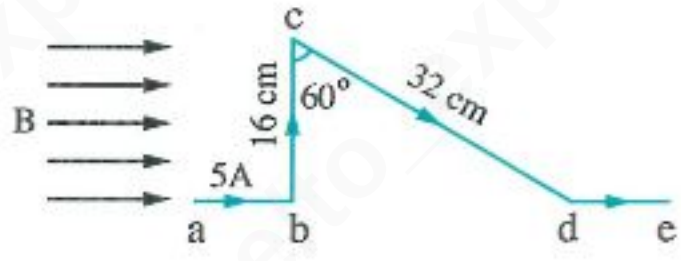
18 ✱ In the opposite figure, if the magnetic force acting on segment ab is F, then the force acting on segment bc ..... .



(a) is less than F (b) is greater than F

(c) equals F (d) equals F sin θ

19 ✱ In the opposite figure, if the passing electric current intensity in the wire is 5 A and the magnetic flux density is 0.15 T, so:



(i) The magnetic force which affects segment ab of the wire due to this flux equals ..... .

(a) 0.24 N (b) 0.12 N (c) 0.06 N (d) 0

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(ii) The magnetic force which affects segment bc of the wire due to this flux equals ..... .

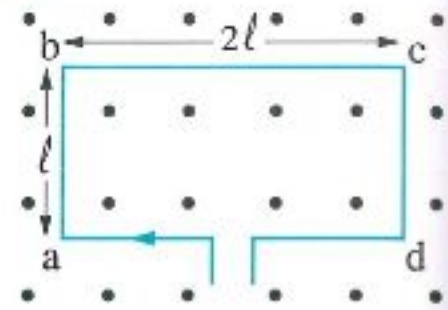
(a) 0.36 N (b) 0.25 N (c) 0.12 N (d) 0

(iii) The magnetic force which affects segment cd of the wire due to this flux equals ..... .

(a) 0.45 N (b) 0.37 N (c) 0.23 N (d) 0.12 N

---

20 The opposite figure shows a rectangular current-carrying coil abcd that is placed perpendicular to a magnetic field, so the ratio between the magnetic force that affects segment ab and the magnetic force that affects segment bc $\left(\frac{F_{ab}}{F_{bc}}\right)$ is ..... .



(a) greater than one (b) less than one (c) equal to one (d) equal to zero

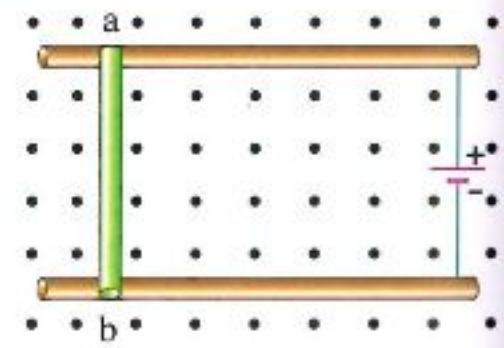
---

21 A wire of weight F is suspended horizontally parallel to the ground surface and perpendicular to a magnetic flux of density B as shown in the opposite figure, then when an electric current passes through the wire, the wire gets affected by a magnetic force of magnitude 2 F, so the resultant force on the wire equals ..... .

(a) F (b) 2 F (c) $\sqrt{5}$ F (d) 3 F

---

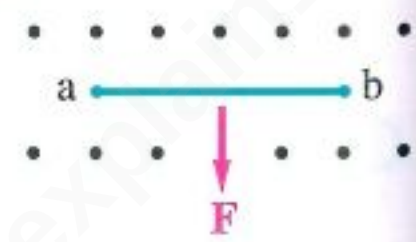
22 The opposite figure shows a cylindrical metallic rod ab that has a length of 20 cm, a resistance of 2 Ω and a mass of 400 g. The rod can slide on two frictionless, parallel rails of copper that have negligible resistances. A 6 V battery has been connected between the terminals of the two copper rails while a magnetic field of flux density 0.1 T is being directed perpendicular to the rod ab. What is the acceleration of the rod at the beginning of its motion? (Where: F = ma)



(a) 3 m/s^2 (b) 1.5 m/s^2 (c) 0.15 m/s^2 (d) 0.015 m/s^2

---

23 A straight wire ab of length 1.5 m that is placed in a magnetic field of 0.2 T. If the magnetic force that affects the wire is 2.4 N in the direction shown in the figure, then the value of the current I and its direction in the wire are ..... .



(a) 16 A, from a to b (b) 8 A, from a to b

(c) 16 A, from b to a (d) 8 A, from b to a

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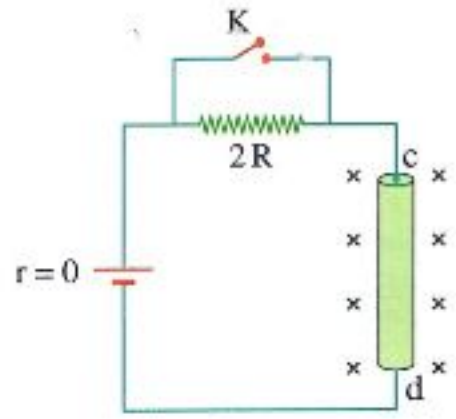
24 A rod (cd) of electric resistance R, is placed perpendicular to a uniform external magnetic field (B) and it is connected to an electric circuit as shown in the opposite diagram. If the magnetic force acting on the rod due to the external field is equal to F_o, then the magnitude of this force when the switch K is closed becomes ..... .



(a) $\frac{1}{3} F_o$ (b) $\frac{1}{2} F_o$ (c) $2 F_o$ (d) $3 F_o$

25 Two straight wires x, y made of the same material, having the same cross-sectional area and the length of wire x is greater than the length of wire y, they are placed perpendicular to a uniform magnetic field of flux density B each at a time. If the terminals of each wire are connected to a potential difference V, which of the two wires will be affected by a greater magnetic force?

(a) Wire (x). (b) Wire (y).

(c) Both are affected by the same magnitude of force.

(d) Neither of the wires is affected by a force.

26 ✱ A metallic straight wire of length ℓ, whose cross-sectional area is 10 mm^2 and the resistivity of its material is 2.8×10^{-8} Ω.m, is placed perpendicular to a magnetic field of flux density 10^{-3} tesla. The wire gets connected to a battery of emf 3 V whose internal resistance is negligible, so:

(i) The magnitude of the magnetic force which affects the wire equals ..... .

(a) 0.53 N (b) 0.85 N (c) 1.07 N (d) 2.13 N

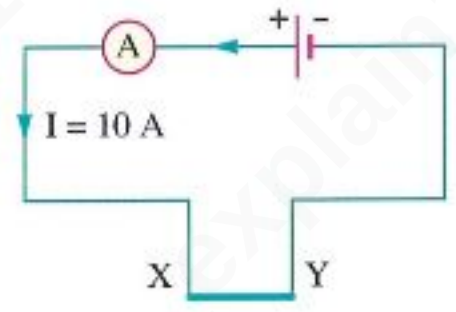
(ii) The magnitude of the magnetic force which affects the wire if its diameter is doubled equals ..... .

(a) 8.36 N (b) 4.28 N (c) 2.15 N (d) 1.07 N

27 A metal straight wire carries an electric current I, so a magnetic flux of density 10^{-5} T is produced at a point of 10 cm apart from it. If the wire is placed inclined by an angle of 30° in a magnetic flux of density 1.5 Wb/m^2, the magnetic force affecting unit length of the wire equals ..... .

(a) 2.5 N/m (b) 5 N/m (c) 3.75 N/m (d) 10 N/m

28 ✱ Aluminum wire XY of cross-sectional area 0.1 cm^2 is suspended horizontally while its terminals are touching the ends of an electric circuit as shown in the opposite figure, hence the density and the direction of the magnetic flux which keeps the wire suspended without any external support are ..... . (Take: $\rho_{Al} = 2700$ kg/m^3, g = 10 m/s^2)



(a) 27×10^{-3} T, perpendicular out of the page (b) 35×10^{-3} T, perpendicular out of the page

(c) 27×10^{-3} T, perpendicular into the page (d) 35×10^{-3} T, perpendicular into the page

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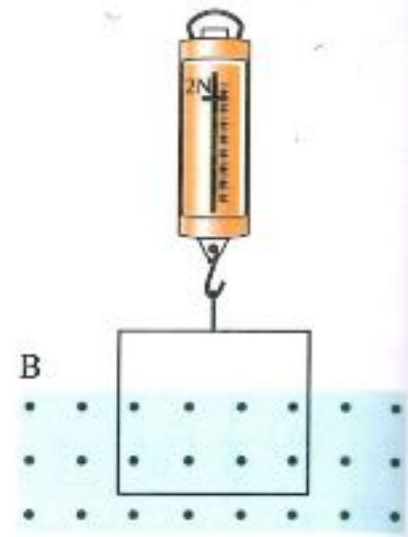
29 A metallic square frame, its side length is 20 cm is suspended to a spring scale whose reading was 2 N, the lower surface of the frame is affected by a magnetic field of a uniform magnetic flux density B as shown in the opposite figure, if an electric current of intensity 20 A passes through the coil in the anti-clockwise direction, then the reading of the scale became 2.2 N, then:



(i) The magnetic flux density (B) equals ..... .

(a) 0.1 T (b) 0.05 T

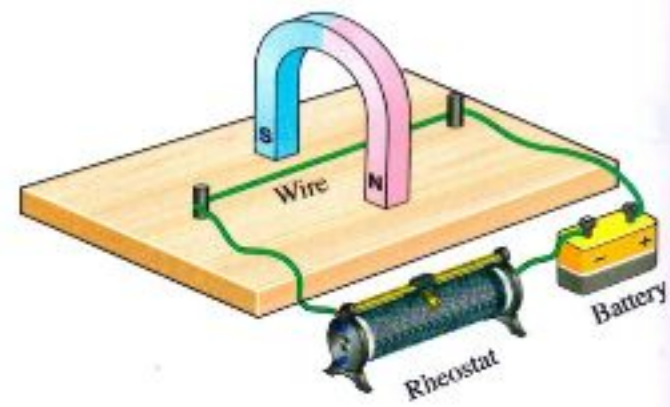
(c) 0.04 T (d) 0.02 T

(ii) The reading of the spring when the direction of the field is reversed equals ..... .

(a) 2.2 N (b) 2 N (c) 1.8 N (d) 0.2 N

---

30 ✱ A straight wire of weight w is placed horizontally perpendicular to a magnetic field, as shown in the opposite diagram. When an electric current of intensity I passed through the wire, the net force acting on it was equal to 3 w and directed vertically downward. Then the magnitude and the direction of the net force acting on the wire if:



(i) The direction of the magnetic field is reversed?

	The magnitude of the net force	The direction of the net force
(a)	w	Vertically upward
(b)	w	Vertically downward
(c)	3 w	Vertically upward
(d)	3 w	Vertically downward

(ii) The electric current passes through the wire is decreased to half its intensity?

	The magnitude of the net force	The direction of the net force
(a)	$\frac{3}{2}$ w	Vertically upward
(b)	$\frac{3}{2}$ w	Vertically downward
(c)	2 w	Vertically upward
(d)	2 w	Vertically downward

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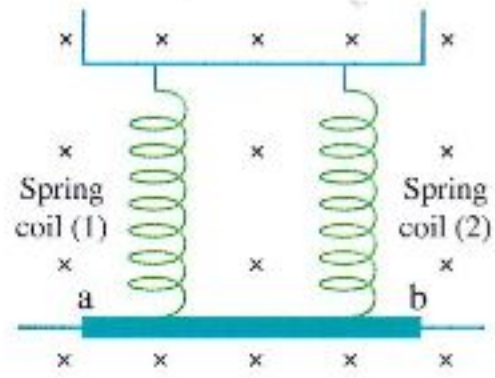
31 * Metallic rod ab of length 0.4 m and mass 50 g is suspended by two similar insulated spring coils of negligible masses and it is affected by a magnetic field of flux density 0.2 T as in the opposite figure, so:
(Take: The acceleration due to gravity = 10 m/s^2)



(i) The intensity and the direction of the electric current in the rod which make the tension forces in the spring coils equal zero are ..... .

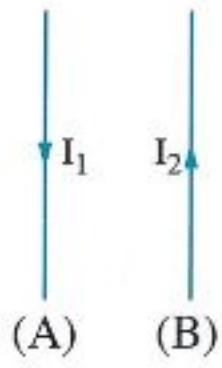
(a) 6.25 A, from a to b
(b) 4.5 A, from a to b
(c) 6.25 A, from b to a
(d) 4.5 A, from b to a

(ii) The magnitudes of tension forces in each spring coil if only the direction of the current is reversed while its intensity is kept unchanged are ..... .

(a) 0.12 N
(b) 0.25 N
(c) 0.5 N
(d) 0.7 N

The mutual force between wires

32 In the opposite figure, two wires (A) and (B) are carrying two electric currents I_1 and I_2 where $I_2 < I_1$, so, the direction of the acting magnetic force on wire (B) is ..... .

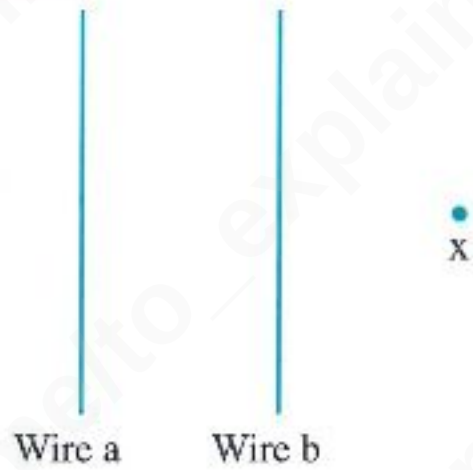


(a) into the page
(b) out of the page
(c) to the right side of the page
(d) to the left side of the page

33 The type of the mutual magnetic force between two current-carrying, parallel wires depends on ..... .

(a) the direction of the current in each of them
(b) the intensity of the current in each of them
(c) the distance between them
(d) their lengths

34 In the opposite figure, two straight parallel wires a, b , each carry an electric current. If the point x shown in the diagram represents the neutral point, then ..... .



(a) a repulsion force arises between two wires
(b) attraction force arises between two wires
(c) no magnetic force arises between two wires
(d) two equal electric currents pass through them

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35 Both of the following figures, 1 and 2, represent the magnetic field generated by the passage of an electric current through two long straight parallel wires placed perpendicular to the plane of the page.

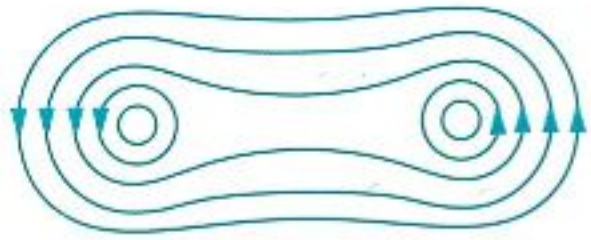


Figure (1)

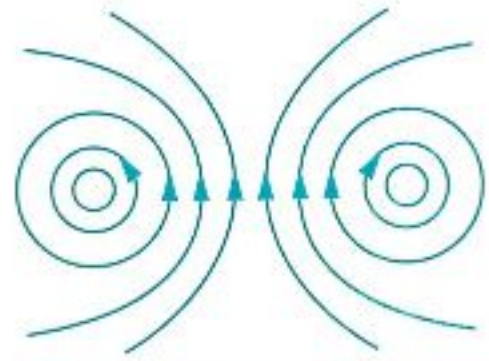
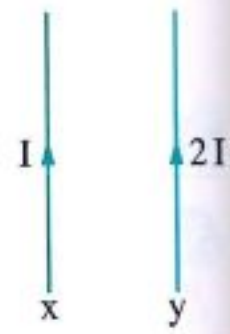


Figure (2)

In which of the two figures does the mutual magnetic force between the two wires become an attractive force?

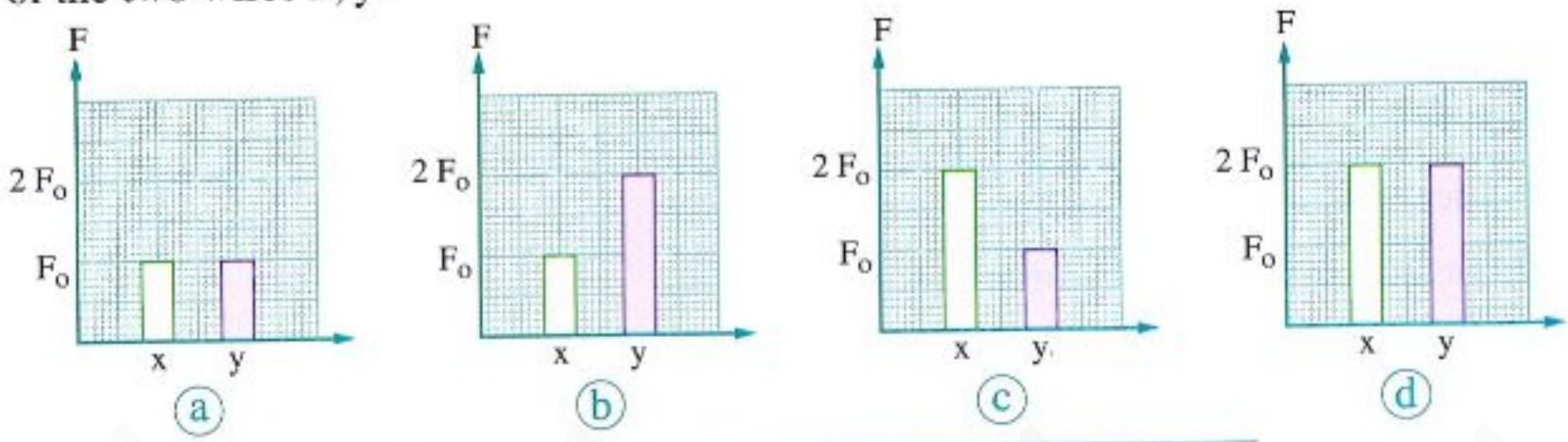
(a) In figure (1).
(b) In figure (2).
(c) In both figures.
(d) Neither of the figures.

36 In the opposite figure, the ratio between the magnetic force acting on wire x to that acting on wire y is ..... .

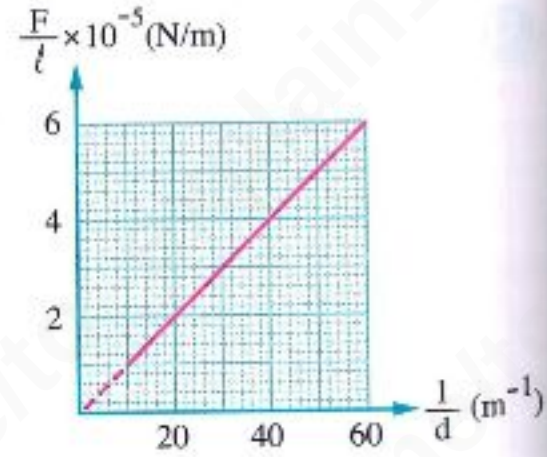


(a) $\frac{1}{1}$
(b) $\frac{2}{1}$
(c) $\frac{1}{2}$
(d) $\frac{1}{4}$

37 Two parallel straight wires x, y carry an electric current of intensity I and the magnetic force affected on each of them was F_o, if the electric current through wire x is increased to double, which of the following figures represents the magnetic force affecting on each of the two wires x, y?



38 The opposite figure represents the relation between the mutual magnetic force per the unit of length between two long parallel wires ($\frac{F}{\ell}$) and the reciprocal of the vertical distance between the two wires ($\frac{1}{d}$). If the current intensities that pass in the two wires have the same value, so the current intensity through any of them equals ..... .



(a) 1 A
(b) 1.51 A
(c) 2.24 A
(d) 3 A

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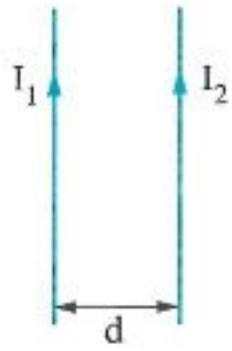
39 Two long parallel wires are separated by a distance d, both of them carry a current of intensity 10 A in the same direction, if the mutual magnetic force per unit length between them is 2×10^{-4} N/m, so distance d equals ..... .

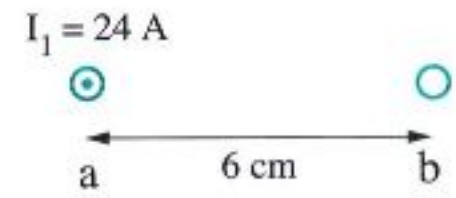
(a) 5 cm (b) 10 cm (c) 15 cm (d) 20 cm

40 In the opposite figure, two very long parallel wires are carrying electric currents where the mutual magnetic force between them is 0.01 N, so if the intensity of one of the two currents is increased to the double and the distance between them is decreased to the half, then the mutual magnetic force between them becomes ..... .



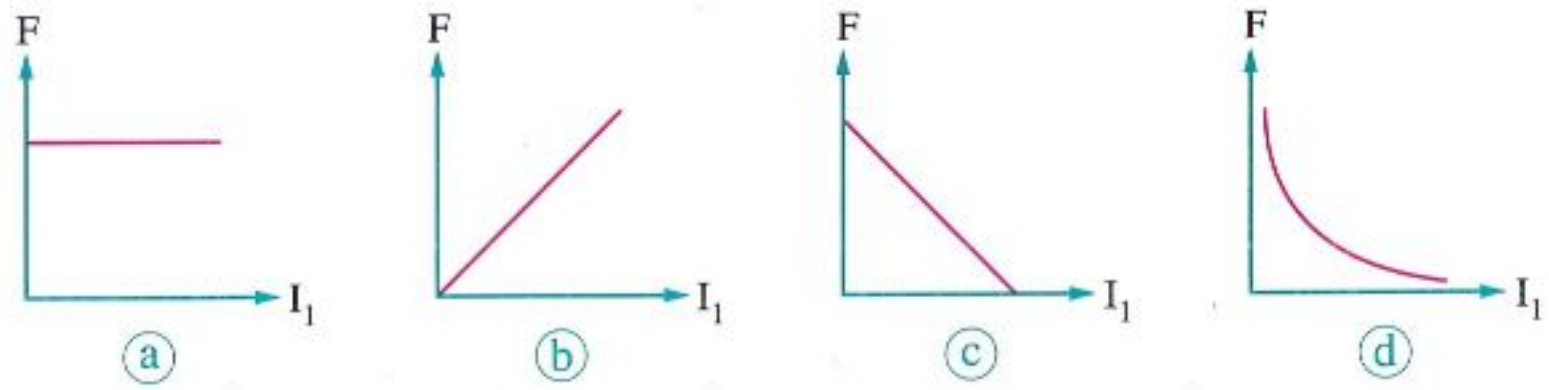
(a) 0.04 N (b) 0.02 N (c) 0.01 N (d) 0.005 N

41 The opposite figure shows two straight parallel wires a and b which are separated by a distance 6 cm. An electric current of intensity 24 A flows through wire a out of the plane of the page. If wire a is affecting wire b by an attraction force whose magnitude per a unit of length equals 8.8×10^{-4} N/m, so the magnitude and the direction of the current which passes through wire b are ..... respectively.

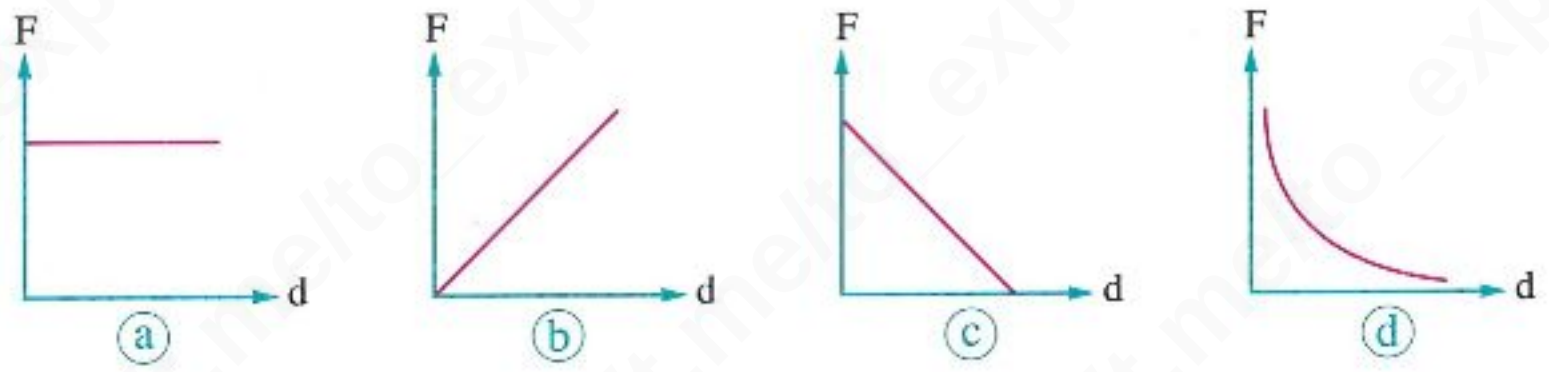


(a) 11 A, out of the page (b) 12.5 A, out of the page
(c) 11 A, into the page (d) 12.5 A, into the page

42 Which of the following graphs represents the relation between the mutual magnetic force (F) between two parallel current-carrying wires and the intensity of the current (I_1) which is passing in one of the two wires while holding the other factors constant?

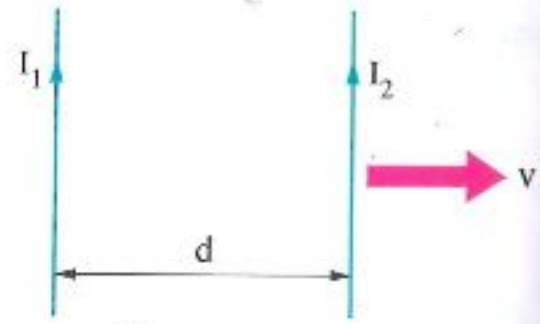


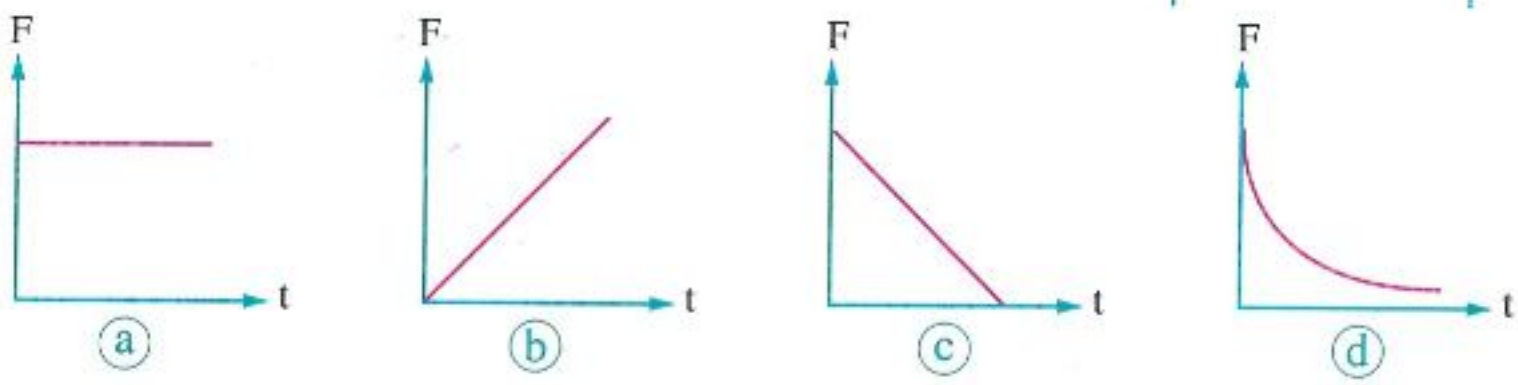
43 Which of the following graphs represents the variation of the mutual force (F) between two parallel current-carrying wires and the distance (d) between them?



https://t.me/to_explain1

44 In the shown figure, if the second wire is moving to the east with a uniform speed (v), which of the following graphs represents the variation of the mutual force (F) between the two wires with time (t)?





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45 ✱ A very long straight wire carries an electric current of intensity 5 A:

(Where : $\frac{\mu}{2\pi} = 2 \times 10^{-7}$ Wb/A.m)

(i) So, the formed magnetic flux density, due to the flow of the electric current in the wire, at a point in air which is separated by a perpendicular distance of 10 cm from the wire equals ..... .

(a) 1×10^{-5} T (b) 2×10^{-5} T (c) 3×10^{-5} T (d) 4×10^{-5} T

(ii) If another wire of length 50 cm is placed at a perpendicular distance of 10 cm parallel to the first wire while carrying an electric current of intensity 2 A, the force affecting this wire due to the field of the first wire equals ..... .

(a) 2.5×10^{-5} N (b) 1×10^{-5} N (c) 0.5×10^{-4} N (d) 0.25×10^{-4} N

---

46 ✱ Two straight, parallel wires which are separated by a distance of 2 m in air carry electric currents in the same direction. If the magnetic flux density has vanished at a point in the middle of the distance between the two wires and the acting force on one meter of any of them is 4×10^{-5} N, the intensities of the passing currents through each wire equal ..... .

(a) 10 A, 20 A (b) 15 A, 3 A (c) 10 A, 10 A (d) 20 A, 20 A

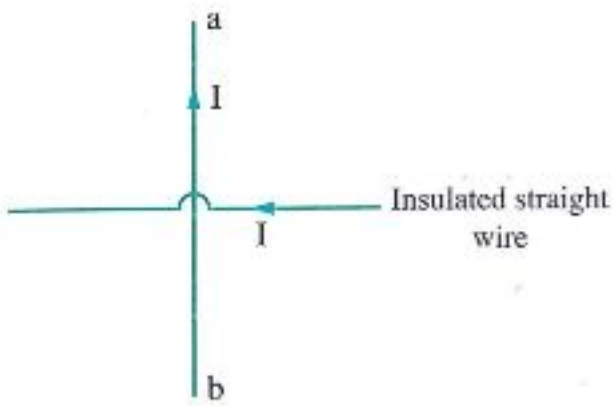
---

47 In the opposite figure, two straight, parallel wires x, y were carrying electric currents of the same intensity I and in the same direction, hence a magnetic force (F) is generated between them. When the current of wire x is increased by 4 A, the mutual force between the two wires is doubled. So, the value of I was equal to ..... .

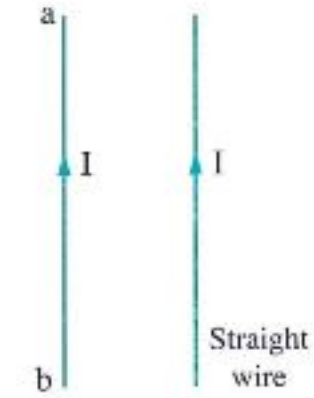
(a) 2 A (b) 4 A (c) 6 A (d) 8 A

https://t.me/to_explain1

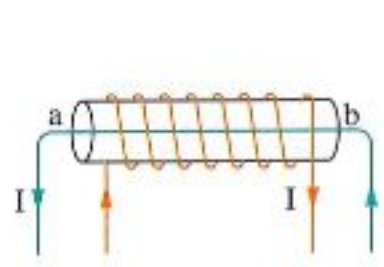
48 In which of the following cases is the insulated straight wire ab not affected by a net magnetic force?



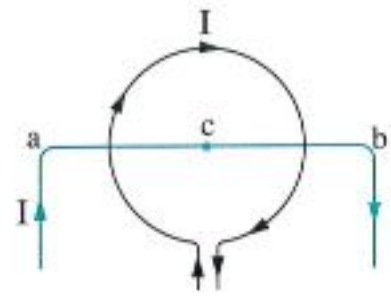
(a)



(b)

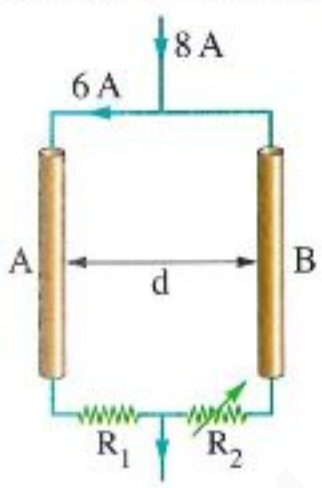


(c)

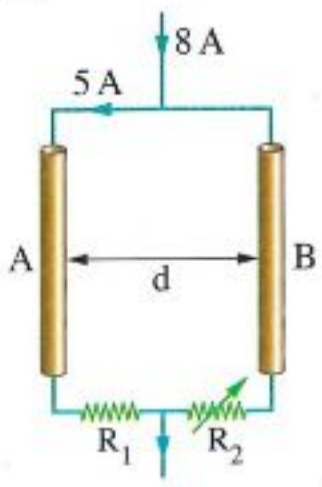


(d)

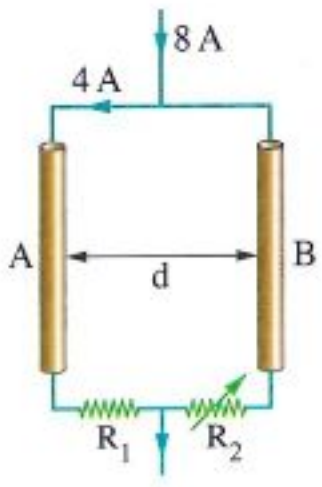
49 Two identical parallel straight wires A, B, the distance between them is d, if they are added to an electric circuit and the value of the variable resistance R_2 is changed, the intensity of the electric current passes through each of them is changed as shown in the following figures. In any of these figures, the magnitude of the mutual force between the two wires is the greatest?



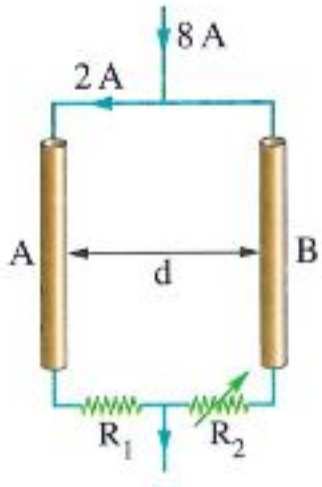
(a)



(b)

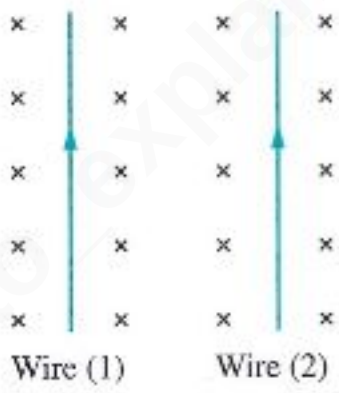


(c)



(d)

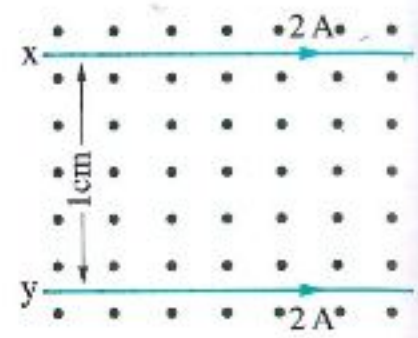
50 Two long parallel wires (1), (2), each carrying an electric current of intensity I , are placed perpendicular to an external uniform magnetic field, as shown in the opposite diagram. If the net magnetic force acting on unit length for each wire of the two wires is F_1 and F_2, respectively, which of the following relation is correct?



(a) $F_1 = F_2 = 0$ (b) $F_1 > F_2$ (c) $F_1 = F_2 \neq 0$ (d) $F_1 < F_2$

https://t.me/to_explain1

51 ✱ Two long parallel wires x, y, each carrying an electric current of intensity 2A , are placed in an external uniform magnetic field of density 2×10^{-5} T and its direction is perpendicular to each wire. What is the total magnetic force acting per unit length for:



(i) wire x?

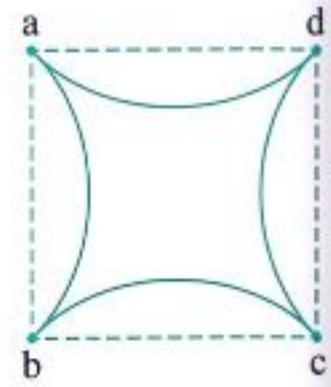
(a) 1.2×10^{-5} N/m (b) 4×10^{-5} N/m (c) 8×10^{-5} N/m (d) 1.2×10^{-5} N/m

(ii) wire y?

(a) 1.2×10^{-5} N/m (b) 4×10^{-5} N/m (c) 8×10^{-5} N/m (d) 1.2×10^{-4} N/m

---

52 An un-insulated elastic metal wire is shaped into a square abcd. Which two points on the frame must be connected to a DC source to take the position shown in the opposite figure?

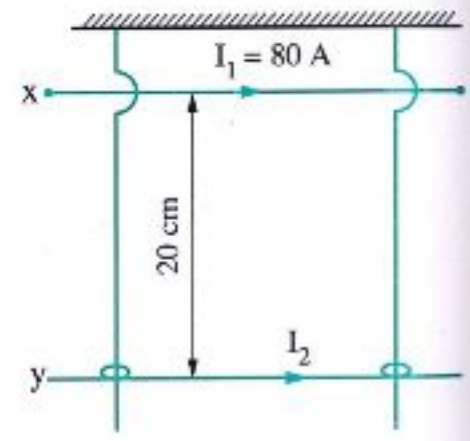


(a) b, a (b) d, a

(c) c, d (d) b, d

---

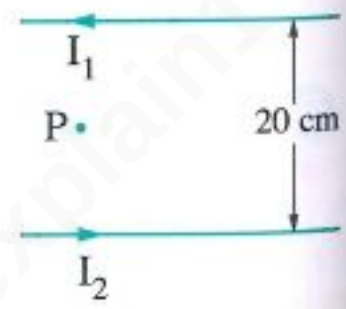
53 ✱ The opposite figure represents two straight horizontal wires (x, y) in the same plane where wire x is fixed horizontally while carrying a current of intensity 80 A at a distance 20 cm from wire y that can move up and down. If the mass of one meter of the wire y is 0.12 g/m, then the current intensity (I_2) that have to pass in this wire so it remains suspended and doesn't fall by the effect of gravity equals ..... . (Take: $g = 10$ m/s^2)



(a) 15 A (b) 20 A (c) 30 A (d) 40 A

---

54 ✱ Two parallel, straight wires, each of them has a length of 50 cm, are separated by a distance of 20 cm in air. The first wire carries a current of intensity I_1 and the second carries a current of intensity $I_2 = 10$ A in the directions that are shown in the opposite figure. If the total magnetic flux density at point P in the middle of the distance between the two wires is 6×10^{-5} T, the mutual magnetic force between them equals ..... .



(a) 10^{-2} N (b) 10^{-3} N (c) 10^{-4} N (d) 10^{-5} N

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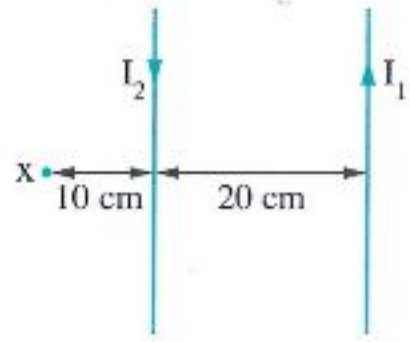
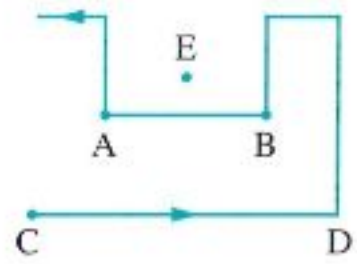
55 ✱ In the opposite figure, if point x is the neutral position and the magnetic force affecting one meter of any of the two wires is 12×10^{-6} N, the intensities of currents I_1 and I_2 respectively are ..... .



(a) 3 A, 1 A (b) 1 A, 1 A
(c) 6 A, 4 A (d) 6 A, 2 A

---

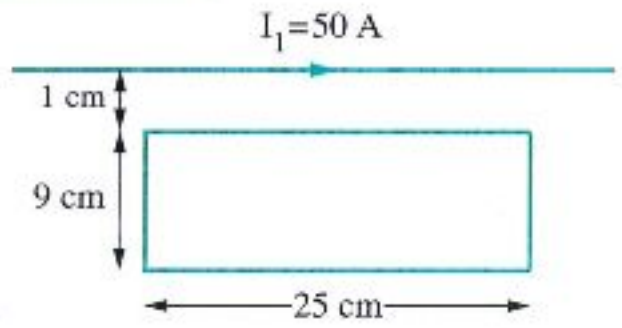
56 ✱ In the opposite figure, two horizontal wire segments AB and CD are in one vertical plane carrying a current of intensity 50 A. Wire segment AB which is 1 m long and has a mass of 5 g is free to move vertically, while wire segment CD is fixed, so by neglecting the magnetic flux due to the vertical segments of the wires, the required distance between the two wire segments to hold segment AB balanced equals ..... . (Take: g = 10 m/s^2)



(a) 0.23 m (b) 0.15 m (c) 0.02 m (d) 0.01 m

---

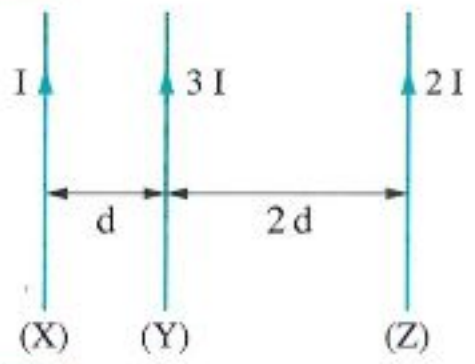
57 ✱ The opposite figure represents a frame of dimensions 25 cm, 9 cm where its mass is 4.5 g. A long straight horizontal wire that carries an electric current of 50 A is placed above it, so the intensity and the direction of the current that should be passing through the frame to remain vertically suspended in air are ..... . (Take: g = 10 m/s^2)



(a) 200 A, anti-clockwise (b) 200 A, clockwise
(c) 100 A, anti-clockwise (d) 100 A, clockwise

---

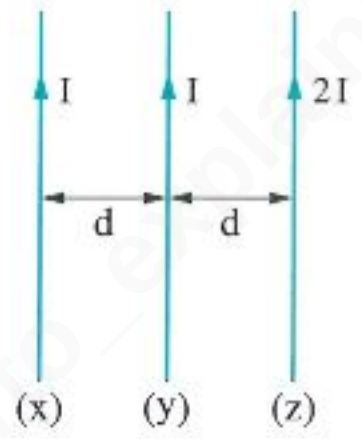
58 In the opposite figure, three long parallel wires carry electric currents, so which of these wires are not affected by a net magnetic force?



(a) Z (b) Y
(c) X (d) Both X and Z

---

59 Three long straight parallel wires x , y and z carry currents in the same direction of intensities I , I and 2I respectively as shown in the opposite figure. Which of the wires is affected by the greatest net magnetic force?



(a) Wire x
(b) Wire y
(c) Wire z
(d) The three wires are affected by the same magnitude of force.

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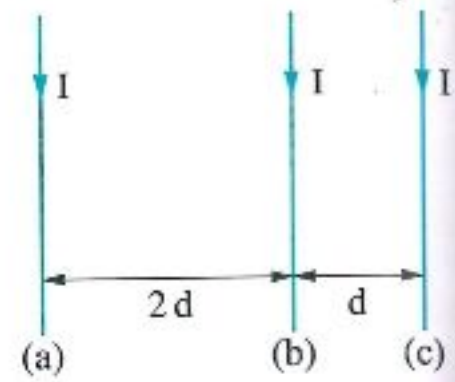
60 In the opposite figure, three long parallel wires (a), (b) and (c) are in the plane of the page carrying electric currents of the same intensity in the directions shown in the figure, so the direction of the net magnetic force acting on wire (b) is ..... .



(a) perpendicular into the plane of the page

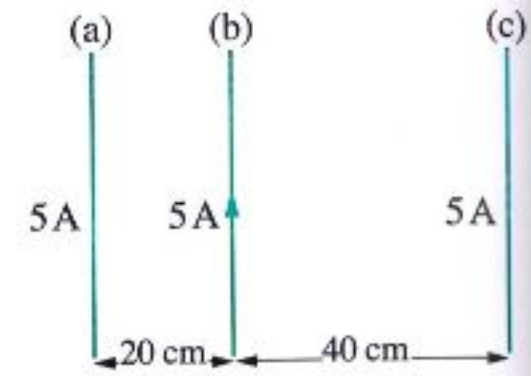
(b) perpendicular out of the plane of the page

(c) in the plane of the page towards the right side

(d) in the plane of the page towards the left side

---

61 ✱ In the opposite figure, three parallel wires each carries electric current of intensity 5 A. They are placed in the same plane, hence the force affecting one meter of wire (b), when the two electric currents in the two other wires (a) and (c):



(i) are in the same direction, equals ..... .

(a) 50×10^{-6} N (b) 37.5×10^{-6} N

(c) 25×10^{-6} N (d) 12.5×10^{-6} N

(ii) are in opposite directions, equals ..... .

(a) 75×10^{-6} N (b) 37.5×10^{-6} N (c) 19×10^{-6} N (d) 14×10^{-6} N

---

62 ✱ Two straight, parallel wires are separated by a distance of 10 cm. A current of intensity 2 A passes in one of them while 3 A in the other and in the same direction, so:

(i) The distance of the neutral point from the wire that carries the 2 A current equals ..... .

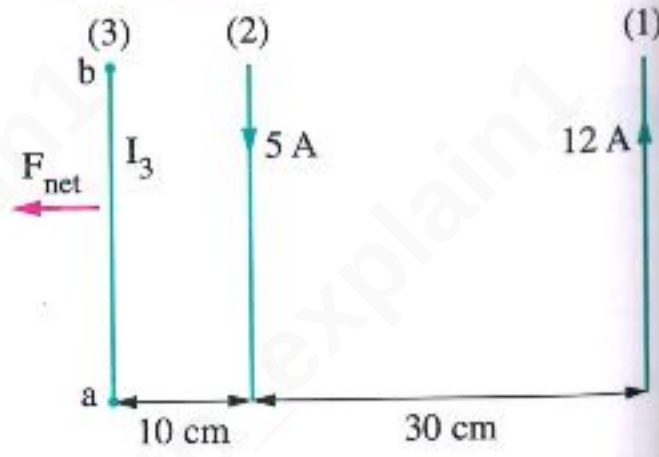
(a) 2.5 cm (b) 4 cm (c) 6.5 cm (d) 8 cm

(ii) If the direction of the current in one of the wires is reversed and a third wire of length 10 cm that carries a current of 5 A is placed parallel to them and in the same plane at the neutral point of the previous part, the force affecting this wire will equal ..... .

(a) 7.3×10^{-5} N (b) 5×10^{-5} N (c) 2.5×10^{-5} N (d) 10^{-5} N

---

63 The opposite figure represents three long straight wires which are placed in the plane of the page, each of them carries an electric current in the direction shown in the figure. If the resultant magnetic force acting on unit length of wire (3) is 3×10^{-6} N/m and its directions is parallel to the plane of the page to the left side, then the intensity and the direction of the current in wire (3) is ..... .



(a) 0.75 A, from b to a (b) 0.75 A, from a to b

(c) 5 A, from b to a (d) 5 A, from a to b

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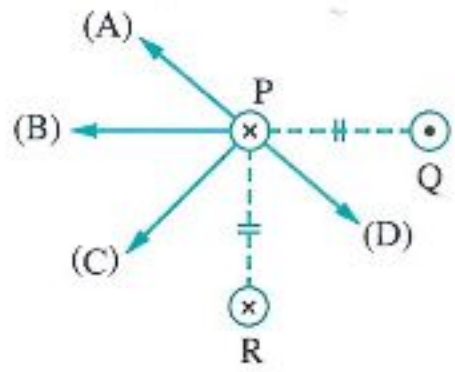
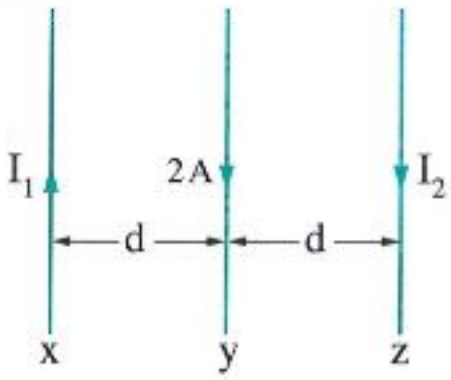
64 The opposite figure shows three long wires P, Q and R which are placed normal to the page. If all of them carry currents of the same intensity, however, the directions of the currents in P and R are into the page and the direction of the current in Q is out of the page, so which of the shown arrows (A, B, C, or D) represents the direction of the resultant magnetic force on wire P?



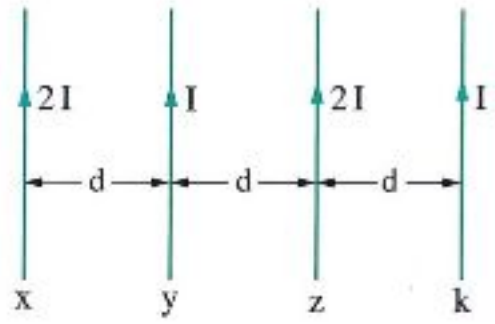
(a) A (b) B (c) C (d) D

65 ✳ In the opposite figure, three parallel, straight current-carrying wires are in the same plane, if you know that the magnetic force that affects a unit length of wire y is F and when the current of wire x is reversed, the force that affects a unit length of wire y becomes $\frac{1}{2}$ F. Given that $I_2 < I_1$, so the ratio between the two currents $(\frac{I_1}{I_2})$ equals ..... .



(a) $\frac{2}{1}$ (b) $\frac{3}{1}$ (c) $\frac{4}{1}$ (d) $\frac{5}{4}$

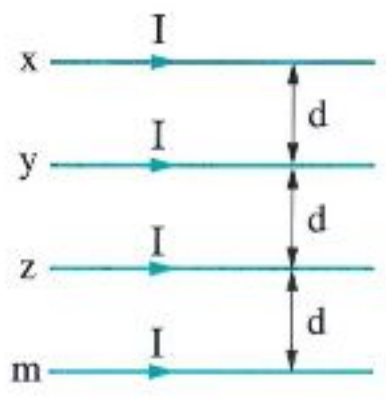
66 ✳ Four straight parallel wires x, y, z, k, each of them carries an electric current as shown in the opposite figure, then the magnitude of the magnetic force for a unit length of wire z is equal to ..... .



(a) $\frac{1}{2} \times \frac{\mu I^2}{\pi d}$ (b) $\frac{\mu I^2}{\pi d}$

(c) $2 \times \frac{\mu I^2}{\pi d}$ (d) $4 \times \frac{\mu I^2}{\pi d}$

67 The opposite figure shows four identical parallel wires x, y, z and m carry an electric current of intensity I in the same direction, if the resultant of the magnetic force affected on wire z equals F, then the resultant of the magnetic force affected on wire m equals ..... .



(a) $\frac{11}{3}$ F (b) $\frac{11}{6}$ F (c) $\frac{11}{5}$ F (d) $\frac{11}{2}$ F

68 Five parallel straight wires x, y, z, k and ℓ are separated by equal distances and each of them carry an electric current of intensity I as shown in the opposite figure, so the correct order for the wires in terms of the value of the magnetic force affecting each of them is .....

(a) $z > x = \ell > y = k$ (b) $y = k > x = \ell > z$

(c) $x = \ell > z > y = k$ (d) $x = \ell > y = k > z$

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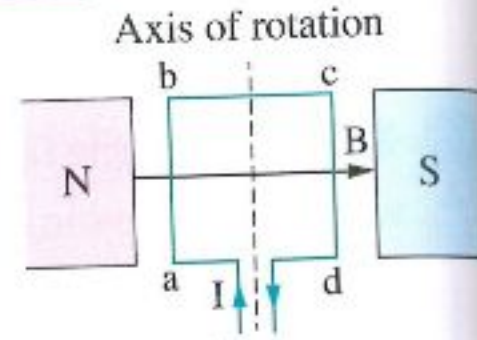
The magnetic torque

69 The torque (τ) acting on a current-carrying coil that is placed in a uniform magnetic field becomes maximum when the plane of the coil is ..... the direction of the magnetic field.

(a) perpendicular to (b) parallel to
(c) inclined with an angle of 30° to (d) inclined with an angle of 60° to

70 A square coil abcd carries an electric current of intensity I and is placed in magnetic field of flux density B as shown in the opposite figure, if the coil is rotated a quarter cycle from the position shown in the figure, what happens to :



(i) the magnitude of magnetic force affecting side ab?

(a) Increases. (b) Decreases but doesn't vanish.
(c) Decreases till vanishes. (d) Remains unchanged.

(ii) the magnetic force affecting side bc?

(a) Increases. (b) Decreases but doesn't vanish.
(c) Decreases till vanishes. (d) Remains unchanged.

(iii) the magnetic torque affecting the coil?

(a) Increases. (b) Decreases but doesn't vanish.
(c) Decreases till vanishes. (d) Remains unchanged.

71 ✱ An electric motor consists of a coil of 200 turns where each turn has a cross-sectional area of 300 cm^2, if the coil of the motor is positioned parallel to a magnetic field of flux density 0.4 T, it gets affected by a torque of 20 N.m. So, the intensity of the passing current in the coil equals ..... .

(a) 4.37 A (b) 8.33 A (c) 11.53 A (d) 13.98 A

72 A coil of 500 turns, each turn has a cross-sectional area of 0.2 m^2, carries an electric current of intensity 10 A where it is placed in a magnetic flux of density 0.25 tesla, so the torque affecting the coil, when the angle between the normal to the coil and the direction of the field is 30°, equals ..... .

(a) 50 N.m (b) 75 N.m (c) 110 N.m (d) 125 N.m

73 ✱ A rectangular coil of dimensions 20 cm, 10 cm, that consists of 200 turns of wire through which a current of 3 A is passing, is placed in a uniform magnetic field of 0.4 tesla, so the torque affecting the coil when:

(i) it is positioned at 60° to the direction of the magnetic field equals ..... .

(a) 0 (b) 2.4 N.m (c) 3.6 N.m (d) 4.5 N.m

(ii) its plane is positioned perpendicular to the direction of the magnetic field equals .....

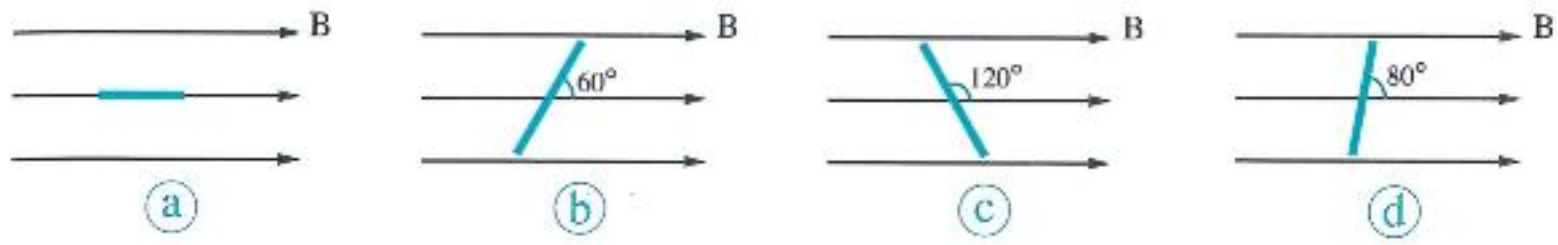
(a) 6.2 N.m (b) 4.8 N.m (c) 2.5 N.m (d) 0

(iii) its plane is positioned parallel to the direction of the magnetic field equals ..... .

(a) 7.4 N.m (b) 0 (c) 4.8 N.m (d) 5.3 N.m

https://t.me/to_explain1

74 Which of the following positions for a current-carrying coil placed in a uniform magnetic field expresses the smallest value of the torque?



ⓐ ⓑ ⓒ ⓓ

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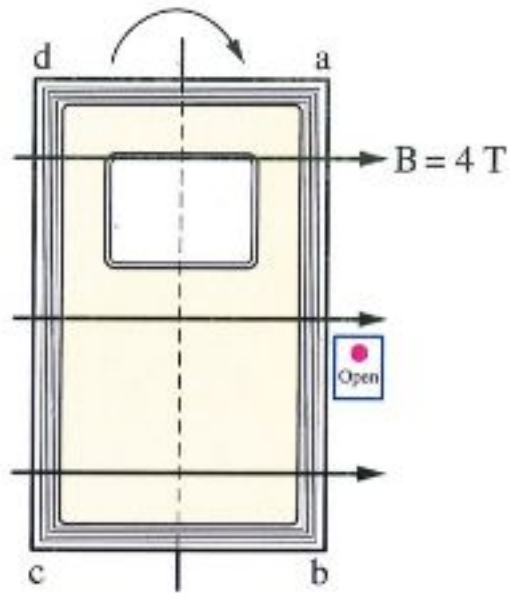
75 An inventor wants to design a door abcd of area 2 m^2 that opens automatically where the door is wrapped by coil of 50 turns of wires as shown in the figure, such that the door starts rotation about its axis with a torque of 400 N.m from the shown position and the direction of side ab is out of the page, hence the intensity and the direction of the current through side ab of the door have to be ..... .

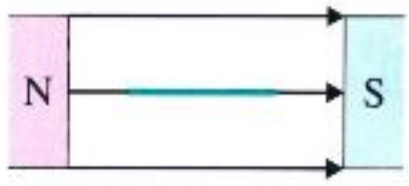


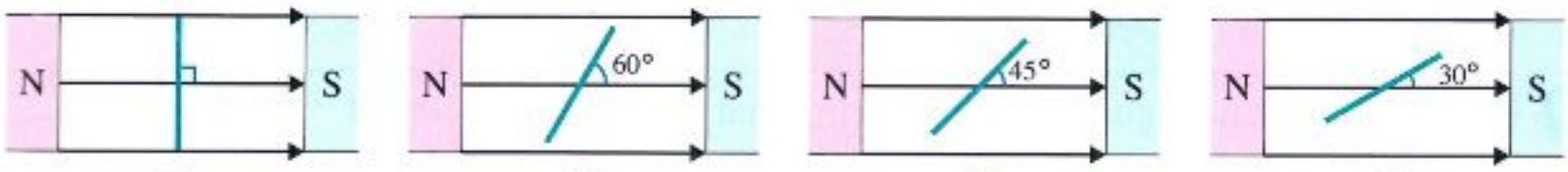
ⓐ 1 A, from a to b ⓑ 0.5 A, from a to b

ⓒ 1 A, from b to a ⓓ 0.5 A, from b to a

---

76 The opposite figure shows a lateral view of a rectangular current-carrying coil that is placed in a magnetic field. In which the coil is affected by a torque (τ), so which of the following positions of the coil makes the torque = $\frac{\tau}{2}$?





ⓐ ⓑ ⓒ ⓓ

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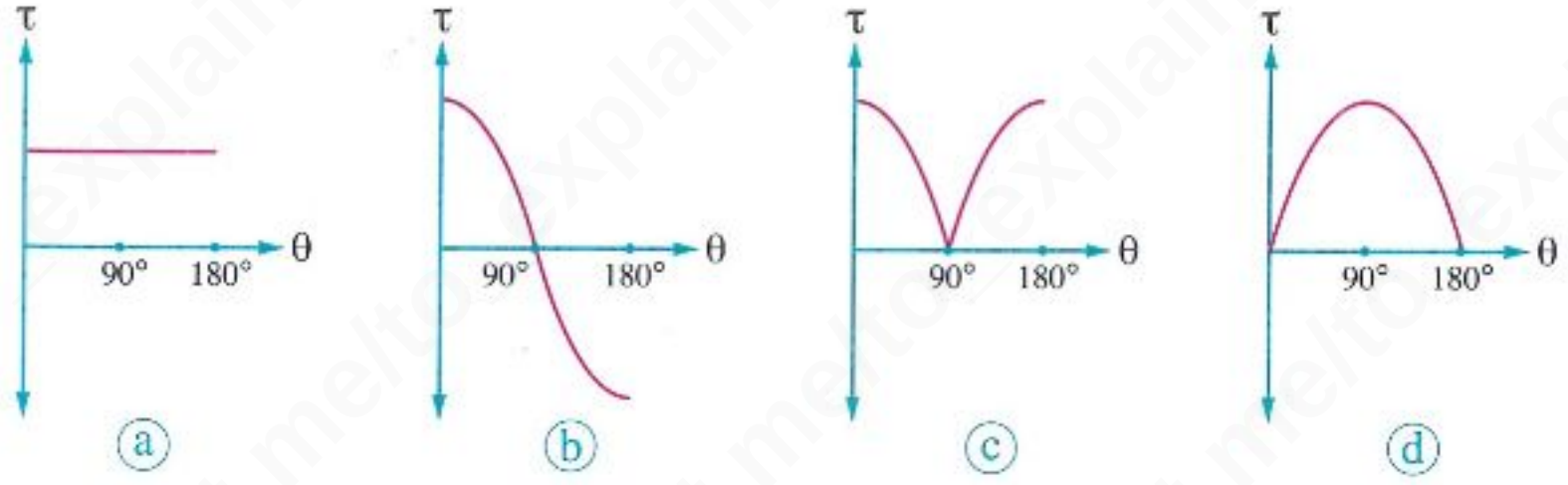
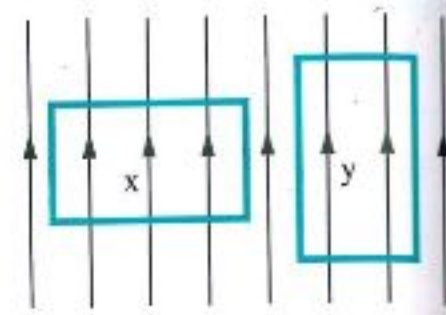
77 Which of the following graphs represents the relation between the torque (τ) on a coil that carries an electric current in a uniform magnetic field and the angle between the coil's plane and the normal to the field (θ) during half cycle from the perpendicular position to the field?



ⓐ ⓑ ⓒ ⓓ

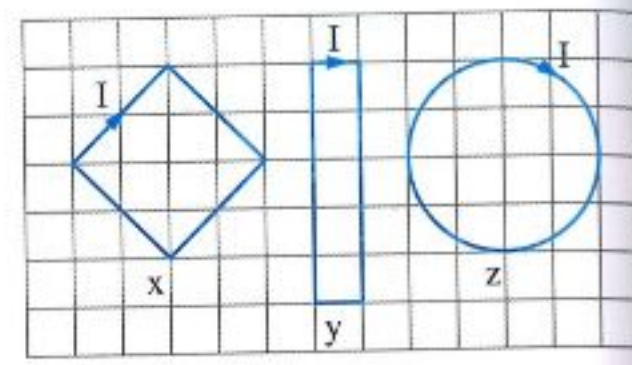
https://t.me/to_explain1

78 The opposite figure shows two identical frames x and y, whose dimensions are ℓ and 2ℓ. The two coils are placed in a uniform magnetic field, so the ratio of torques which act on each of the frames $(\frac{\tau_x}{\tau_y})$, if both of them carry the same electric current equals ..... .



(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{3}{1}$ (d) $\frac{1}{1}$

79 Three coils x, y and z, each of them consists of one turn, are different in the shape and their dimensions are shown in the opposite graph, if the plane of these coils are parallel to a uniform magnetic field of flux density B and carry an electric current of intensity I, then the correct order for the magnetic torque affecting them is ..... .

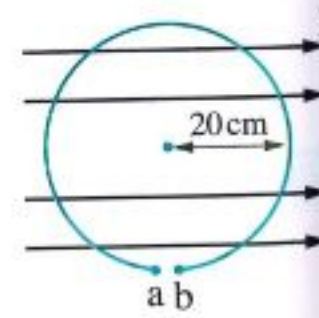


(a) $\tau_x > \tau_y > \tau_z$ (b) $\tau_x > \tau_z > \tau_y$ (c) $\tau_z > \tau_y > \tau_x$ (d) $\tau_z > \tau_x > \tau_y$

80 A rectangular coil has 50 turns of wire through which a magnetic flux of maximum value 0.2 Wb is passing, hence the maximum value of the torque that can affect the coil when it carries a current of intensity 2 A equals ..... .

(a) 20 N.m (b) 40 N.m (c) 60 N.m (d) 80 N.m

81 ✱ In the opposite figure, a metallic ring that is made of a wire of resistance 0.1 Ω nearly forms a complete circle. If a battery of emf 9 V that has a negligible internal resistance is connected between a and b, the torque affecting the ring due to the effect of a uniform magnetic field (B) of flux density 0.4 T that is directed parallel to the plane of the ring equals ..... . (Take: $\pi = 3.14$)



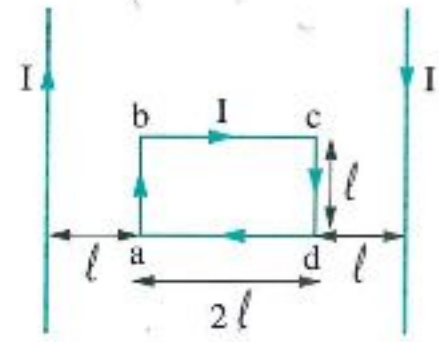
(a) 2.35 N.m (b) 3.75 N.m (c) 3.92 N.m (d) 4.52 N.m

82 ✱ A battery of emf 14 V, whose internal resistance is negligible, is connected to a circular coil of radius 10 cm. If the coil is made of a wire whose material's resistivity is 7×10^{-7} Ω.m and its radius is 1 mm, the torque affecting the coil when its plane is positioned parallel to a magnetic field of flux density 0.5 T equals ..... . (Take: $\pi = 3.14$)

(a) 0.53 N.m (b) 0.61 N.m (c) 0.93 N.m (d) 1.57 N.m

https://t.me/to_explain1

83 A metallic rectangular frame abcd is placed in the same plane between two long, straight and parallel wires, if currents of equal intensity I are set up in each of them as shown in the opposite figure, the coil (frame) will ..... .



(a) rotate about an axis that is parallel to the two wires

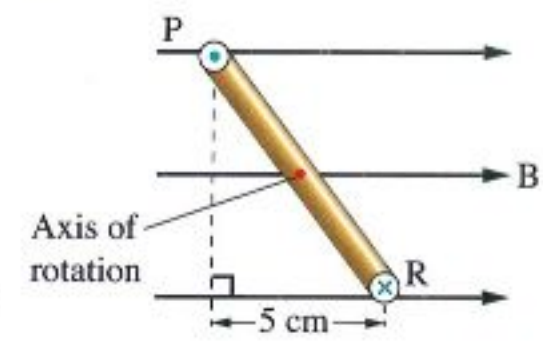
(b) rotate about an axis that is perpendicular to the two wires

(c) move upwards in a direction parallel to the two wires

(d) not be affected by a torque

---

84 The opposite diagram represents a top view of a rectangular coil that carries an electric current which is directed out of the page at point P and into the page at point R, so if the length of side PR of the coil which is perpendicular to the axis of rotation is 10 cm, how much will be the magnitude of the torque that affects the coil in this position with respect to the maximum value of the torque (τ_o)?



(a) $\sqrt{2}\,\tau_o$ (b) $\frac{1}{\sqrt{2}}\,\tau_o$ (c) $\frac{\sqrt{3}}{2}\,\tau_o$ (d) $\frac{1}{2}\,\tau_o$

---

85 Two coils x, y, each carries an electric current and placed in a uniform magnetic field B as shown in the two figures (1) and (2) :

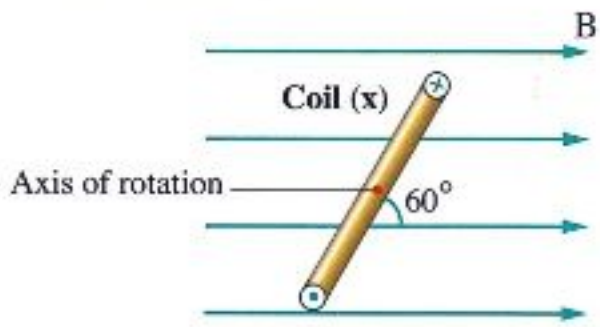


Figure (1)

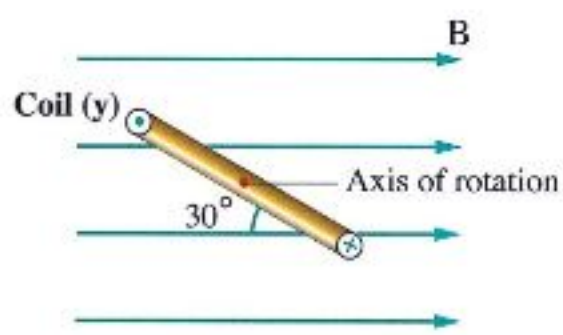


Figure (2)

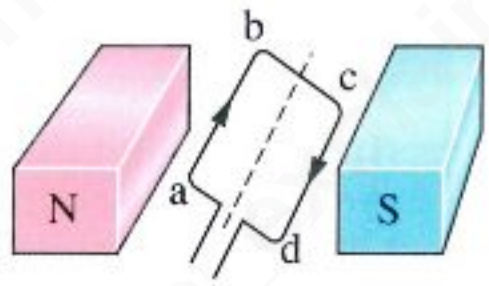
Which of the two coils, when rotated 60° around the axis shown in the figure, causes the magnetic torque acting on it vanishes?

(a) Coil (x) only. (b) Both of the two coils.

(c) Coil (y) only. (d) Neither of the two coils.

---

86 The opposite diagram represents a coil abcd of one turn and its dimensions are 5 cm and 10 cm, it carries an electric current and placed in a uniform magnetic field. If the plane of the coil is inclined at an angle of 60° to the direction of the field and the magnetic force acting on side bc in the given position is 0.5 N, then the value of the magnetic torque acting on the coil in this position is approximately equal to ..... .



(a) 0.01 N.m (b) 0.02 N.m (c) 0.03 N.m (d) 0.05 N.m

https://t.me/to_explain1

87 The magnetic torque acting on a coil carrying an electric current and rotating in a uniform magnetic field vanishes when the direction of the magnetic dipole moment of the coil is ..... .

(a) parallel to the direction of the field.

(b) perpendicular to the direction of the field.

(c) inclined by angle 45° to the direction of the field.

(d) inclined by angle 135° to the direction of the field.

88 A one-turn square coil that was made of a wire of length 32 cm has been re-wound as a square coil of 4 identical turns, if a current of the same intensity has flowed through the coil in both cases, the magnetic dipole moment of the coil in the first case is ..... of that in the second case.

(a) quadruple (b) double (c) half (d) quarter

89 A rectangular coil that carries an electric current of intensity I is positioned perpendicular to a magnetic flux of density B, so the magnetic dipole moment of the coil increases when ..... .

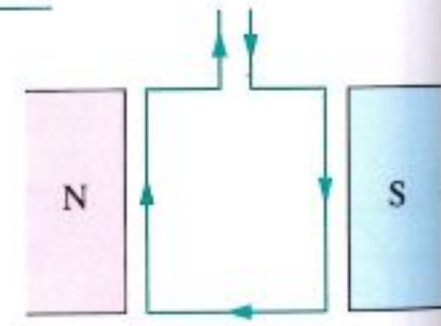
(a) the plane of the coil becomes parallel to the magnetic flux

(b) the magnetic flux density (B) increases

(c) the passing current intensity (I) in the coil increases

(d) the net magnetic flux (ϕ_m) through the coil increases

90 The opposite figure represents a rectangular metal frame that carries an electric current while being in the plane of the page parallel to a uniform magnetic field, so the direction of the magnetic dipole moment of that coil is ..... .



(a) parallel to page and rightward (b) parallel to page and leftward

(c) perpendicular into the page (d) perpendicular out of the page

91 A coil of cross-sectional area 0.001 m^2 carrying an electric current of 10 A is placed in a magnetic field of density 2 T and inclined by an angle of 60° on the field. So, the torque acting on it equals 1 N.m, so:

(i) The number of turns of the coil equals ..... turns.

(a) 15 (b) 50 (c) 100 (d) 200

(ii) The maximum value of torque acting on the coil is ..... .

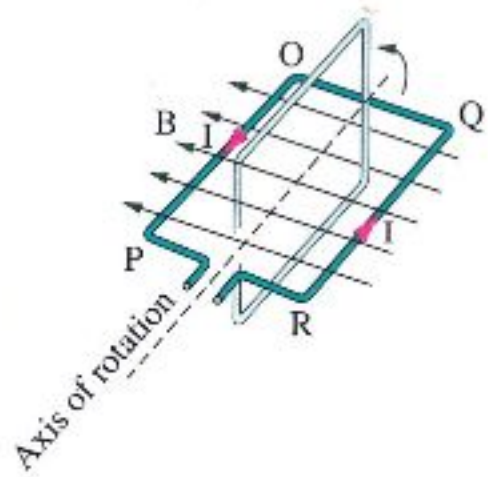
(a) 2 N.m (b) 1.5 N.m (c) 1 N.m (d) 0.5 N.m

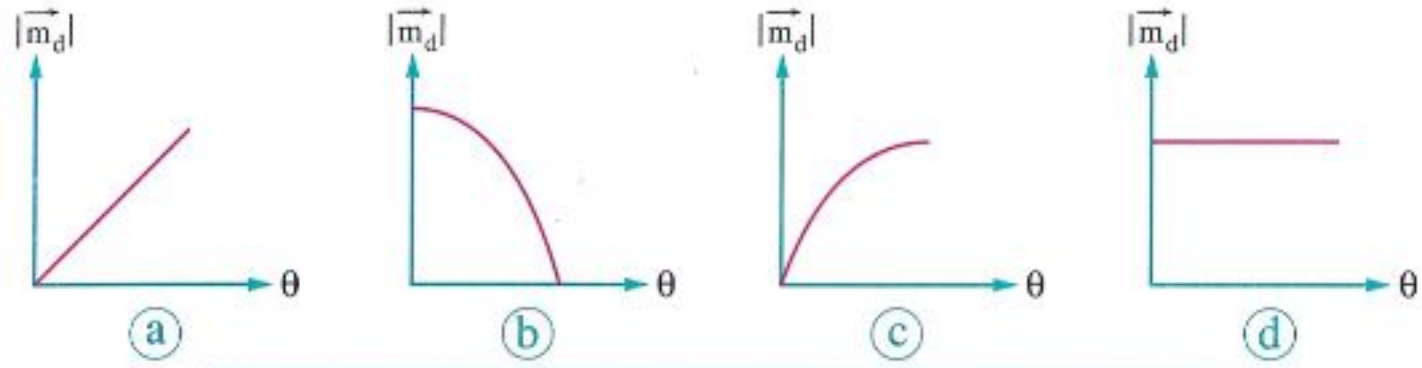
(iii) The magnetic dipole moment of the coil equals ..... .

(a) 2 $A.m^2$ (b) 1.5 $A.m^2$ (c) 1 $A.m^2$ (d) 0.5 $A.m^2$

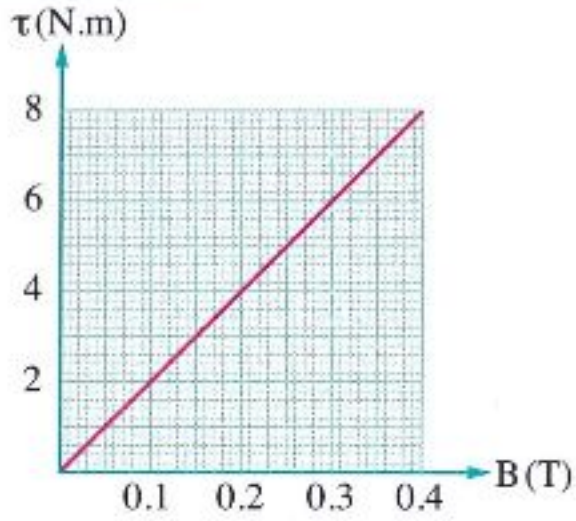
https://t.me/to_explain1

92 The opposite figure represents a rectangular coil (POQR) that has N turns of wire and carries an electric current of intensity I. The coil is placed in a uniform magnetic flux of density B where the coil's plane is parallel to the magnetic flux lines, so which of the following graphs represents the variation of the magnitude of the magnetic dipole moment $|\overrightarrow{m_d}|$ of the coil with respect to the angle of rotation (θ) when the coil rotates through an angle of 90° from this position?



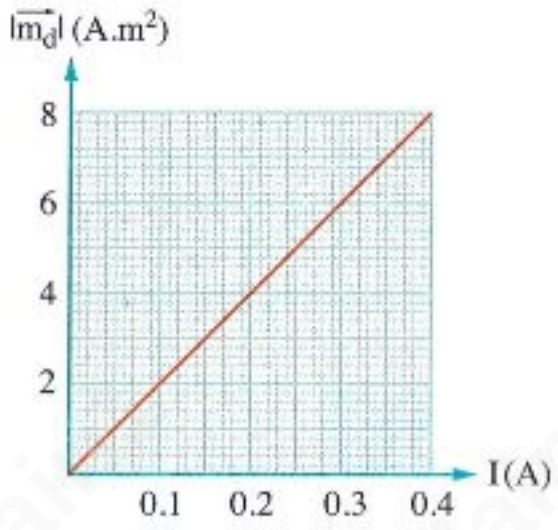


93 The opposite graph represents the relation between the torque (τ) acting on a current-carrying rectangular coil and the magnetic field (B) that is positioned parallel to the plane of the coil and has a changeable uniform strength, so the magnitude of the magnetic dipole moment of the coil equals ..... .



(a) 10 $A.m^2$ (b) 15 $A.m^2$
(c) 20 $A.m^2$ (d) 40 $A.m^2$

94 A coil of 50 turns carries an electric current and rotates in a uniform magnetic field of flux density B. The opposite graph represents the variation of the magnetic dipole moment $|\overrightarrow{m_d}|$ of the coil and the electric current intensity (I) that passes through it, if a maximum magnetic flux of 0.2 Wb passes through the coil during its rotation, then the magnetic flux density (B) in which the coil is placed is equal to ..... .



(a) 0.5 T (b) 1 T (c) 1.5 T (d) 2 T

95 * A circular coil has N turns of wire and has a radius of 10 cm, if an electric current I passes through it, a magnetic flux of density 2×10^{-4} T is formed at its center, so the magnitude of the magnetic dipole moment of the coil is ..... .

(a) 1 $A.m^2$ (b) 2 $A.m^2$ (c) 3 $A.m^2$ (d) 4 $A.m^2$

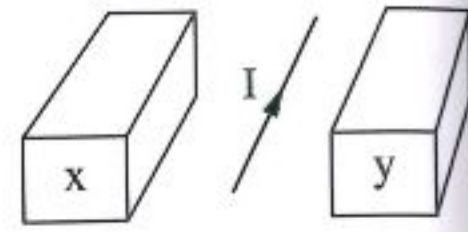
https://t.me/to_explain1

96 ✱ A circular coil of 3.14 cm^2 face area carries a current of intensity I, so the magnetic flux density at its center is 2×10^{-5} T, so its magnetic dipole moment equals ..... .
(Take: $\pi = 3.14$)
(a) 10^{-2} A.m^2 (b) 10^{-4} A.m^2 (c) 10^{-6} A.m^2 (d) 10^{-8} A.m^2

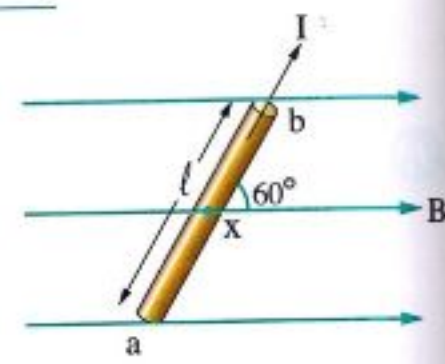
Second Essay questions

The force affecting on a wire

1 A movable straight wire carries an electric current I while being placed horizontally between the poles of magnets x, y as shown in the figure. It is noticed that the wire moves vertically downwards, **determine with explanation** the type of the magnetic pole x.

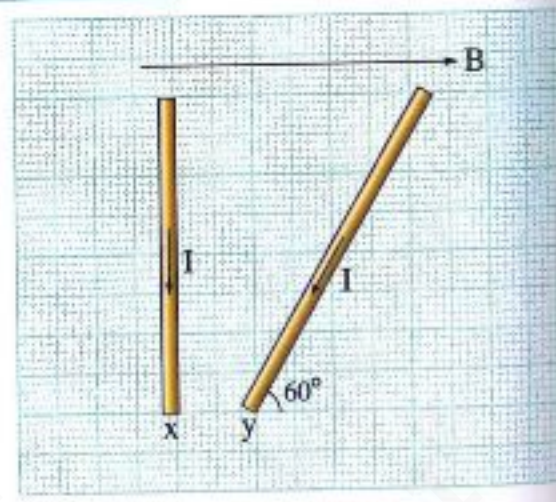


2 In the opposite figure, a straight wire ab is affected by a magnetic force of 0.1 N, **calculate** the value of the magnetic force that affects the wire if it is rotated about the axis x in the plane of the page by an angle of 30°:
(a) In the clockwise direction.
(b) In the anti-clockwise direction.



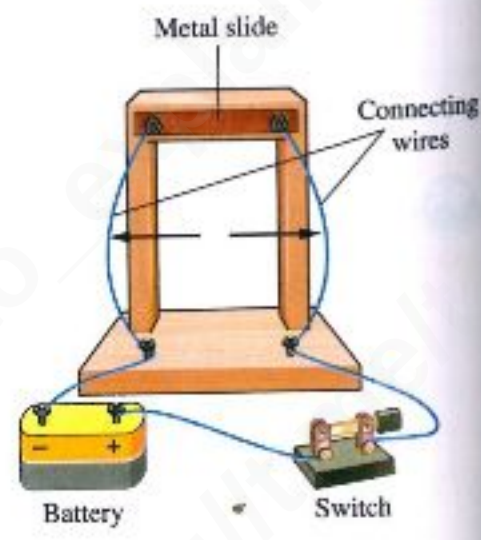
3 A straight wire of resistance 1 Ω for every meter is connected to DC electric source of emf 2 V and its internal resistance is negligible. The wire is placed perpendicular to a magnetic field (B) of flux density 0.1 T, **calculate** the value of the magnetic force that acts on the wire due to the magnetic field (B).

4 In the opposite figure, two straight wires x, y each carries an electric current I. They are placed in a magnetic field of flux density (B) parallel to the common plane of the two wires. **Find** the ratio between the magnetic forces which are acting on them $\left(\frac{F_x}{F_y}\right)$.



The mutual force between wires

5 In the shown experiment, the connecting wires bend outward when an electric current passes through them, **explain this observation**.



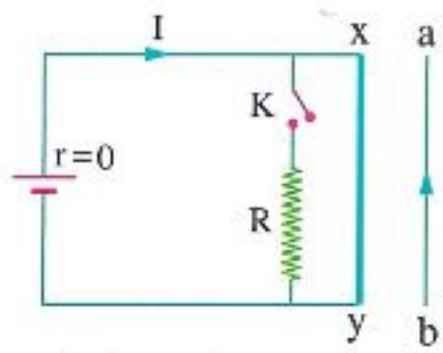
https://t.me/to_explain1

6 In the opposite figure:

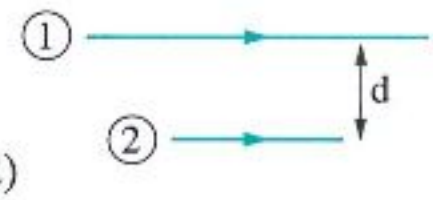
If the resistance of wire xy is R and the passing electric current through the circuit is I:

(a) **What** is the type of the mutual electromagnetic force between the two wires (xy and ab) in the case of opening switch K?

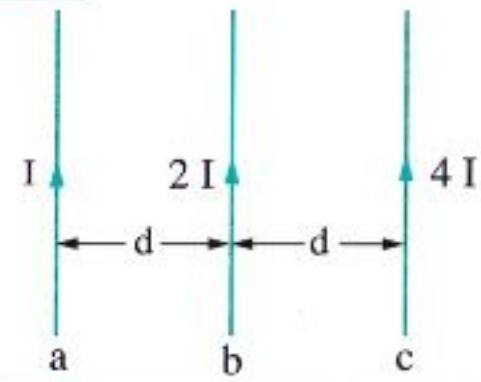
(b) When switch K is closed, **what will happen to** this electromagnetic force?



7 In the opposite figure, two parallel straight wires (1), (2) of lengths $\ell, \frac{\ell}{2}$ respectively where each of them carries electric current I. If the magnetic force acting on unit length of the wire (2) is 0.2 N/m, **mention with explanation what happens to** the value of that force when wire (1) is replaced with another of length 2ℓ while keeping both the currents and the same distance between them constant.

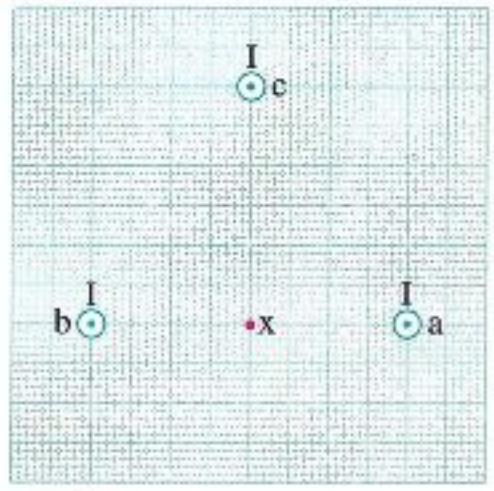


8 Three straight parallel wires a, b, c are in the same plane, each of them carries an electric current as in the opposite figure, **prove that** the wire which is affected by the greatest magnetic force for every unit length is wire c.



9 In the opposite figure, three straight vertical wires a, b, c each of them carries electric current of intensity I.

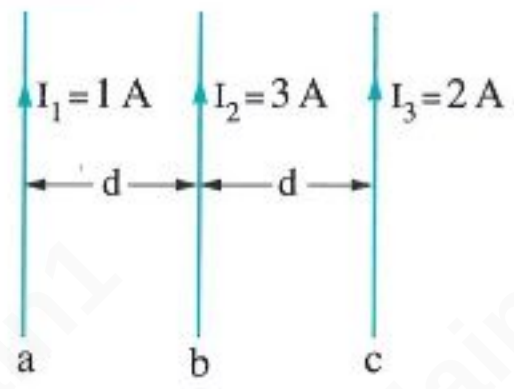
Show what happens to the value of the magnetic force per unit length of wire c if it is transferred to position x.



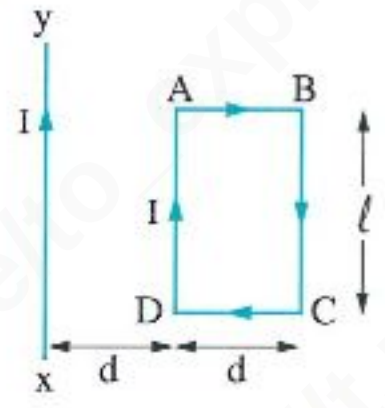
10 Three straight parallel wires a, b, c each of them carries an electric current as in the opposite figure, **what happens to the magnitude of the magnetic force for every unit length of wire a at the following cases:**

(a) reversing the current in wire b?

(b) tripling the current of wire c?

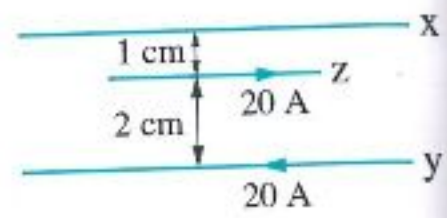


11 In the opposite figure, a rectangular metal frame (ABCD) of length ℓ and width d, carries an electric current of intensity I. A long wire xy in the same plane of the frame and at a distance d from it carries an electric current of intensity I. **Prove that** the total magnetic force acting on the frame can be calculated from the relation; $F = \frac{\mu I^2 \ell}{4\pi d}$



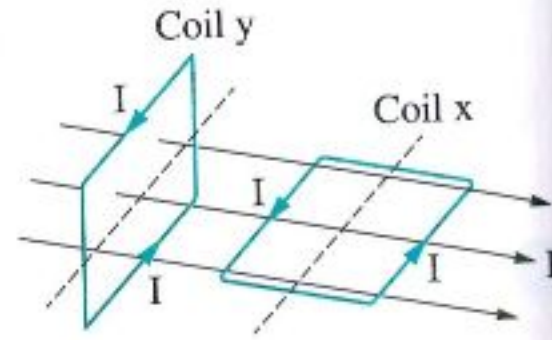
https://t.me/to_explain1

12 Two long horizontal wires x, y extend in one vertical plane and carry electric currents I, 20 A respectively. A free movable wire z of length 1 m and weight 0.01 N that carries a current of intensity 20 A is placed in the plane of the two wires as in the opposite figure. **Determine** the intensity and the direction of the current passing in wire x that makes wire z stay balanced.

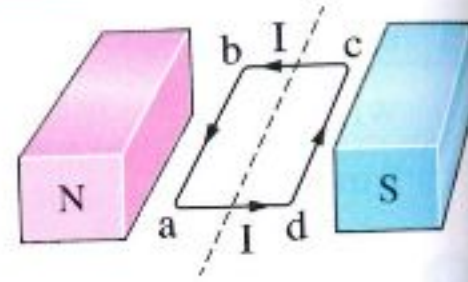


The magnetic torque

13 Two identical coils x, y are placed in a uniform magnetic field (B) as in the opposite figure. When electric current of intensity (I) passes through each of them, coil x rotates but coil y does not. **Explain that.**



14 A rectangular coil abcd that can rotate about its longitudinal axis which is parallel to ab carries a DC electric current and placed parallel to a uniform magnetic field as in the opposite figure:

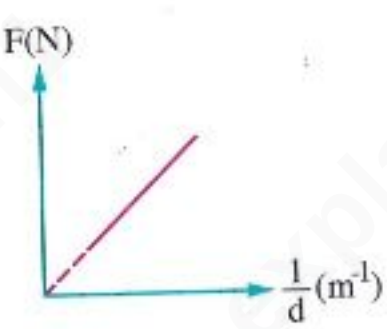
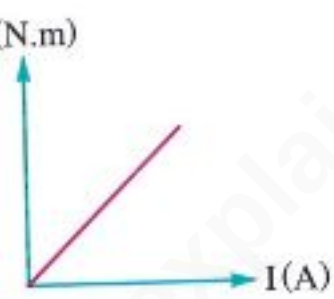
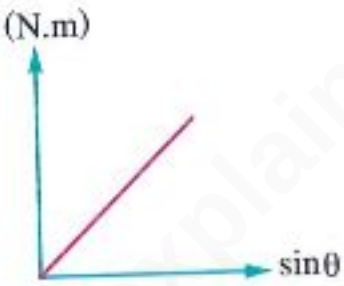


(a) **Determine** the direction of rotation of the coil relative to the clockwise direction.

(b) **What** are the coil sides that affected by a magnetic force after its rotation for quarter a cycle?

15 A ring is placed in a uniform magnetic field of density B, so the maximum magnetic flux that can pass through it is 1 Wb. **Calculate** the maximum torque by which this field can affect the ring when a current of intensity 1 A passes through it.

16 Write the mathematical relation and the slope for each of the following graphs:

(a)	(b)	(c)
		

Where: (F) is the mutual magnetic force between two parallel wires, (I) is the current, (τ) is the torque on the coil, (θ) is the angle between the normal to the coil and the magnetic field and (d) the distance between the two wires.

https://t.me/to_explain1

17 A circular coil of number of turns N where each turn is of area 0.01 m^2 and resistance 1 Ω. The coil is connected to an electric source of emf of 2 V and negligible internal resistance. The coil is placed parallel to a magnetic flux of density 1T, **determine** the torque that acts on it.

---

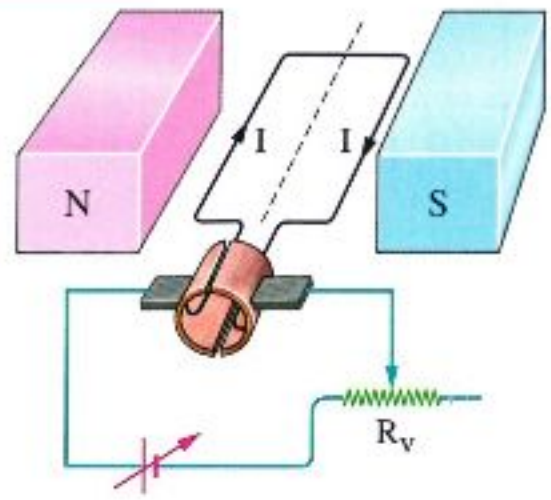
18 A straight wire of length ℓ is coiled in the form of a circular coil of radius r, number of turns N and placed parallel to the direction of a magnetic flux density B. If a current of intensity I is passed in the coil, **prove that** the maximum value of the acting magnetic torque that acts on the coil can be calculated from the relation; $\tau = \frac{1}{2}$ BIrℓ

---

19 Two straight identical wires, each of them is reshaped in the form of a circular coil where the number of turns of the first is three times that of the second. **Determine** the ratio between the values of the magnetic dipole moment for the two coils if a current of intensity I is passing through each of them.

---

20 A rectangular coil connected in a closed circuit is placed between the poles of a magnet as shown in the opposite figure. **How** can each of the magnetic dipole moment and the maximum value of torque which are acting on it be increased without changing the specifications of the coil?



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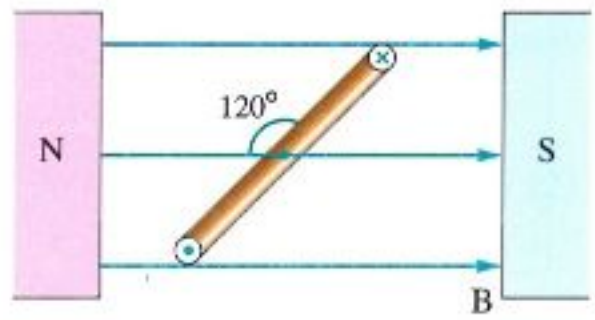
21 The opposite figure represents a front view of a rectangular coil of magnetic dipole moment 10 $A.m^2$ that is placed in a uniform magnetic field of density 0.1 T. **Calculate:**



(a) The torque that acts on the coil in the shown position in the figure.

(b) The torque after rotating the coil 60° in the clockwise direction from the shown position in the figure.

---

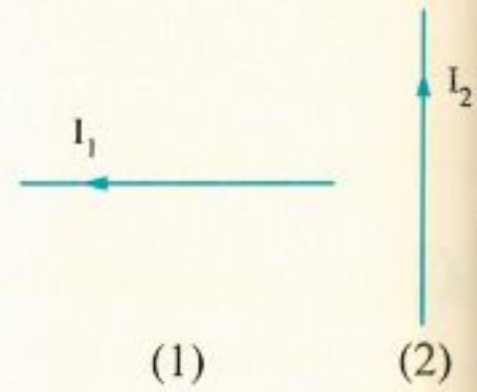
22 A straight wire of length (ℓ) is coiled in the form of a square coil of number of turns N. If a current of intensity (I) is set up through the coil, **prove that** the magnetic dipole moment of the coil can be determined from the relation; $|\overrightarrow{m_d}| = \frac{I\ell^2}{16\,N}$

https://t.me/to_explain1

Questions of the Previous Years Exams ? on Lesson 3

The magnetic force affecting a wire

1 In the opposite figure, two straight wires (1) and (2) are in one plane, perpendicular to each other, while two electric currents I_1 and I_2 are set up through them respectively, so the direction of the magnetic force that affects wire (1) due to the effect of the magnetic field arising from the current in wire (2) is ..... .



(a) up the page

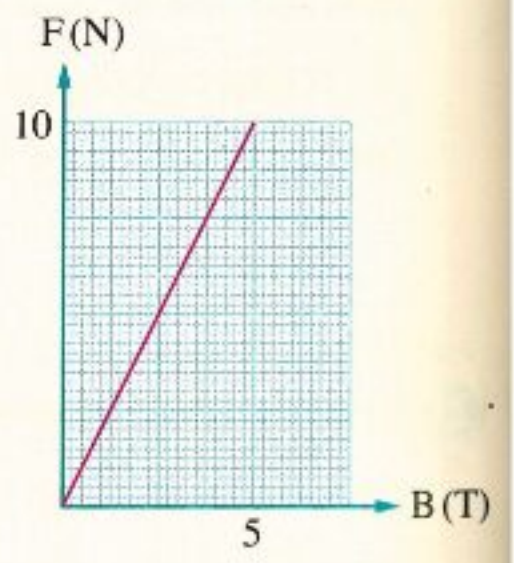
(b) down the page

(c) perpendicular into the page

(d) perpendicular out of the page

(Exp. May 21)

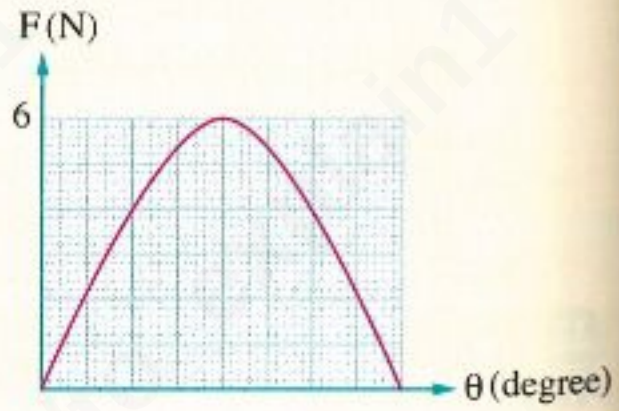
2 The graph represents the relation between the magnetic force (F) acting on a current-carrying wire when it is placed perpendicular to a changing magnetic field and the magnetic flux density (B) of the field, so the magnetic force acting on the wire when the magnetic flux density equals 3 T will be ..... newtons. *(Exp. June 21)*



(a) 6 (b) 4

(c) $\frac{1}{2}$ (d) 2

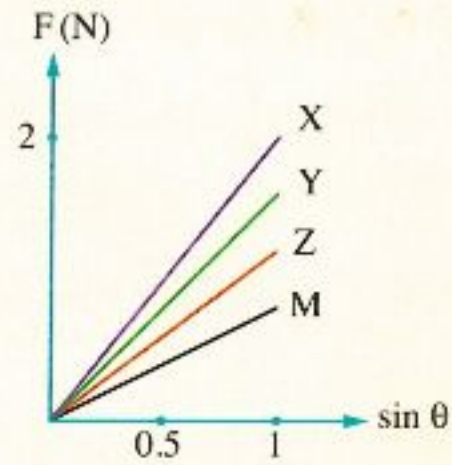
3 The opposite graph represents the relation between the magnetic force (F) acting on a current-carrying straight wire that is placed in a magnetic field of density (B) and the angle between the direction of the magnetic flux and the wire (θ). So, the angle (θ) at which the magnetic force (F) that acts on the wire equals half its maximum value is ..... . *(I^{st} session 21)*



(a) 30° (b) 45° (c) 60° (d) 120°

https://t.me/to_explain1

4 (X), (Y), (Z) and (M) are four straight wires that are different in length, each carries electric current of intensity I and all are placed in the same magnetic field of flux density B. The graph represents the relation between the magnetic force (F) that affects each wire and sine of the angle between each wire and the direction of the magnetic flux (sin θ). So, the longest wire is ..... .



(2nd session 21)

(a) wire (X) (b) wire (Y) (c) wire (Z) (d) wire (M)

5 Two straight wires (X) and (Y) of the same length are carrying electric currents in the directions shown in the figure. They are placed perpendicular to a uniform magnetic flux of density (B) perpendicular to and out of the page.

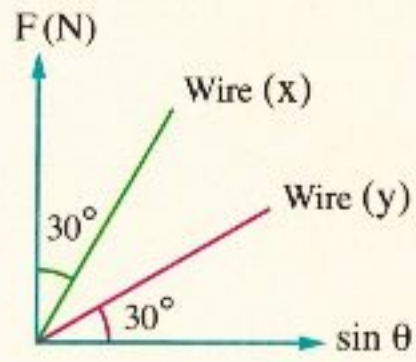
So, the relation between the magnetic force [F_x] that is acting on wire (x) and the magnetic force [F_y] that is acting on wire (y) is ..... .

(1st session 22)

(a) $F_y > F_x$ and both are directed downwards (b) $F_y > F_x$ and both are directed upwards

(c) $F_x > F_y$ and both are directed upwards (d) $F_x > F_y$ and both are directed downwards

6 The graph represents the relation between the magnetic force (F) acting on two straight wires (x, y) and sine the angle between each wire and the direction of the magnetic field of flux density (B) in which the wires are placed (sin θ). If the ratio between:



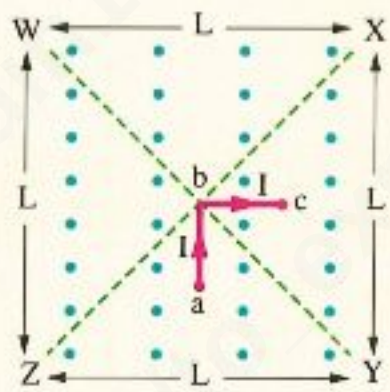
$$\frac{\text{electric current intensity passing in the wire (x)}}{\text{electric current intensity passing in the wire (y)}} = \frac{3}{4}$$

So, the ratio between : $\frac{\text{the length of wire (x)}}{\text{the length of wire (y)}}$ = ...

(2nd session 22)

(a) $\frac{4}{3}$ (b) $\frac{4}{9}$ (c) $\frac{4}{1}$ (d) $\frac{8}{3}$

7 A straight metal wire that carries an electric current of (I) intensity, is bent into two equal and perpendicular parts {ab, bc}, then placed parallel to the page inside a uniform magnetic field which is perpendicular out of the page as in the figure, toward which point (Z, Y, X, W) the point b of the wire will move?



(a) Point Y. (b) Point X.

(c) Point W. (d) Point Z. *(2nd session 22)*

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8 A cylindrical metallic rod, slides on two copper sheets fixed in the same plane of the page, the two sheets are connected to a battery and a rheostat where the rod and sheets are placed in a uniform magnetic field of flux lines perpendicular to the plane of the page as in figure, so a magnetic force F acts on the rod.

Which of the following represents. What happens to the value and the direction of the force F when the slider of the rheostat moves towards point B?

(Exp. 23)

(a) Decreases and remains in the same direction.

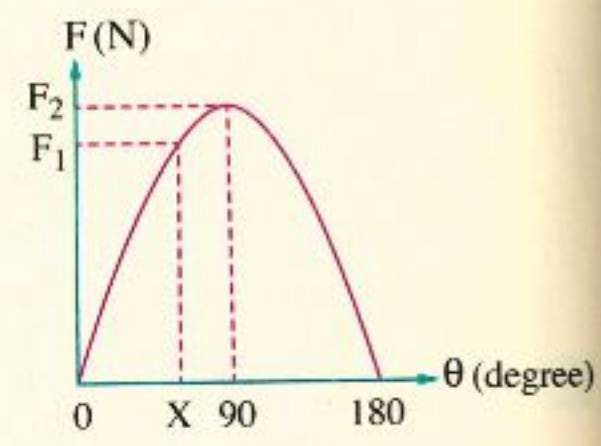
(b) Increases and remains in the same direction.

(c) Decreases and reverses its direction.

(d) Increases and reverses its direction.

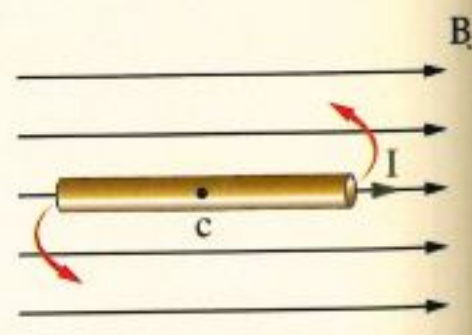
9 The graph represents the relation between the magnetic force (F) acting on a straight wire of length (ℓ) placed in a uniform magnetic field of flux density (B) and the change of angle (θ) which is the angle between the wire and the field. If $\frac{F_2}{F_1} = \frac{2\sqrt{3}}{3}$, so the value of angle (X) = ...

(2nd session 23)

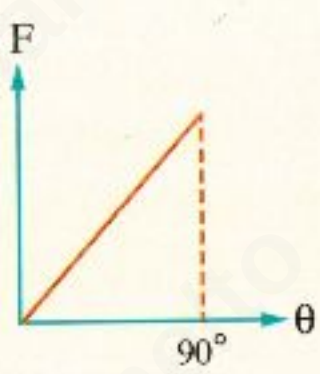


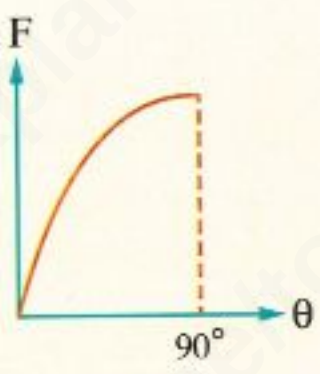
(a) 45° (b) 75° (c) 60° (d) 80°

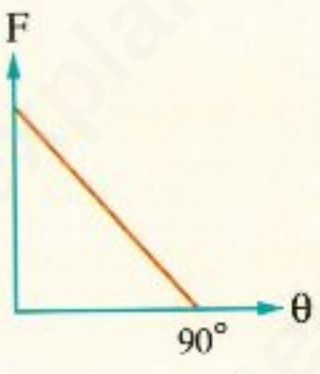
10 In the opposite figure, a straight wire carries an electric current (I) and is placed parallel to a uniform magnetic field of flux density B. If the wire rotates a quarter cycle around an axis perpendicular to the plane of the page at point c, the graph that represents the relation between the magnetic force (F) acting on the wire and the angle of rotation (θ) is ..... .

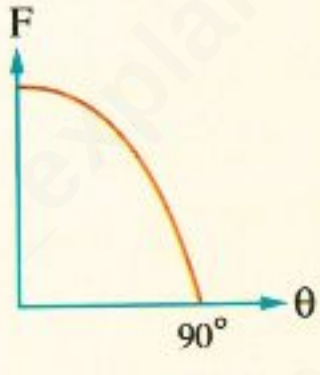


(Exp. 25)

(a)


(b)


(c)


(d)


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11 A wire of weight F is horizontally suspended to a uniform magnetic field perpendicular to it, of flux density B as shown in the opposite figure. When an electric current of intensity I passes through the wire, it is affected by a magnetic force of magnitude 2 F. The net force acting on the wire equals ..... . *(Exp. 25)*

(a) F (b) 2 F (c) $\sqrt{5}$ F (d) 3F

12 A solenoid contains 250 turns/m and carries a current of intensity 5A. If a wire of length 0.35 m and carries a current of 10 A is placed coinciding with the axis of the solenoid, the magnetic force acting on the wire equals ..... . *(Exp. 25)*

(a) zero (b) 5.5×10^{-3} N (c) 7.5×10^{-3} N (d) 0.01 N

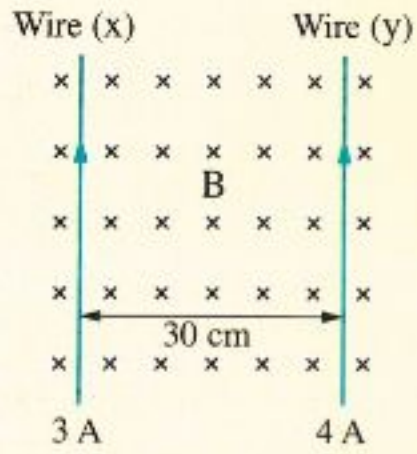
13 An electron moves perpendicularly out of the plane of the page into a uniform magnetic field directed southward in the plane of the page. Then the direction of the magnetic force acting on the moving electron is ..... . *(Exp. 25)*

(a) parallel to the page eastwards (b) parallel to the page westwards
(c) parallel to the page northwards (d) perpendicular into the plane of the page

The mutual force between two wires

14 The figure shows two parallel wires (x) and (y), separated by normal distance 30 cm, carrying electric currents of intensities 3 A and 4 A respectively and being affected by external magnetic field of flux density B that directed normal into the page as shown. If the resultant magnetic force per unit length of the wire (x) is 2×10^{-5} N/m, the value of B equals ..... . *(Exp. June 21)*

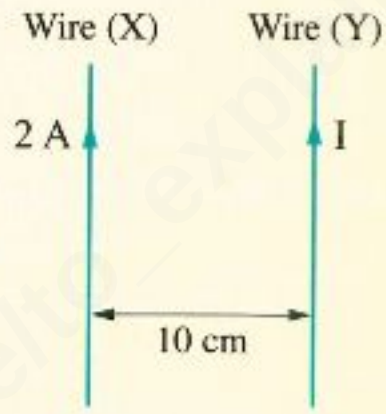
(Take: $\mu = 4\pi \times 10^{-7}$ T.m/A)



(a) 6.67×10^{-6} T (b) 9.3×10^{-6} T (c) 4×10^{-6} T (d) 2.67×10^{-6} T

15 The figure represents two parallel straight wires (X) and (Y). If the force acting on a unit length of each wire is 4×10^{-5} N/m, the passing electric current intensity (I) in wire (Y) equals ..... .

(Take: $\mu = 4\pi \times 10^{-7}$ Wb/A.m) *(1^{st} session 21)*



(a) 0.1 A (b) 1 A
(c) 10 A (d) 100 A

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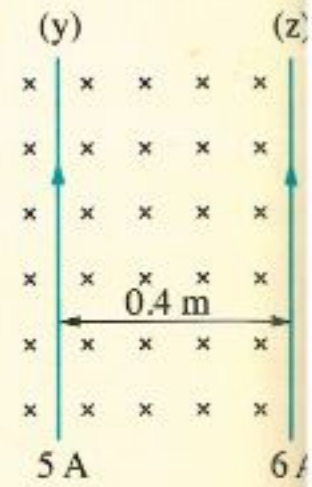
16 The figure shows two parallel straight wires (z), (y) separated by a normal distance of 0.4 m, carrying electric currents of intensities 6 A and 5 A respectively and being affected by external magnetic field of flux density 2.5×10^{-5} T perpendicular into the page as shown in the figure, so the net magnetic force that affects unit length of the wire (z) equals ..... . *(2nd session 21)*

(Knowing that: $\mu = 4\pi \times 10^{-7}$ T.m/A)

ⓐ 1.5×10^{-5} N/m ⓑ 1.5×10^{-4} N/m

ⓒ 1.7×10^{-4} N/m ⓓ 4×10^{-5} N/m

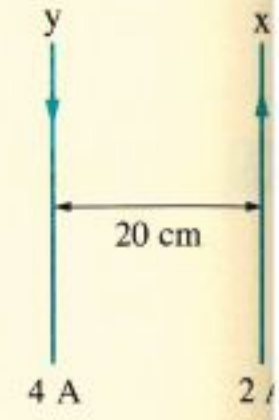


17 The figure shows two parallel straight wires (x), (y), each of length 1.6 m and the normal distance between them is 20 cm, carrying electric currents of intensities 2 A and 4 A respectively. The mutual magnetic force between (x, y) is ..... .

($\mu = 4\pi \times 10^{-7}$ T.m/A) *(1st session 22)*

ⓐ 1.28×10^{-4} N ⓑ 1.28×10^{-6} N

ⓒ 1.28×10^{-7} N ⓓ 1.28×10^{-5} N



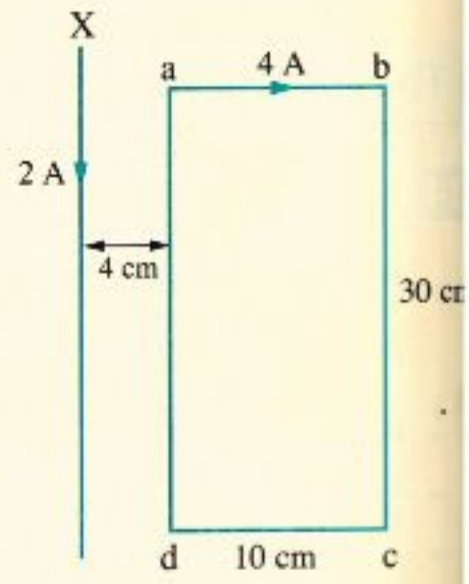
18 The figure shows a conducting rectangle (abcd) that carries 4 A electric current, another wire (X) which carries 2 A electric current is placed at 4 cm away from it, so the magnitude and the direction of the magnetic force affecting wire X are ..... .

ⓐ 1.54×10^{-5} N, to the left

ⓑ 1.54×10^{-5} N, to the right

ⓒ 8.57×10^{-6} N, to the right

ⓓ 8.57×10^{-6} N, to the left *(1st session 22)*



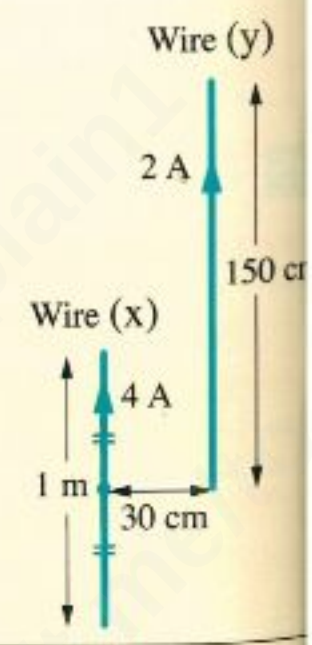
19 Two current-carrying straight wires x, y are parallel as shown in the figure, the mutual magnetic force between the two wires equals ..... . ($\mu = 4\pi \times 10^{-7}$ tesla.m/A) *(2nd session 22)*

ⓐ 2.67×10^{-6} N

ⓑ 8×10^{-6} N

ⓒ 5×10^{-6} N

ⓓ 5.33×10^{-6} N



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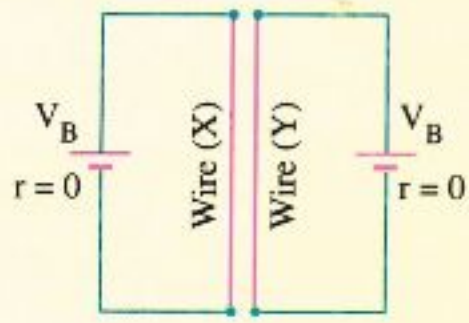
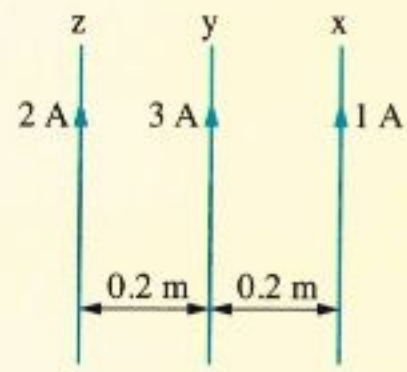
20 Two long parallel wires X and Y, each of them is connected to a battery of negligible internal resistance, the mutual force between them is (F).
When wire X is replaced by another one of same length and radius but the resistivity of its material is $\frac{1}{4}$ of that of wire X, so the mutual force between the two wires becomes ..... . *(Exp. 23)*



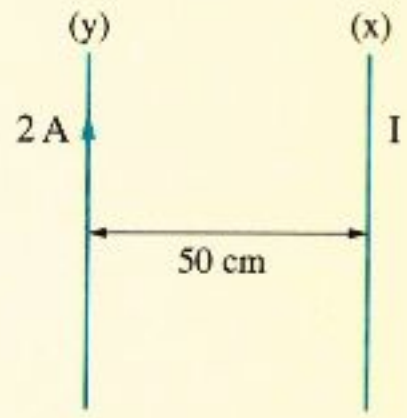
(a) 2 F (b) F (c) 4 F (d) $\frac{F}{4}$

21 From the data in the figure, which of the following choices represents the correct arrangement of magnetic forces per unit length acting on each wire? *(Exp. 23)*



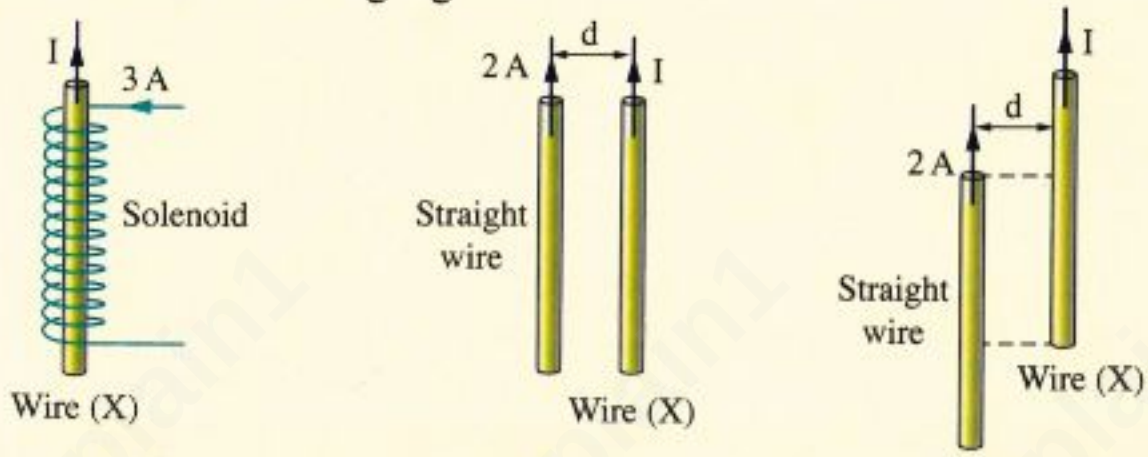
(a) $F_y < F_x < F_z$ (b) $F_z < F_y < F_x$
(c) $F_x < F_y < F_z$ (d) $F_y < F_z < F_x$

22 In the shown figure:
If wire (x) is affected by a magnetic force per unit length of 2×10^{-6} N/m rightwards due to the effect of the magnetic flux resulted due to the passing current through wire (y), then the magnitude and the direction of (I) are ..... .
($\mu = 4\pi \times 10^{-7}$ T.m/A) *(1^{st} session 23)*



(a) 2.5 A, upward (b) 2.5 A, downward
(c) 25 A, downward (d) 25 A, upward

23 A wire (X) that carries a current of intensity (I) is placed in different magnetic fields as shown in the following figures.



Which of the following choices represents the correct arrangement of the values of the magnetic force acting on the wire (X) according to each figure? *(1^{st} session 23)*

(a) $F_2 > F_3 > F_1 = F_4$ (b) $F_2 = F_3 > F_1 = F_4$
(c) $F_1 > F_2 > F_3 > F_4$ (d) $F_1 > F_2 = F_3 = F_4$

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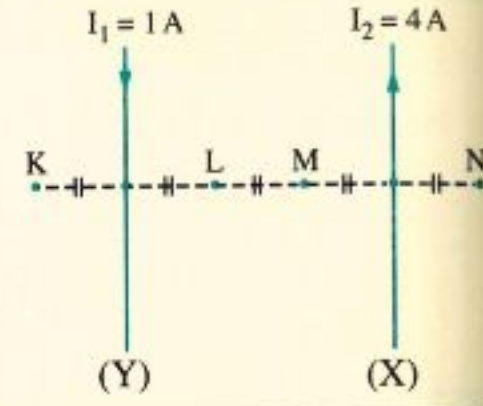
24 Two parallel straight wires A and B, carry electric currents of intensities 2 A and I respectively in opposite directions. If the normal separating distance between the two wires is 5 cm and the common length between them is 10 cm. The two wires are affected by a mutual magnetic force of 2.4×10^{-6} N, then the value of (I) should be ..... and the type of the mutual force is ..... .

(Take: $\mu = 4\pi \times 10^{-7}$ Wb/A.m) *(2nd session 23)*

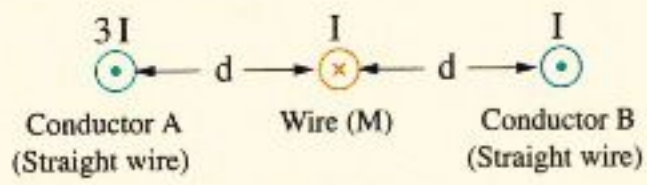
(a) 3 A, repulsion
(b) 3 A, attraction
(c) 6 A, repulsion
(d) 6 A, attraction

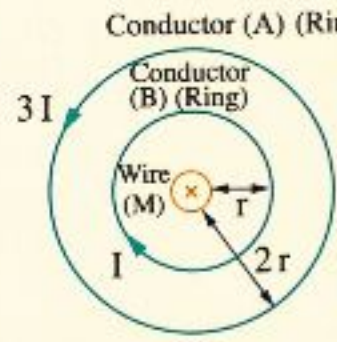
25 From the shown figure, at which point a straight current carrying wire can be placed in the same plane of the page, parallel to the two wires (X) and (Y) and doesn't be affected by a magnetic force? *(1st session 24)*

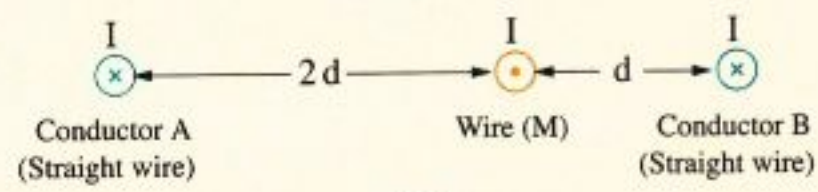


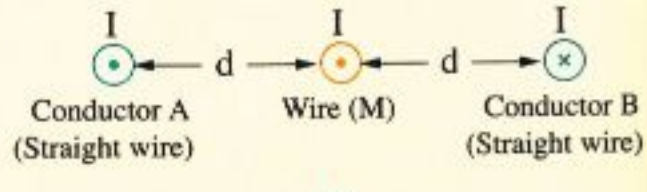
(a) K
(b) L
(c) M
(d) N

26 A current carrying wire (M) is placed perpendicular to the plane of the page surrounded by two current carrying conductors (A and B), so in which figure the wire (M) will not be affected by a magnetic force due to the magnetic field produced from the surrounding conductors? *(1st session 24)*

(a)


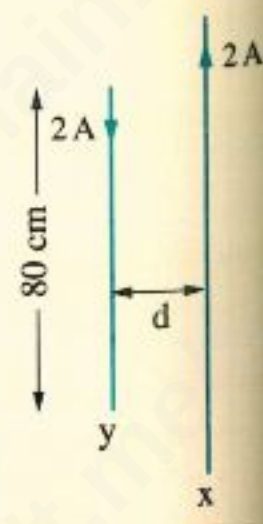
(b)


(c)


(d)


27 The figure illustrates two parallel straight wires (x), (y), wire (x) is very long and wire (y) has a length of 80 cm and both are carrying electric currents as shown. The mutual force between them is 2×10^{-5} N so, the normal distance (d) between the two wires equals ..... .

($\mu = 4\pi \times 10^{-7}$ T.m/A) *(2nd session 24)*



(a) 3.2 cm
(b) 0.32 cm
(c) 0.032 cm
(d) 0.0032 cm

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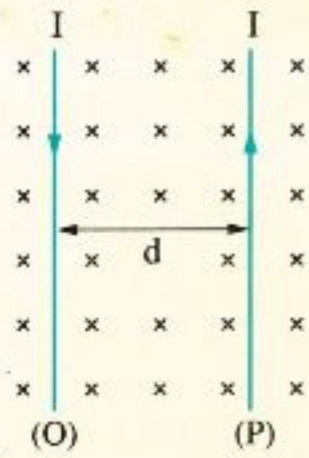
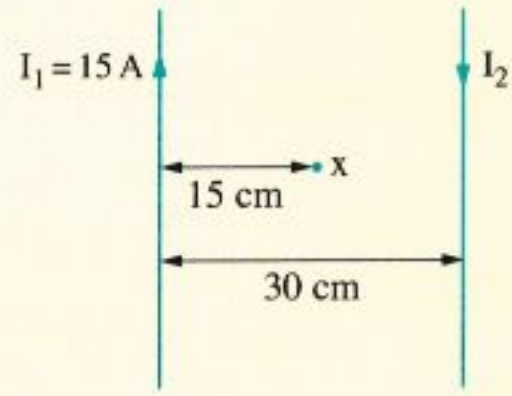
28 Two long parallel wires (O) and (P) are in the same plane of the page, separated by a distance (d) and two electric currents of the same intensity (I) pass through them in opposite directions and affected by uniform magnetic field of flux density $\frac{\mu I}{\pi d}$ as shown in the figure, if the wire (P) is free to move but wire (O) is fixed, in which direction will the magnetic force act on wire (P)? *(2nd session 24)*



(a) Not affected by a magnetic force.
(b) Towards the left of the page.
(c) Towards the right of the page.
(d) Perpendicular to the plane of the page.

29 In the opposite figure, two long parallel straight wires are separated by a distance of 30 cm. The first wire carries a current of 15 A. If the resultant magnetic flux density at point x, which is mid-point between the two wires, equals 6×10^{-5} T, then the mutual magnetic force per unit length between the wires acting on either of them equals ..... . *(Exp. 25)*



(a) 2×10^{-4} T
(b) 3×10^{-4} T
(c) 4×10^{-4} T
(d) 5×10^{-4} T

30 Figure (1) shows two straight parallel wires (X) and (Y) carrying electric currents 2I and I respectively. The mutual magnetic force between the two wires is F. When both wires are placed in an external magnetic field of flux density B, as shown in figure (2), if the net magnetic force acting on wire (X) vanishes. The net magnetic force acting on wire (Y) is ..... . *(Exp. 25)*

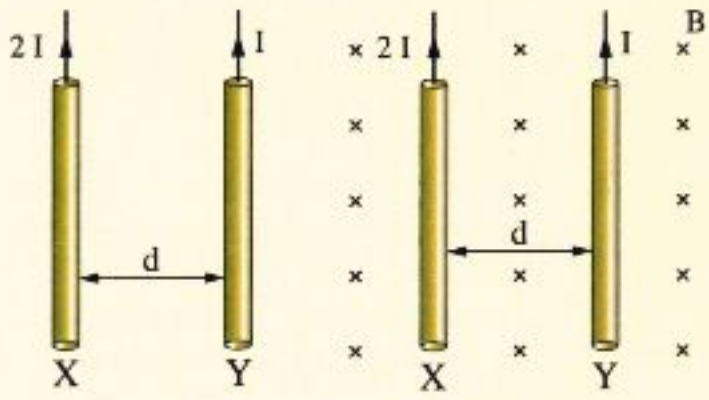
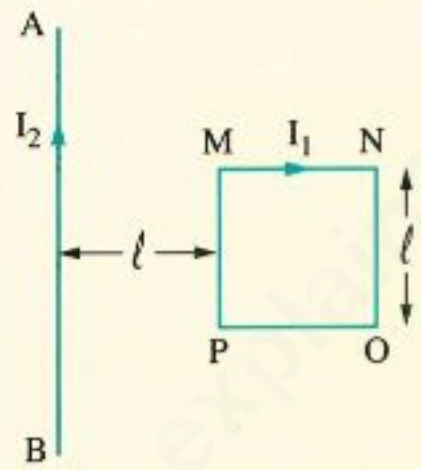


Figure (1) **Figure (2)**

(a) 0.5 F
(b) 1 F
(c) 1.5 F
(d) 2 F

31 A freely movable square coil MNOP consists of one turn carries an electric current of intensity I_1, a long straight fixed wire (AB) is placed near to the coil and in the same of its plane and also carries a current of intensity I_2, as shown in the opposite figure. If the net magnetic force acting on the wire equals F, considering the following statements: *(Exp. 25)*



(I) The magnitude of the mutual magnetic force between the wire AB and the side MP equals 2 F.
(II) The magnitude of the mutual magnetic force between the wire AB and the side NO equals F.

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(III) The coil rotates in the anti-clockwise direction.

(IV) The coil is approaching a straight wire.

Which of the previous statements is correct?

(a) (I), (II), (IV) only. (b) (I), (II) only.

(c) (II), (IV) only. (d) (I), (II), (III), (IV).

The magnetic torque

32 A circular coil of 30 turns and cross-sectional area 10 cm^2 is placed in a magnetic field of flux density 0.3 T while carrying a current of 2 A. Knowing that the direction of the magnetic dipole moment of the coil makes an angle of 30° with the direction of the magnetic field, so the magnitude of the magnetic torque that affects the coil is ..... .

(a) $9\sqrt{3} \times 10^{-3}$ N.m (b) 18×10^{-3} N.m

(c) $18\sqrt{3} \times 10^{-3}$ N.m (d) 9×10^{-3} N.m *(Exp. May 21)*

33 An electric current passes through a rectangular coil whose plane is parallel to the direction of a magnetic field of flux density 2 T, if the magnetic dipole moment of coil is 0.3 $A.m^2$, the magnetic torque acting on the coil equals ..... . *(Exp. June 21)*

(a) 0.6 N.m (b) 0.15 N.m (c) 0.06 N.m (d) 0.015 N.m

34 A rectangular coil, that has no. of turns = 2 turns, length =10 cm and width = 2 cm, carries an electric current of 2 A while being placed in a uniform magnetic field of flux density 2 T, so the magnetic torque acting on the coil, when the angle between the coil and the direction of the magnetic flux = 60°, equals ..... . *(1^{st} session 21)*

(a) 16×10^{-3} N.m (b) $8\sqrt{3} \times 10^{-3}$ N.m (c) 8×10^{-3} N.m (d) 16×10^{-4} N.m

35 If the magnetic torque acting on a current-carrying coil while being placed in magnetic field = 0.86 N.m when the angle between the normal to coil plane and the direction of field = 60°, so the magnetic torque acting on the coil when the coil plane becomes parallel to the magnetic field = ... *(2^{nd} session 21)*

(a) 1 N.m (b) 1.5 N.m (c) 1.86 N.m (d) zero

36 A current-carrying coil is placed inside a magnetic field of flux density 400 mT, where the coil plane makes angle θ with the direction of the magnetic flux. If the ratio of ; $\frac{\text{The value of the magnetic dipole moment}}{\text{The value of the magnetic torque}} = 5\ T^{-1}$, then the value of angle (θ) equals ..... . *(1^{st} session 22)*

(a) 30° (b) 35° (c) 60° (d) 55°

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37 A 5 turns rectangular coil of dimensions 20 cm, 40 cm, is placed inside a magnetic field of flux density 0.02 T where the coil plane makes angle 55° with the flux direction. If electric current of 4 A intensity passes through the coil, then the affecting magnetic torque on that coil equals ..... . *(2nd session 22)*

(a) 18.4×10^{-3} N.m (b) 26.2×10^{-3} N.m

(c) 320×10^{-3} N.m (d) 640×10^{-3} N.m

38 A rectangular coil made of an insulated wire, its dimensions are 0.1 m and 0.05 m, consists of 50 turns, is placed in a magnetic flux of 10^{-3} Wb perpendicularly to the coil plane, it can rotate about an axis in the same plane of its surface that is parallel to its length. If a current of 2 A passes through the coil, the value of the magnetic torque acting on the coil is equal to ..... . *(Exp. 23)*

(a) 0.1 N.m (b) zero (c) 5×10^{-4} N.m (d) 2×10^{-3} N.m

39 A current of intensity (I) passes in a current-carrying coil which is placed in a magnetic field of flux density (B), where the coil plane makes an angle 60° with the direction of the magnetic flux. If the value of magnetic dipole moment in ($A.m^2$) is 4 times as the value of the magnetic torque acting on the coil in (N.m), then the value of the magnetic flux density (B) equals ..... . *(1st session 23)*

(a) 3.46 T (b) 2 T (c) 8 T (d) 0.5 T

40 A rectangular coil carrying a current is placed in a magnetic field where its plane makes an angle 60° with the direction of the magnetic field lines. If the value of the magnetic torque acting on the coil in (N.m) equals the value of the magnetic dipole moment of the coil in ($A.m^2$), the magnetic flux density equals ..... . *(2nd session 23)*

(a) 2 T (b) 1.15 T (c) 0.5 T (d) 0.86 T

41 A rectangular coil carries an electric current and is inclined at an angle of 30° to the lines of a uniform magnetic field of flux density 0.5 T. If the magnetic dipole moment acting on the coil is 120 $A.m^2$, then the torque acting on the coil is approximately equal to ..... .

(a) 75 N.m (b) 60 N.m (c) 52 N.m (d) 34 N.m *(Exp. 25)*

42 A straight wire was shaped into a circular coil consisting of one turn and had an electric current passing through it. It was placed parallel to a uniform magnetic field and affected by a magnetic torque (τ). If the wire is reshaped into a circular coil with 3 turns, placed parallel to the same magnetic field and carrying the same current, the magnetic torque acting on the coil becomes ..... . *(Exp. 25)*

(a) 3τ (b) $\frac{\tau}{3}$ (c) 9τ (d) $\frac{\tau}{9}$

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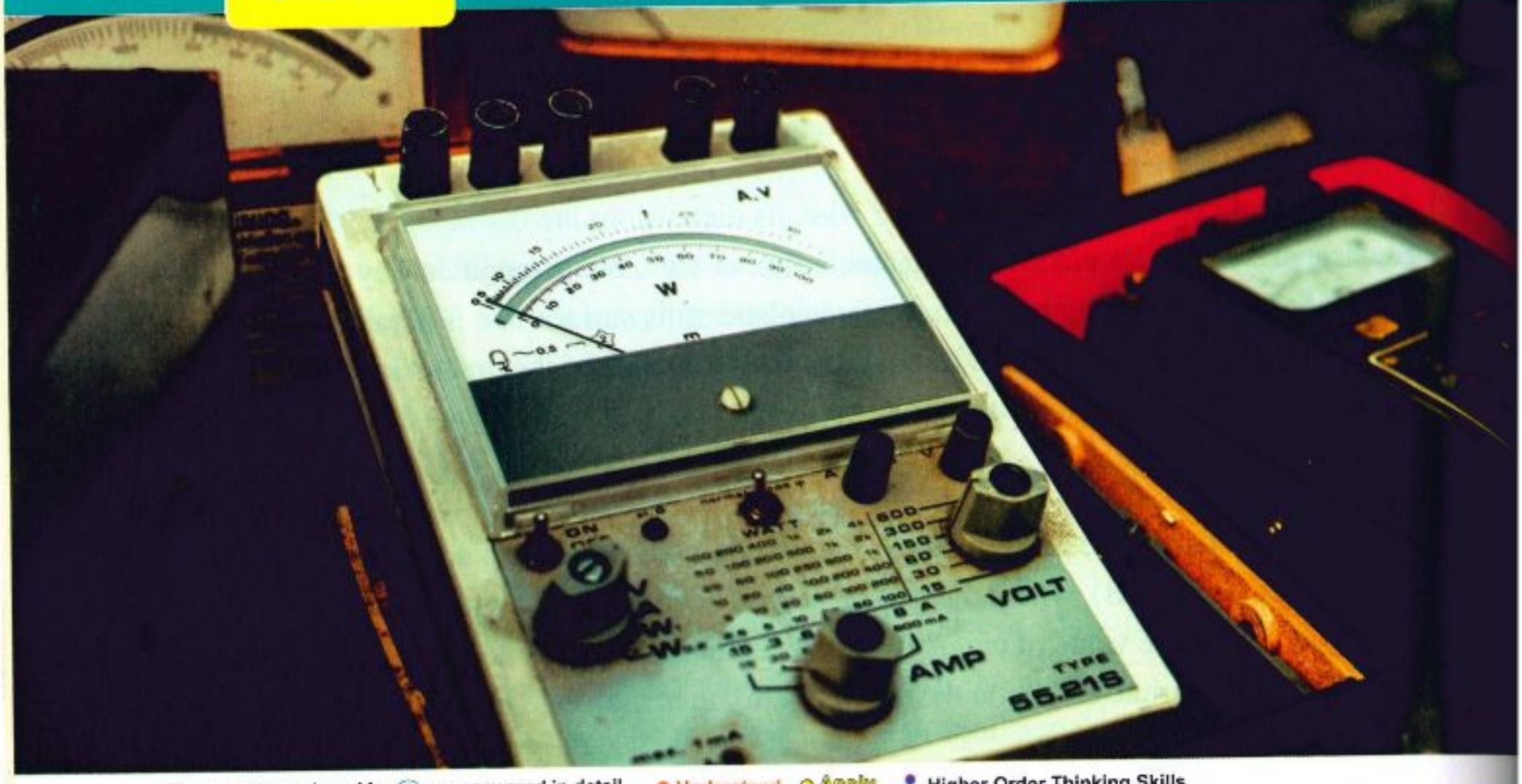
Chapter 2

Questions on Lesson Four

The Measuring Instruments

Interactive test



The questions signed by ✳ are answered in detail. ● Understand ○ Apply ∴ Higher Order Thinking Skills

Important guidelines

Moving coil galvanometer

- **Current intensity**
  - Current intensity (I) = The equivalent of one division × No. of divisions
- **Galvanometer sensitivity**
  - Galvanometer sensitivity = $\frac{\theta}{I}$

Moving coil ammeter

- **Ammeter resistance**
  - $R` = \frac{R_g R_s}{R_g + R_s}$
- **Current intensity (I)**
  - Current intensity (I) = Value of one division × Number of divisions indicated by the pointer
  - $I = I_g + I_s = I_g + \frac{I_g R_g}{R_s}$
- **Shunt resistance**
  - $R_s = \frac{I_g R_g}{I - I_g}$

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Voltmeter

- **Voltmeter resistance**
  - $R` = R_g + R_m$
- **Total potential difference (V)**
  - Total potential difference (V) = Value of one division × Number of divisions
  - $V = V_g + V_m$
    $= I_g (R_g + R_m)$
- **Multiplier resistance**
  - $R_m = \frac{V - V_g}{I_g}$

Ohmmeter

- **Calculating the unknown resistance**
  - $\frac{I_g}{I} = \frac{R` + R_x}{R`}$
  - $I = \frac{V_B}{R` + R_x}$
- **Calculating the standard resistance**
  - $I_g = \frac{V_B}{R_g + R_c + r + R_v} = \frac{V_B}{R`}$

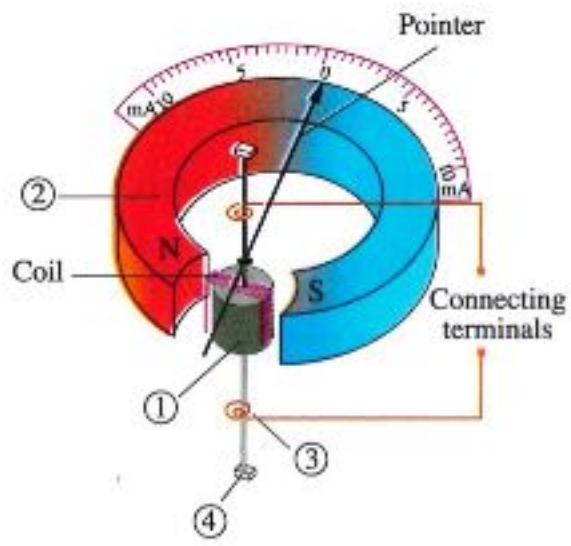
First Multiple choice questions

The moving coil galvanometer

1 The opposite figure represents the internal structure of the moving coil galvanometer, so the component which is made of agate to reduce friction of the coil during its motion is ..... .

(a) ① (b) ②

(c) ③ (d) ④



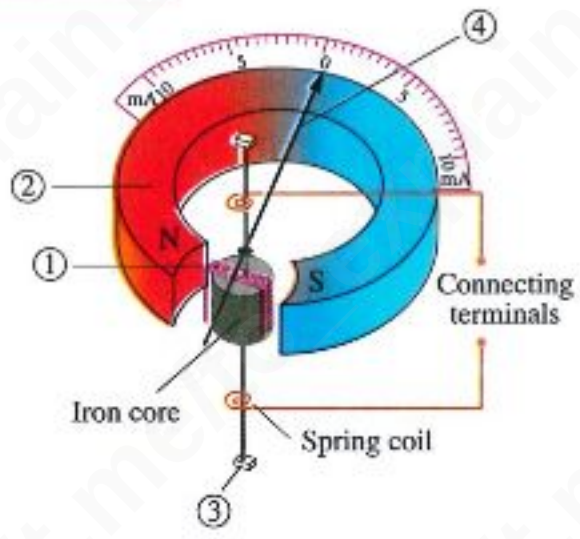
2 The opposite figure represents the internal structure of the moving coil galvanometer, so the component which is made of copper is ..... .

(a) ①

(b) ②

(c) ③

(d) ④



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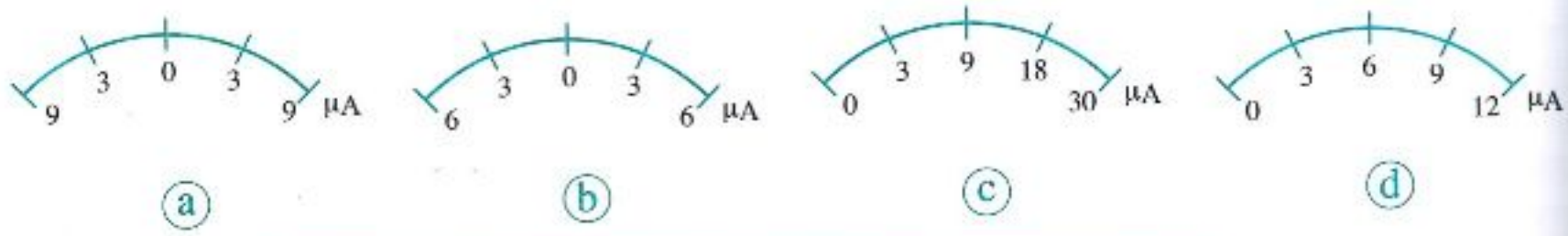
3 Which of the following figures represents the measuring scale of a moving coil galvanometer to determine the direction of the electric current?



(a) (b) (c) (d)

4 The magnetic torque which acts on the coil of a galvanometer when an electric current passes through it always equals ..... .

(a) BIAN sin 0 (b) BIAN sin 45 (c) BIAN sin 90 (d) BIAN sin 30

5 The resultant torque acting on the coil of a galvanometer when its pointer stops at a certain reading equals ..... .

(a) BIAN (b) 2 BIAN (c) 2 BIAN sin θ (d) zero

6 When an electric current passes through a coil of a sensitive galvanometer, its pointer takes a period t to deflect from zero position and settle at a certain reading, what happens to the values of each of the magnetic torque (τ_1) affected on the coil and the torsion (τ_2) for the two spring coils within that period?

(a) Increases, constant. (b) Increases, increases.

(c) Constant, constant. (d) Constant, increases.

7 When an electric current of intensity (I) passes through the coil of a galvanometer, the magnitude of the magnetic torque acting on the galvanometer coil does not change during its rotation due to ..... .

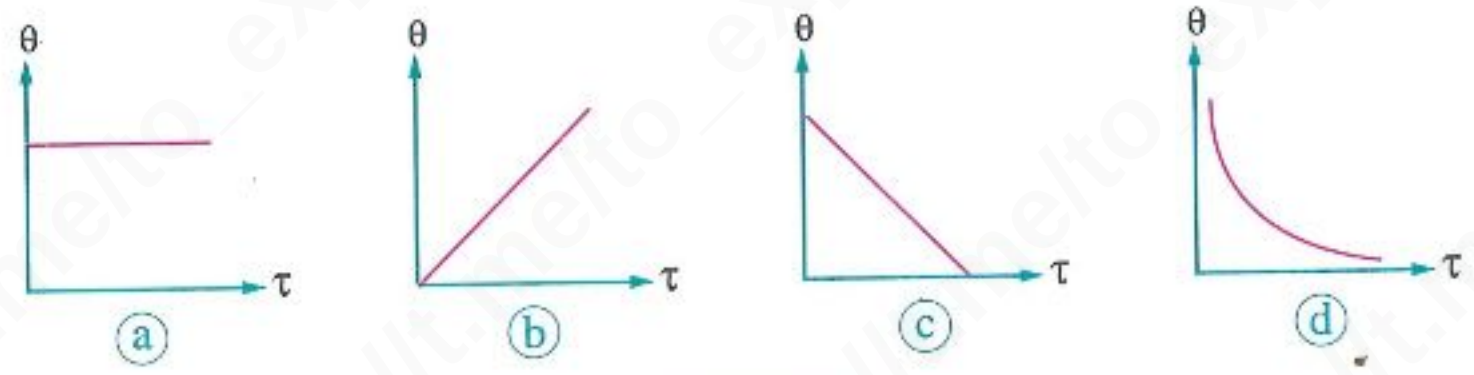
(a) the presence of spring coils

(b) the presence of agate bearings

(c) the presence of an aluminum pointer

(d) the concavity of the magnet poles and the presence of a soft iron core

8 * Which of the following graphs represents the relation between the angle (θ) at which a galvanometer's pointer deflects from the zero position and the torque (τ) that affects the coil of the galvanometer due to the flow of a direct current?



(a) (b) (c) (d)

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9 When a suitable electric current passes in a moving coil galvanometer, what is the quantity that its value changes during the motion of the pointer starting from rest and till it stops at a certain reading?

(a) The torque acting on the coil.
(b) The torsion in the two spring coils.
(c) The sensitivity of the galvanometer.
(d) The angle between the coil and the direction of the magnetic flux.

10 When an alternating current of a very low frequency (1 Hz) passes through the galvanometer, the pointer of the galvanometer ..... .

(a) doesn't deflect from the zero point of its scale
(b) deflects and settles at a certain value
(c) vibrates about the sides of the zero point of its scale
(d) deflects to the end of its scale

11 When a DC electric current of high intensity passes through the coil of a galvanometer, then ..... .

(a) the galvanometer pointer does not deflect
(b) no torque is generated to act on the galvanometer coil
(c) high temperature is generated that may damage the coil
(d) the galvanometer sensitivity increases

12 If the pointer of the galvanometer has deflected by an angle of 50°, when a current of 500 μA passes through it, then the galvanometer sensitivity equals ..... deg/μA.

(a) 550 (b) 450 (c) 0.1 (d) 10

13 A galvanometer has a sensitivity of 2 deg/μA. Given that the value of each division is 5 μA and the maximum deflection angle of the galvanometer pointer from the zero position is 50°, so the number of divisions on the galvanometer scale is equal to ..... .

(a) 5 divisions (b) 10 divisions (c) 20 divisions (d) 25 divisions

14 A sensitive galvanometer scale is divided into 20 divisions. Its pointer deflects to half its scale when a current of 0.1 mA passes through its coil, so the indication of one division on the scale of the device equals ..... .

(a) 20 μA (b) 10 μA (c) 5 μA (d) 2 μA

15 * A moving coil galvanometer shows half scale deflection when an electric current of 200 μA passes through it, hence if you know that each division denotes 0.08 mA, the number of divisions of the galvanometer's scale equals ..... .

(a) 10 divisions (b) 9 divisions (c) 7 divisions (d) 5 divisions

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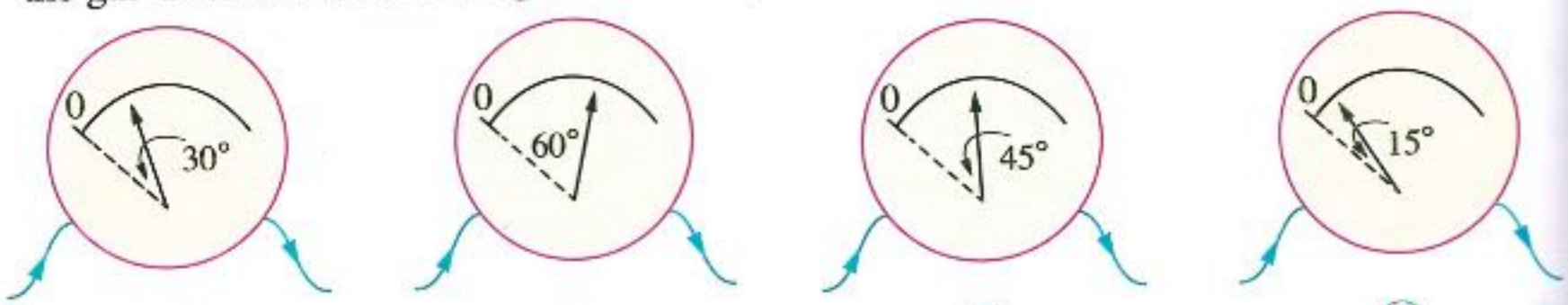
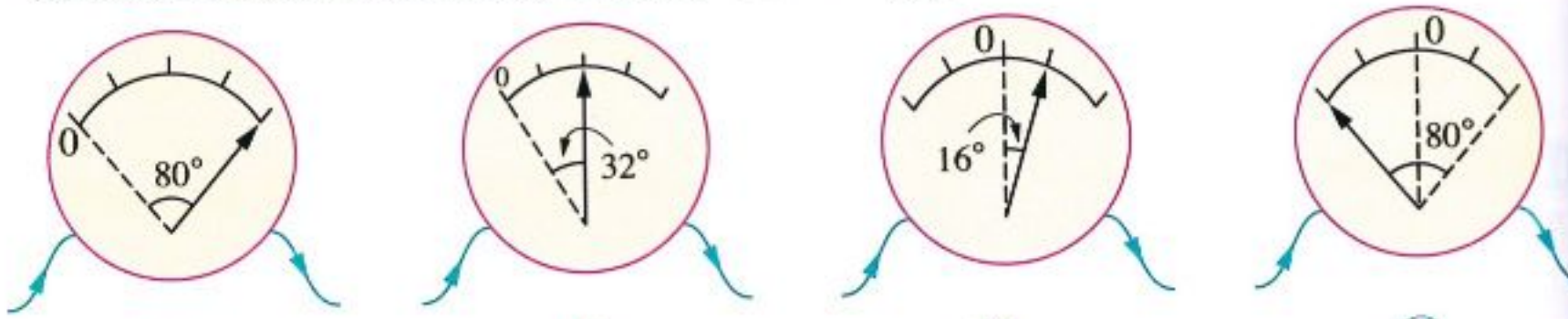
16 The following figures represent the deflection in four sensitive galvanometers during the flow of the same electric current in each of them, which of them expresses the galvanometer with the higher sensitivity?



(a) (b) (c) (d)

17 The following figures represent the deflection of the pointer for four sensitive galvanometer devices when an electric current of 250 μA passes through each of them. Which of these devices has a sensitivity of 0.16 deg/μA?



(a) (b) (c) (d)

18 ✱ Two copper wires of the same length were used to manufacture the coils of two galvanometers P and Q, respectively. The wires were wound around square aluminum frame with side lengths X and 2 X, respectively. If both galvanometers have identical magnetic flux density affecting the coil and the same elasticity coefficient, then the ratio of $\frac{\text{the sensitivity of galvanometer P}}{\text{the sensitivity of galvanometer Q}}$ is equal to ..... .

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) $\frac{2}{1}$ (d) $\frac{1}{1}$

19 ✱ A galvanometer coil that consists of 600 turns and has a cross-sectional area of 6 cm^2 is hung in a magnetic flux of density 0.1 T, hence the electric current intensity that is required to generate a torque of 4.32×10^{-3} N.m equals ..... .

(a) 0.01 A (b) 0.02 A (c) 0.12 A (d) 0.21 A

20 ✱ A sensitive galvanometer has a coil that consists of 1200 turns where the face area of each turn is 3 cm^2. The coil rotates in a uniform magnetic field of flux density 0.01 T. When a current of intensity 1 mA passes in the coil of the galvanometer, its pointer gets deflected by an angle of 30° from the zero position, then the torsion of the two spring coils when the pointer of the galvanometer settles equals ..... .

(a) 2.55×10^{-6} N.m (b) 3.6×10^{-6} N.m
(c) 4.22×10^{-6} N.m (d) 6.4×10^{-6} N.m

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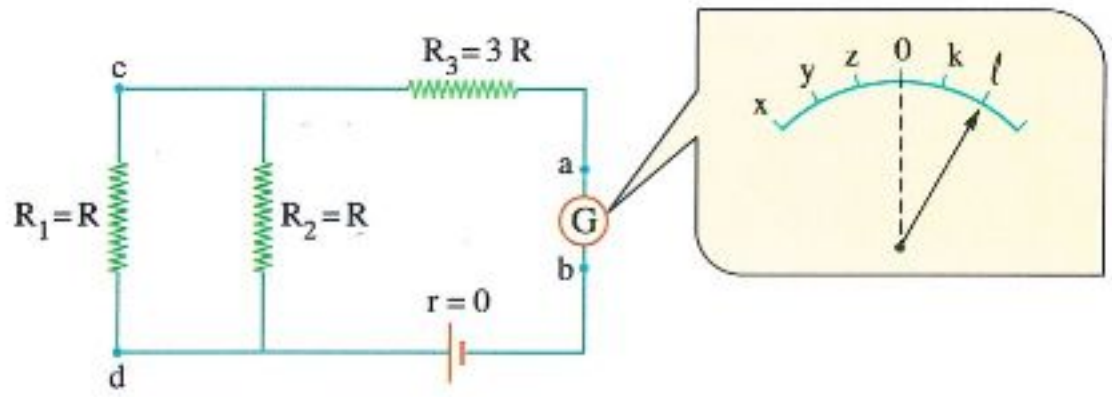
21 * A sensitive galvanometer with terminals a and b and its resistance R, with its zero position at the middle of its scale, its pointer deflects to position ℓ when connected in the electric circuit shown in the following diagram.



When the galvanometer's position in the circuit is swapped with resistor R_1, such that terminal a is connected to point c and terminal b is connected to point d, then the galvanometer pointer will deflect to position ..... .

(a) x (b) y (c) z (d) k

The ammeter

22 When the shunt resistance which is connected to the galvanometer decreases, the ammeter sensitivity ..... .

(a) increases (b) decreases
(c) remains unchanged (d) increases then decreases

23 The ratio between the shunt resistance to the total resistance of the ammeter is ..... one.

(a) greater than (b) equal to (c) less than (d) indeterminable

24 In the ammeter, when the shunt resistance which is connected to the galvanometer decreases while passing the same current, the quantity that increases is ..... .

(a) the torsion that affects the two spring coils
(b) the magnetic force which acts on the sides of the galvanometer coil
(c) the sensitivity of the ammeter
(d) the current measuring accuracy of the ammeter

25 An ammeter is connected in an electric circuit; hence it shows a full range deflection, what happens to the galvanometer if the shunt resistance is increased while the same current intensity flows in the ammeter?

(a) Its pointer deflects in the opposite direction.
(b) Its sensitivity decreases vastly.
(c) A current of intensity less than the end of the ammeter scale passes.
(d) The passing current in its coil will be greater than the maximum reading of its scale.

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26 In the ammeter, the range for measuring electric current intensity becomes greater when connecting the galvanometer with a shunt resistance of value that equals ..... .

(a) one third the galvanometer's resistance
(b) double the galvanometer's resistance
(c) half the galvanometer's resistance
(d) one fifth the galvanometer's resistance

27 A moving coil galvanometer shows full-scale deflection when a current (I) passes through it and when it is connected with a resistor of 12 Ω in parallel and allowing the same current (I) to pass, its pointer gets deflected to one fifth its scale, so the resistance of the galvanometer's coil (R_g) is ..... .

(a) 24 Ω
(b) 36 Ω
(c) 48 Ω
(d) 60 Ω

28 If the ratio between the resistance of the ammeter and that of the galvanometer is $\frac{1}{10}$, then the ratio between the shunt resistance and the galvanometer resistance is ..... .

(a) $\frac{1}{10}$
(b) $\frac{10}{1}$
(c) $\frac{1}{99}$
(d) $\frac{1}{9}$

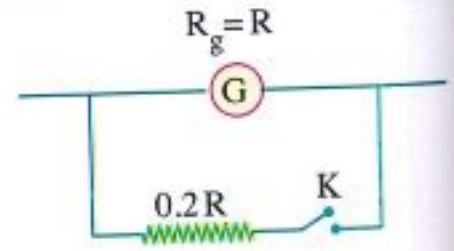
29 If the resistance of the coil of a galvanometer is R, so the shunt resistance that makes its sensitivity decrease to its quarter is ..... .

(a) R
(b) $\frac{R}{2}$
(c) $\frac{R}{3}$
(d) $\frac{R}{4}$

30 ✱ A shunt resistance of 0.1 Ω reduces the sensitivity of an ammeter to the one-tenth of its initial value, so the shunt resistance that reduces the sensitivity of this ammeter to the quarter of its initial value equals ..... .

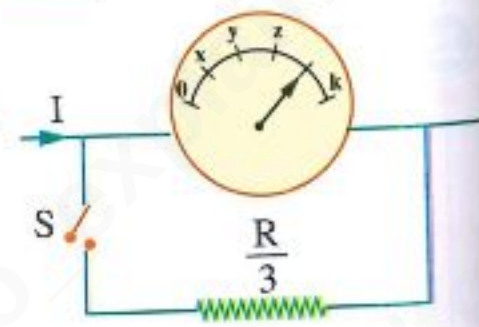
(a) 0.2 Ω
(b) 0.3 Ω
(c) 0.6 Ω
(d) 0.9 Ω

31 In the opposite figure, a shunt resistance that is connected to a galvanometer through a switch K, when the switch is closed, the device sensitivity decreases to ..... its value.



(a) half
(b) fifth
(c) sixth
(d) quarter

32 A galvanometer of resistance R is connected to a shunt resistance of value $\frac{R}{3}$ via a switch S to form an ammeter. When a current of intensity I passes through the galvanometer, its pointer deflects as shown in the opposite diagram. If switch S is closed and the same current passes through the ammeter, the galvanometer pointer will deflect to the position ..... .



(a) x
(b) y
(c) z
(d) k

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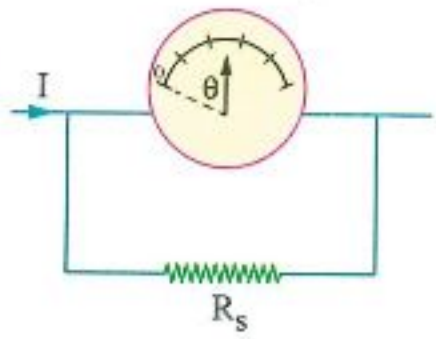
33 An ammeter consists of a galvanometer and a shunt of resistance that equals the galvanometer resistance. When a current of intensity I passes in the ammeter, the pointer of the galvanometer deflects by an angle θ as in the opposite figure. If the shunt resistance is decreased to be one third that of the galvanometer while passing the same current (I) in the ammeter, then the deflection angle of the pointer from the zero position becomes ..... .



(a) θ (b) $\frac{\theta}{2}$ (c) $\frac{\theta}{3}$ (d) $\frac{\theta}{4}$

34 An ammeter that contains a galvanometer of resistance R_g is connected in a closed electric circuit, so if 2 % of the circuit current is passing through the galvanometer, then the shunt resistance equals ..... .

(a) $\frac{R_g}{50}$ (b) $\frac{R_g}{49}$ (c) 49 R_g (d) 50 R_g

35 ✱ A galvanometer has a resistance of 54 Ω, if it is connected to a shunt resistance R_s, an electric current that equals 0.1 of the total current passes through its coil, so the value of resistance R_s equals ..... .

(a) 4.5 Ω (b) 6 Ω (c) 8.25 Ω (d) 10 Ω

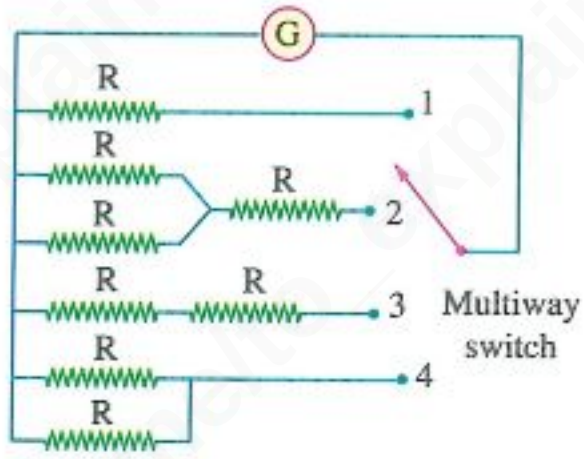
36 A galvanometer's coil of resistance 36 Ω is connected to a shunt resistance of 4 Ω, then the resulted device is connected in a closed electric circuit, so the percentage of the current which passes in the galvanometer's coil to the total current equals ..... .

(a) 8% (b) 9% (c) 10% (d) 91%

37 ✱ A galvanometer that has a coil of 0.1 Ω resistance shows full range deflection for a current of intensity I_g, hence the value of the shunt resistance that is required to increase the range of the galvanometer by 10 times as its initial range equals ..... .

(a) 0.03 Ω (b) 0.02 Ω (c) 0.01 Ω (d) 0.003 Ω

38 A sensitive galvanometer is connected to a multiway switch that can connect a galvanometer to one of the positions (1, 2, 3, 4) to convert it into ammeter, so the maximum measuring range of the ammeter can be achieved when connecting the switch at position ..... .



(a) 1 (b) 2
(c) 3 (d) 4

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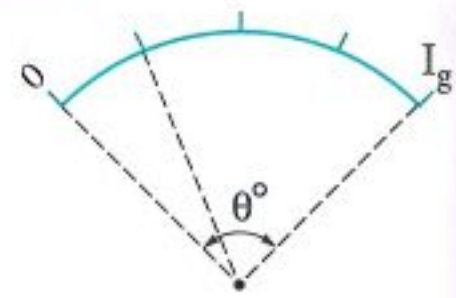
39 ✱ A galvanometer of 54 Ω resistance shows a full-scale deflection for a current of 0.01 A. It is desired to be modified to measure a current of intensity 0.1 A, so ..... .

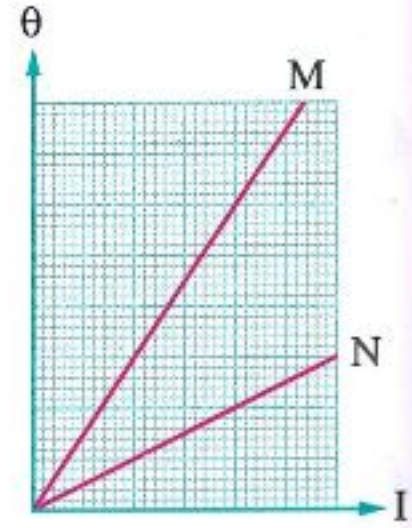
	The value of the shunt resistance	The method of connecting the resistance with the galvanometer
(a)	6 Ω	in series
(b)	3 Ω	in series
(c)	6 Ω	in parallel
(d)	3 Ω	in parallel

40 In the opposite figure , when an electric current of intensity (I_g) passes through a moving coil galvanometer, its pointer deflects by angle (θ) to the end of the scale and when it is connected to a shunt resistance to convert it into ammeter and the same current (I_g) passes through the ammeter, so the pointer deflects by an angle less than θ with ratio 75%, then the sensitivity of the device is ..... .



(a) increased by 75%
(b) decreased by 75%
(c) increased by 25%
(d) decreased by 25%

41 A galvanometer is connected to an electric circuit which its components are connected in series, the two graphical lines N, M represent the relation between the angle of deflection (θ) of the galvanometer's pointer and the current intensity (I) through the circuit before and after converting it into ammeter as shown in the opposite figure, then the sensitivity of the ammeter equals ..... .



(a) half the sensitivity of the galvanometer
(b) one third the sensitivity of the galvanometer
(c) quarter the sensitivity of the galvanometer
(d) the sensitivity of the galvanometer

42 A galvanometer was connected to a shunt resistance R_1, the maximum current the device could measure was (I) as in figure (1), when the same galvanometer was connected to a shunt resistance (R_2), the maximum current the device could measure was (2 I) as in figure (2). In which of the figures is the voltage difference between the terminals of the device greater?

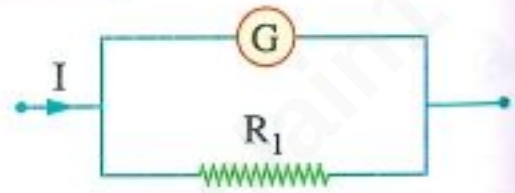


Figure (1)

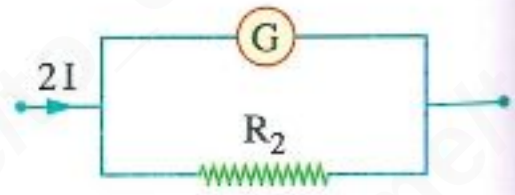


Figure (2)

(a) In figure (1)
(b) In figure (2)
(c) Both figures (1), (2).
(d) Indeterminable.

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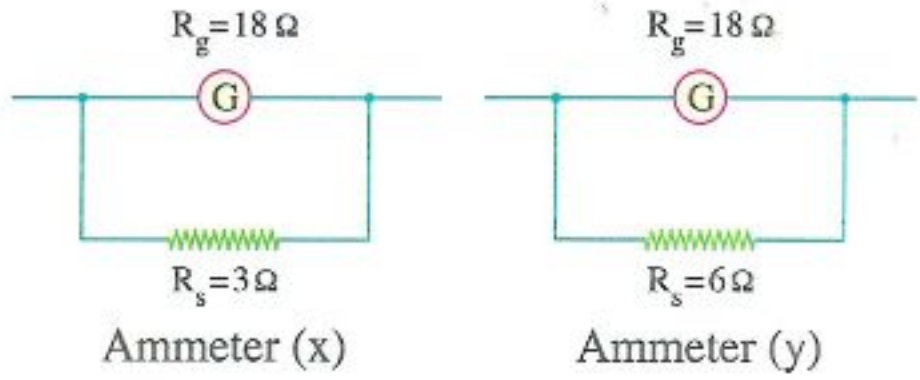
43 The opposite figure shows two identical galvanometers. If each of them is connected to a shunt resistance to be converted into an ammeter, the ratio of the maximum currents that can be measured by both ammeters $(\frac{I_x}{I_y})$ is ..... .



ⓐ $\frac{4}{7}$ ⓑ $\frac{2}{1}$ ⓒ $\frac{3}{1}$ ⓓ $\frac{7}{4}$

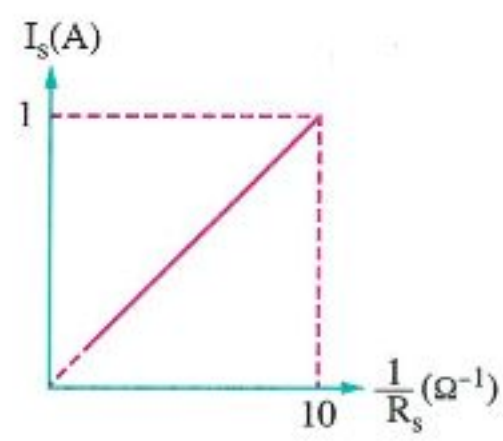
44 ✱ A moving coil galvanometer shows a full-scale deflection of 500 μA when a potential difference of 0.04 V is applied between its terminals, so the value of a shunt resistance, that can be used to convert it into an ammeter that can measure electric currents intensities up to a maximum value of 500 mA, equals ..... .

ⓐ 0.07 Ω ⓑ 0.035 Ω ⓒ 0.4 Ω ⓓ 0.08 Ω

45 ✱ An ammeter shows full-scale deflection when an electric current of 200 mA passes through it, also it shows a reading of 50 mA when a potential difference of 0.04 V is applied between its two terminals, so the value of a shunt resistance that enables the ammeter to measure electric currents up to a maximum value of 2 A equals ..... .

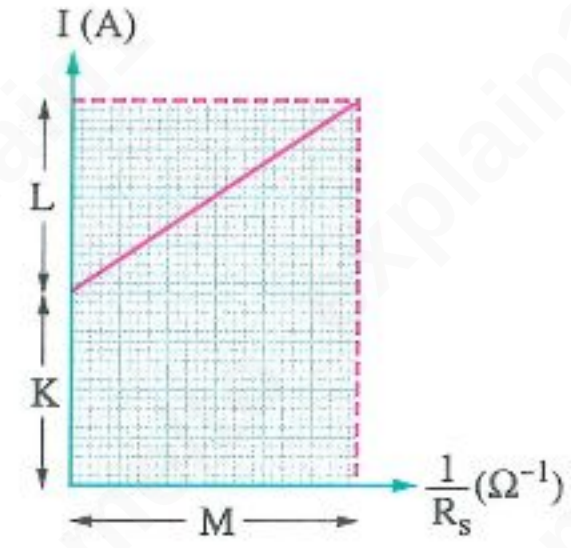
ⓐ 0.089 Ω ⓑ 0.037 Ω ⓒ 0.52 Ω ⓓ 0.41 Ω

46 A sensitive galvanometer, whose coil has a resistance of 50 Ω, has been converted into an ammeter where the opposite graph represents the relation between the intensity of the current that passes through the shunt resistance (I_s) when the galvanometer shows full-scale deflection and the reciprocal of the shunt resistance $(\frac{1}{R_s})$, so the maximum current intensity that can pass through the galvanometer (I_g) equals ..... .



ⓐ 2×10^{-3} A ⓑ 3×10^{-2} A ⓒ 6×10^{-3} A ⓓ 9×10^{-2} A

47 An ammeter consists of a galvanometer of resistance R_g and a variable resistance R_s acts as a shunt resistance, the opposite graph represents the relation between the current intensity (I) that measured by ammeter and the reciprocal of the shunt resistance $(\frac{1}{R_s})$, then the resistance of the galvanometer is determined from the relation; .....



ⓐ $R_g = \frac{L}{M}$ ⓑ $R_g = \frac{L}{KM}$

ⓒ $R_g = \frac{M}{L}$ ⓓ $R_g = \frac{L+K}{M}$

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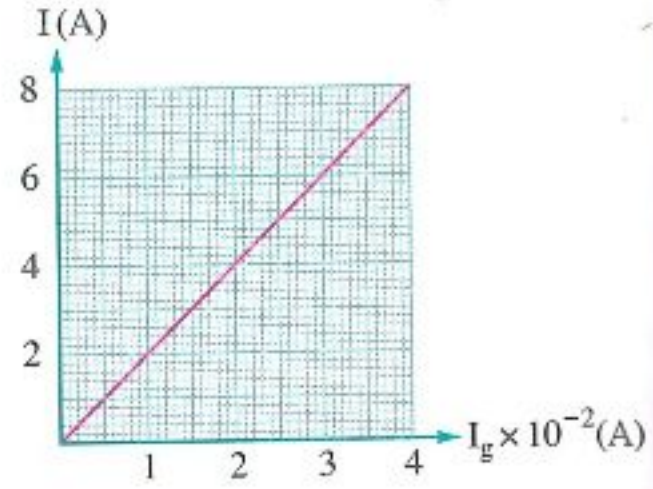
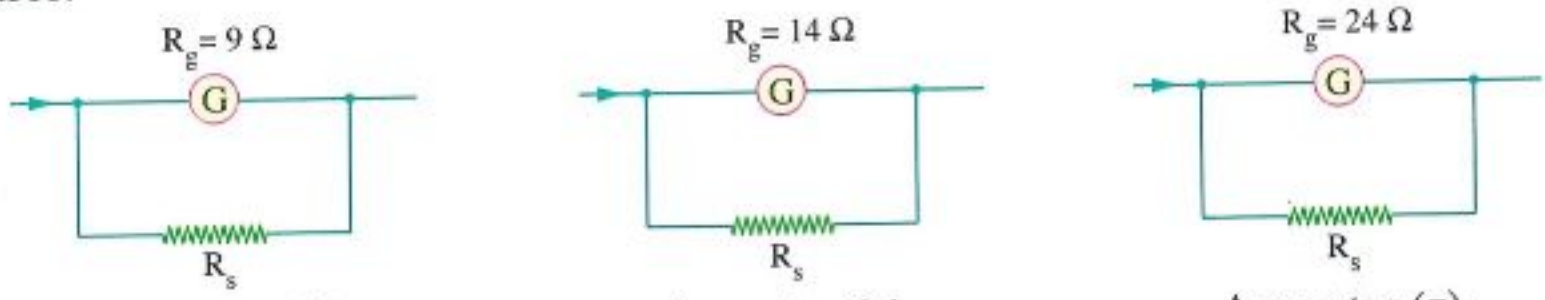
48 A sensitive galvanometer of resistance 6 Ω is connected to a shunt resistor R_s to be converted into an ammeter and the ammeter is connected in an electric circuit, where the opposite graph represents the relation between the reading of the ammeter (I) and the electric current intensity (I_g) that passes through the coil of the galvanometer, so the value of the shunt resistor R_s is equal to ..... .



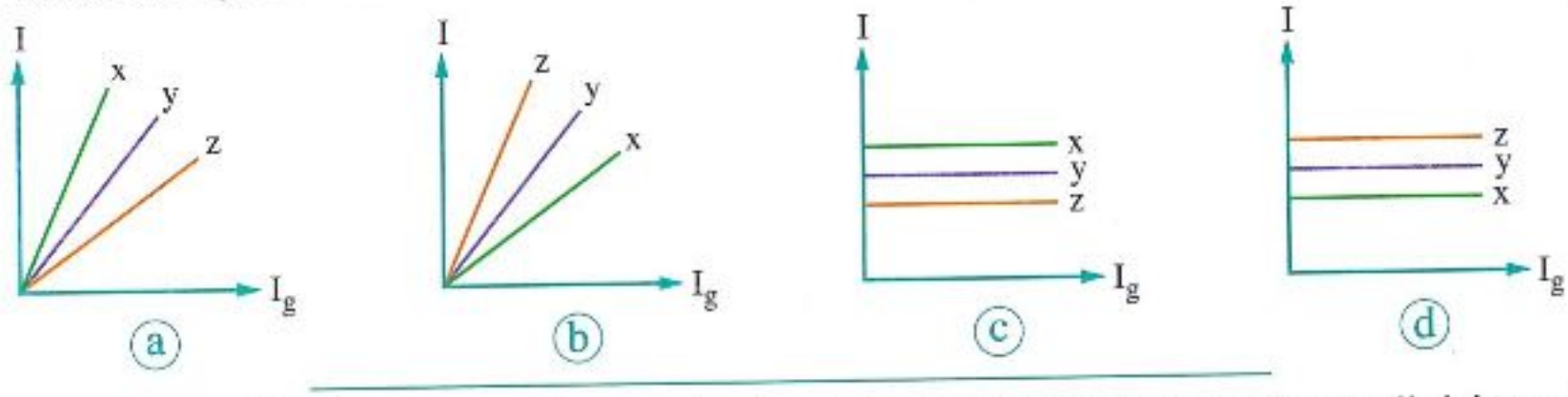
(a) 0.1 Ω (b) 0.03 Ω (c) 0.5 Ω (d) 0.8 Ω

49 Three galvanometers of different resistances, each of them are connected to a shunt resistance R_s one at a time to form three ammeters x, y and z as shown in the following figures:



Ammeter (x) Ammeter (y) Ammeter (z)

Which of the following graphs represents the relation between the electric current (I) that measured by the ammeter and the electric current that passes through the galvanometer (I_g)?



50 A moving coil galvanometer has a coil of resistance 100 Ω where each one division of its scale is representing an electric current of intensity 25 mA. If its coil is connected to a shunt resistor of 0.05 Ω, so the electric current intensity denoted by one division equals ..... .

(a) 30.06 A (b) 40.01 A (c) 25.02 A (d) 50.025 A

51 ✱ The maximum angle of deflection for a moving coil galvanometer from zero position is 80° and when an electric current of 30 mA passes through the galvanometer, its angle of deflection from the zero position becomes 60°, so:

(i) The sensitivity of the galvanometer equals ..... .

(a) 5 deg/mA (b) 3 deg/mA (c) 2 deg/mA (d) 1 deg/mA

(ii) The maximum current that can be withstood by the galvanometer's coil equals ..... .

(a) 0.02 A (b) 0.04 A (c) 0.06 A (d) 0.08 A

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(iii) The maximum current that can be measured by the device if its coil is connected to a shunt resistance of a value that equals 0.01 of the resistance of its coil equals ..... .

(a) 1.51 A (b) 2.12 A (c) 3.75 A (d) 4.04 A

52 * A galvanometer coil of resistance 20 Ω was connected in parallel to a shunt resistance made of a wire of length 20 cm and resistance 5 Ω, so the galvanometer becomes able to measure a current of maximum value 1 A. Then another wire is used with the same galvanometer as a shunt resistance where this wire was made from the same material and has the same cross-sectional area but has half the length of the first wire, so the maximum current that can be measured by the device becomes ..... .

(a) 1.2 A (b) 1.4 A (c) 1.6 A (d) 1.8 A

53 * A sensitive galvanometer measures an electric current up to a maximum value of 8×10^{-3} A when it is connected to a shunt resistance of 1 Ω and it measures an electric current up to a maximum value of 71×10^{-3} A when it is connected to a shunt resistance of 0.1 Ω, so:

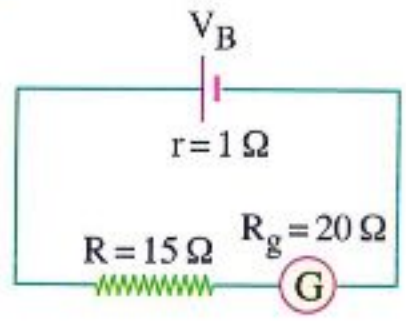
(i) The resistance of the galvanometer's coil equals ..... .

(a) 7 Ω (b) 9 Ω (c) 11 Ω (d) 15 Ω

(ii) The maximum current that can be withstood by the galvanometer's coil equals ..... .

(a) 1×10^{-3} A (b) 2×10^{-3} A (c) 3×10^{-3} A (d) 4×10^{-3} A

54 * The opposite electric circuit consists of battery V_B whose internal resistance is 1 Ω, a constant resistor of 15 Ω and a galvanometer of resistance 20 Ω, hence the ratio between the two intensities of the passing currents in the circuit before and after connecting the galvanometer coil with a shunt resistor of 5 Ω equals ..... .



(a) $\frac{5}{9}$ (b) $\frac{9}{5}$ (c) $\frac{4}{3}$ (d) $\frac{3}{4}$

55 * A galvanometer that has a resistance of 10 Ω where it can be used to measure a current up to a maximum intensity of 40 mA, is connected to a shunt resistance (R_s) then in an electric circuit that contains a resistor of 8 Ω and an electric cell of emf that equals 1.5 V which has a negligible internal resistance. When the circuit is closed, the pointer of the galvanometer deflects to $\frac{3}{4}$ of its graduation scale, so the value of the shunt resistance equals ..... .

(a) 7.6 Ω (b) 5 Ω (c) 2.5 Ω (d) 0.3 Ω

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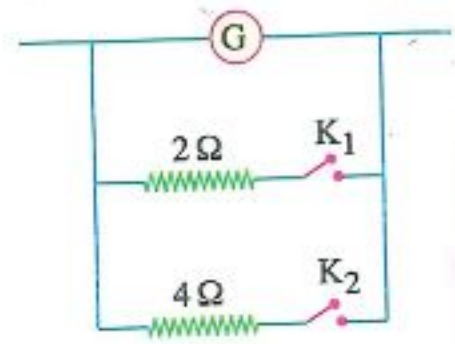
56 ✱ In the opposite figure, a galvanometer that can be connected to one of shunt resistances or both, when switch K_1 only is closed, the sensitivity of the device decreases to its quarter and it becomes suitable for measuring a current up to an intensity of 0.5 A, so:



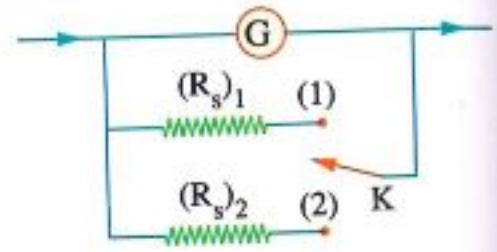
(i) The maximum current that can be measured when closing switch K_2 only equals ..... .

(a) 0.45 A (b) 0.31 A (c) 0.25 A (d) 0.17 A

(ii) The maximum current that can be measured when closing both switches K_1 and K_2 together equals ..... .

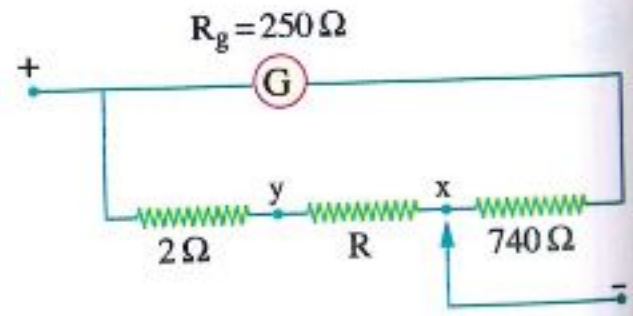
(a) 0.38 A (b) 0.43 A (c) 0.52 A (d) 0.69 A

57 A galvanometer is connected to switch K by two methods as shown in the opposite figure, when the switch is at position (1), 90% of the total current passes through the shunt $(R_s)_1$ and when the switch is at position (2), 99% of the total current passes through the shunt $(R_s)_2$, then the ratio between the two shunt resistances $\left(\frac{(R_s)_1}{(R_s)_2}\right)$ equals ..... .



(a) 10 (b) 11 (c) 9 (d) 99

58 A galvanometer coil of resistance 250 Ω and the maximum current which can be measured is 0.1 A and it has been connected to multiple resistors to form an ammeter, as shown in the opposite figure. When the slider is positioned at point "x" the maximum reading of the device is 10 A. So, the maximum reading of the device when the slider is moved to point "y" is ..... .



(a) 20 A (b) 30 A (c) 40 A (d) 50 A

59 ✱ An electric circuit consists of a battery of negligible internal resistance, a constant resistor of 350 Ω and a galvanometer that is connected in parallel to a shunt resistance of 20 Ω. If the shunt resistance is replaced with another of 30 Ω resistance and to keep the galvanometer deflection unchanged it is required to replace the constant resistor with another of 450 Ω resistance, hence the resistance of the galvanometer equals ..... .

(a) 20 Ω (b) 40 Ω (c) 60 Ω (d) 80 Ω

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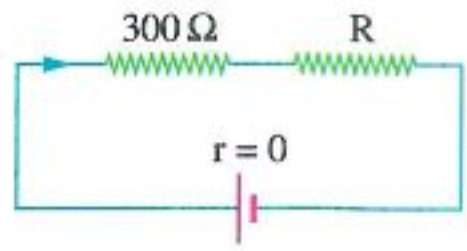
The voltmeter

60 Three voltmeters (A, B, C) have the same measuring range while the resistances of them respectively are 1000 Ω, 4000 Ω and 8000 Ω, so the voltmeter which will have the highest accuracy of measuring the potential difference in the same circuit is ..... .

(a) the voltmeter A
(b) the voltmeter B
(c) the voltmeter C
(d) all of them have the same accuracy

---

61 In the opposite electric circuit, the voltage across the 300 Ω resistor is (V_1). When a voltmeter of resistance 3000 Ω is connected across the 300 Ω resistor terminals, its reading is (V_2). When a voltmeter of 6000 Ω resistance is connected across the same 300 Ω resistor, its reading is V_3. Which of the following relation is correct in terms of (V_1) , (V_2), (V_3)?



(a) $V_1 = V_2 = V_3$
(b) $V_1 > V_2 > V_3$
(c) $V_1 > V_3 > V_2$
(d) $V_1 < V_2 < V_3$

---

62 ✱ A galvanometer shows full-scale deflection when a current of 50 μA passes through it. If it has been converted into a voltmeter that can read up to 10 V, so:

(i) The total resistance of the voltmeter equals ..... .

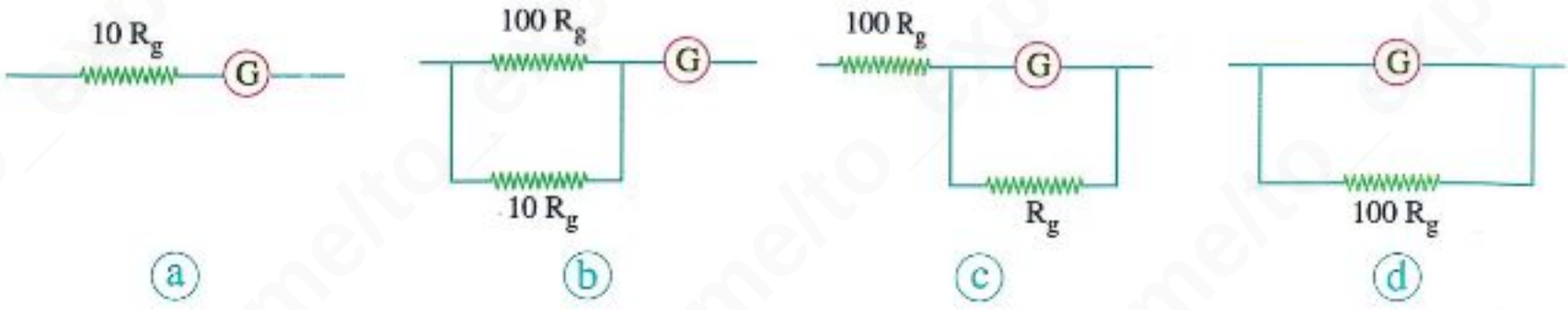
(a) 100×10^3 Ω (b) 200×10^3 Ω (c) 300×10^3 Ω (d) 400×10^3 Ω

(ii) The value of the multiplier resistance if the resistance of the galvanometer coil is 1 kΩ equals ..... .

(a) 111×10^3 Ω (b) 150×10^3 Ω (c) 199×10^3 Ω (d) 245×10^3 Ω

---

63 Four similar galvanometers each of resistance R_g and also each of them is connected to a resistor or more than one resistor as in the following figures, which of the following voltmeters can withstand higher potential difference?



(a) (b) (c) (d)

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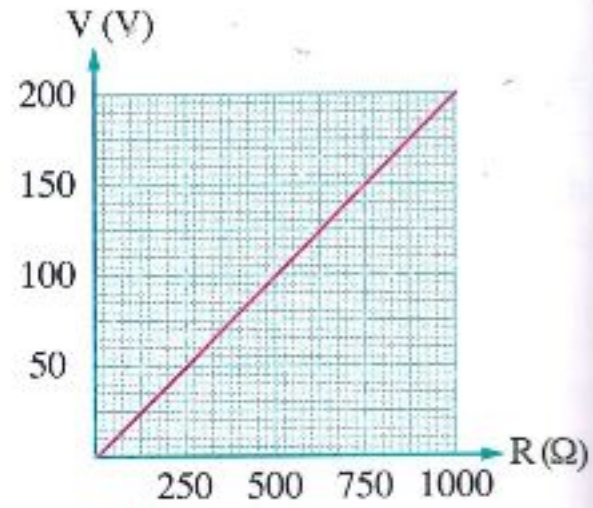
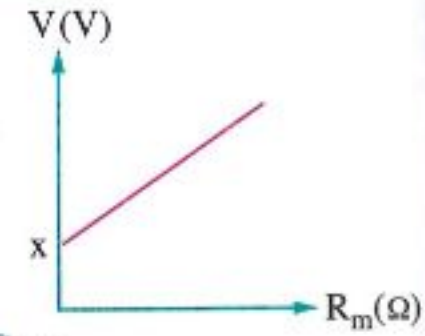
64 A sensitive galvanometer can measure a current of maximum limit I_g, was connected with different multiplier resistors each one at a time to convert it into a voltmeter and the opposite graph represents the relation between the maximum potential difference (V) that can be measured by the voltmeter and the total resistance of the voltmeter (R), so the value of I_g is ..... .



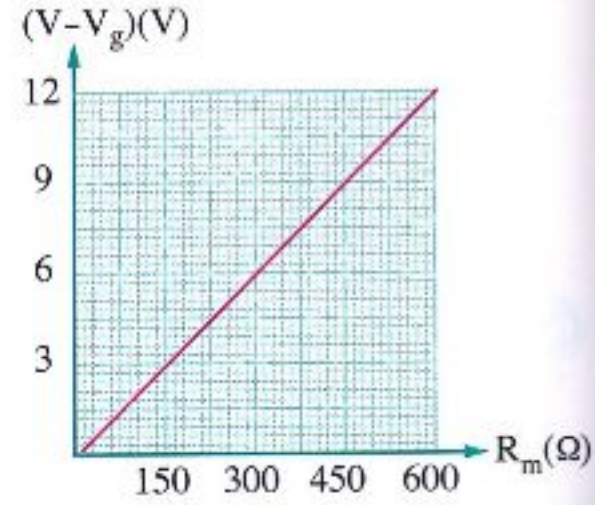
(a) 0.1 A (b) 0.2 A (c) 0.25 A (d) 0.5 A

65 The opposite graph represents the relation between the total potential difference (V) between the terminals of a voltmeter and the value of the multiplier resistance (R_m) in the voltmeter, so the quotient of $\frac{\text{value of x}}{\text{slope}}$ represents ..... .



(a) R_g (b) V_m (c) $\frac{1}{I_m}$ (d) V_g

66 The opposite graph represents the variation of the difference of the maximum voltages that can be measured by the galvanometer before and after connecting the voltage multipliers ($V - V_g$) with the change of the voltage multiplier (R_m);



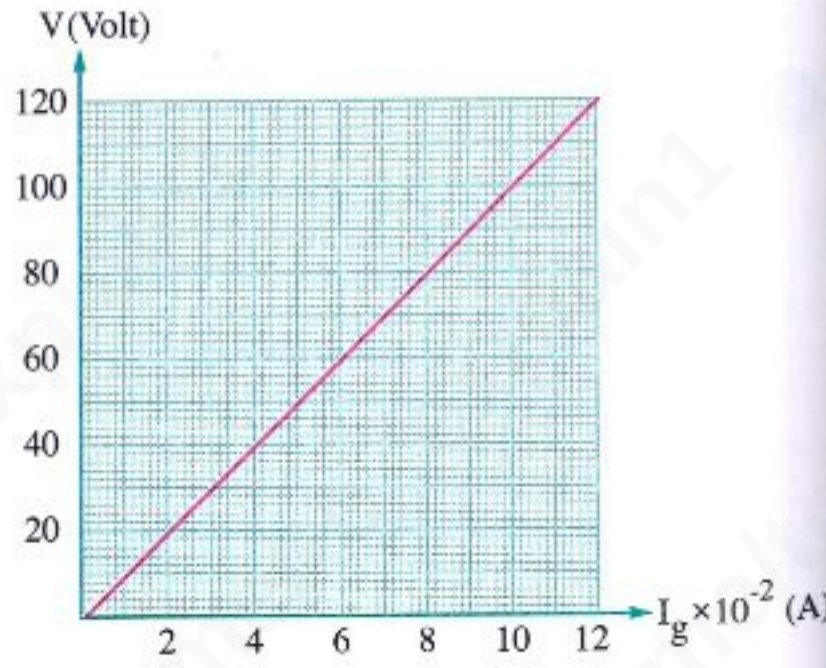
(i) So the maximum current intensity that can be withstood by the galvanometer before connecting the voltage multiplier equals ..... .

(a) 0.01 A (b) 0.02 A (c) 0.03 A (d) 0.04 A

(ii) If the maximum potential difference that can be withstood by the galvanometer's coil before connecting the voltage multiplier is 1 V, so the galvanometer's coil resistance equals ..... .

(a) 30 Ω (b) 50 Ω (c) 80 Ω (d) 100 Ω

67 * A sensitive galvanometer contains a coil whose resistance is 50 Ω where the maximum current that it can withstand is 0.12 A. It is connected to a multiplier resistance (R_m) to be converted into a voltmeter and the opposite graph represents the relation between the voltmeter reading (V) and the intensity of the current which passes through its coil (I_g), so:



(i) The resistance of the voltage multiplier (R_m) equals ..... .

(a) 125 Ω (b) 240 Ω
(c) 460 Ω (d) 950 Ω

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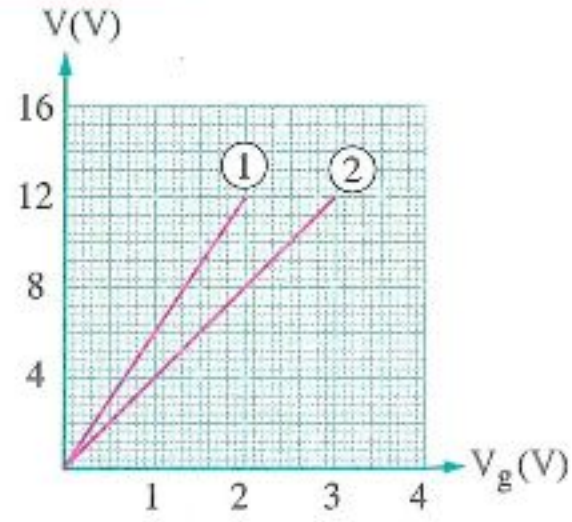
(ii) The maximum voltage that can be measured by the voltmeter equals ..... .

(a) 90 V (b) 120 V (c) 210 V (d) 180 V

68 The maximum voltage can be measured by a sensitive galvanometer is V_g and it is connected separately to two voltage multipliers 1 kΩ and R to convert it into two voltmeters ① and ②, respectively. The opposite graph represents the relation between the voltage difference across each voltmeter (V) and the voltage difference across the galvanometer (V_g). Then the value of the voltage multiplier R is equal to ..... .



(a) 200 Ω (b) 400 Ω (c) 600 Ω (d) 800 Ω

69 If the multiplier resistance in a voltmeter is ten times as large as the galvanometer's resistance and the maximum voltage that can be withstood by the galvanometer is V_g, then the maximum voltage that can be measured by the voltmeter equals ..... .

(a) 10 V_g (b) 9 V_g (c) 0.1 V_g (d) 11 V_g

70 A voltmeter consists of a galvanometer of resistance R and a multiplier resistance of 50 R, so which of the following ratios equals 0.02?

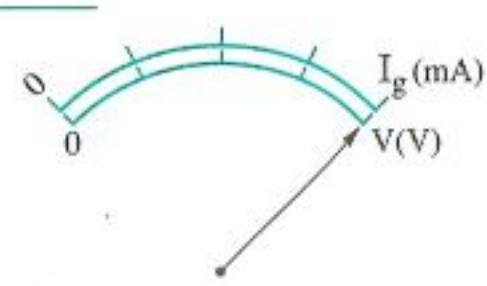
(a) The ratio between the current intensity that passes in the galvanometer and that in the voltmeter.

(b) The ratio between the current intensity that passes in the galvanometer and that in multiplier resistance.

(c) The ratio between the voltage across the multiplier resistance and that across the voltmeter.

(d) The ratio between the voltage across the galvanometer and that across the multiplier resistance.

71 The opposite figure shows the graduation scale of a galvanometer after its calibration into a voltmeter scale, what does the ratio between the reading of the voltmeter and that of the galvanometer $\left(\frac{V}{I_g}\right)$ represent?



(a) $R_m + R_g$ (b) $R_m - R_g$ (c) $R_m R_g$ (d) $\frac{R_m}{R_g}$

72 A galvanometer of resistance 100 Ω that can withstand a maximum current of 0.01 A is required to be converted into a voltmeter, then:

(i) The multiplier resistance that makes it measure a potential difference up to 5 V is ..... .

(a) 5 Ω (b) 100 Ω (c) 400 Ω (d) 500 Ω

(ii) The value of the maximum potential difference that can be measured by the device when it is connected to multiplier resistance of 900 Ω is ..... .

(a) 0.9 V (b) 9 V (c) 10 V (d) 90 V

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73 ✱ A galvanometer shows full-scale deflection when an electric current of intensity 0.02 A passes through it when the potential difference between its two terminals is 5 V, so:

(i) The value of the multiplier resistance that makes the device suitable to measure a potential difference of 150 V equals ..... .

(a) 2916 Ω (b) 4374 Ω (c) 5841 Ω (d) 7250 Ω

(ii) The resistance of the galvanometer coil equals ..... .

(a) 110 Ω (b) 250 Ω (c) 315 Ω (d) 520 Ω

74 In a voltmeter device, the ratio between the electric current intensity which passes in the galvanometer coil and that which passes in the multiplier resistance that is connected to it is always ..... one.

(a) greater than (b) equal to (c) less than (d) indeterminable

75 As the value of the multiplier resistance of a voltmeter increases, ...

(a) the total resistance of the device decreases

(b) the sensitivity of the device increases

(c) the range of the device to measure the potential difference decreases

(d) the accuracy of the device in measuring the potential difference increases

76 A voltmeter of resistance 2000 Ω can measure a maximum potential difference of 2 V. If it is connected to a multiplier resistor R_m, its measuring range increases by 8 V, then the value of R_m is ..... .

(a) 2000 Ω (b) 4000 Ω (c) 6000 Ω (d) 8000 Ω

77 A voltmeter has a resistance of 500 Ω, each division of its graduation scale denotes to 0.1 V, so the value of the multiplier resistance that makes each division of its scale denotes to 1 V equals ..... .

(a) 5000 Ω (b) 2400 Ω (c) 4500 Ω (d) 2700 Ω

78 ✱ A galvanometer of resistance 5 Ω measures electric currents up to a maximum value of 20 mA, so:

(i) The maximum current that can be measured by the device if it is connected with a shunt resistance of 0.1 Ω equals ..... .

(a) 0.96 A (b) 1.02 A (c) 3.16 A (d) 4.05 A

(ii) The multiplier resistance which could be connected to the galvanometer, so it works as a voltmeter that measures a potential difference up to a maximum value of 5 V equals ..... .

(a) 100 Ω (b) 175 Ω (c) 245 Ω (d) 332 Ω

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79 The resistance of the coil of a moving coil galvanometer is 18 Ω, so:

(i) The value of the shunt resistance that allows $\frac{1}{3}$ of the total current to pass through the galvanometer coil equals ..... .

(a) 3 Ω (b) 6 Ω (c) 9 Ω (d) 12 Ω

(ii) The value of the multiplier resistance that makes the galvanometer suitable for measuring a potential difference up to 10 times as large as the potential difference across its coil equals ..... .

(a) 162 Ω (b) 81 Ω (c) 324 Ω (d) 202.5 Ω

---

80 ✳ When a moving coil galvanometer is connected to a shunt resistance of 0.5 Ω, it becomes suitable for measuring currents up to a maximum intensity of 0.11 A and when it is connected to a voltage multiplier of resistance 245 Ω, it becomes suitable for measuring a potential difference up to a maximum voltage of 2.5 V, so:

(i) The maximum current (I_g) that can be withstood by the galvanometer coil equals ..... .

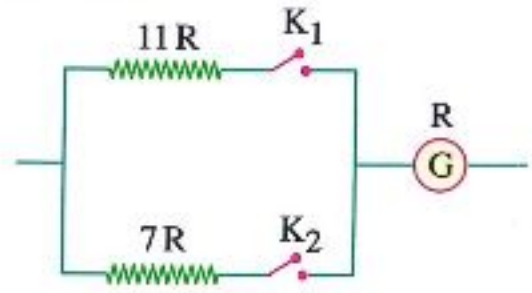
(a) 0.5 A (b) 0.25 A (c) 0.01 A (d) 0.005 A

(ii) The galvanometer resistance equals ..... .

(a) 5 Ω (b) 3 Ω (c) 2.5 Ω (d) 1.5 Ω

---

81 In the opposite figure, a galvanometer of resistance R is connected to voltage multipliers 7 R and 11 R. When switch K_1 is closed only, the maximum reading of the device for measuring voltage is 24 V. When switch K_2 is closed only, the maximum reading of the device for measuring voltage decreases by an amount of ..... .



(a) 6 V (b) 8 V (c) 12 V (d) 16 V

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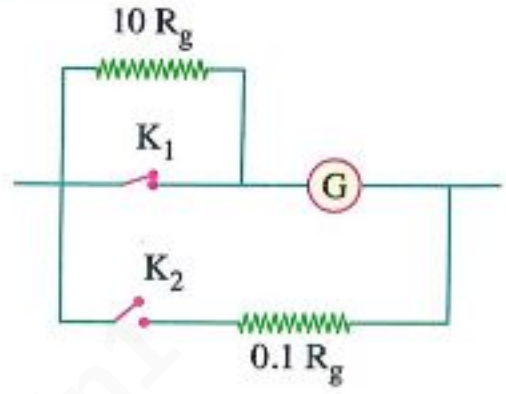
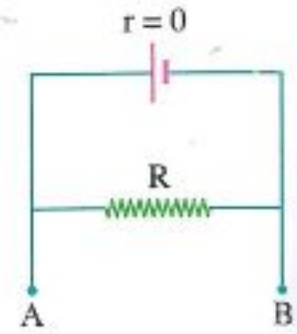
82 ✳ In the opposite figure, a part of a circuit that contains a galvanometer of resistance R_g where the maximum current that it can withstand is I_g. When the switch K_1 is opened, it becomes a voltmeter that can measure a potential difference of maximum value 11 V and when both switches K_1, K_2 are closed together, the galvanometer gets converted into an ammeter that can measure a current of maximum intensity 0.11 A, so the value of each of I_g, R_g are ..... .



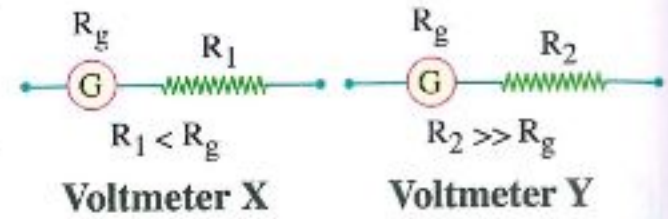
	I_g	R_g
(a)	0.1 A	10 Ω
(b)	0.1 A	100 Ω
(c)	0.01 A	10 Ω
(d)	0.01 A	100 Ω

https://t.me/to_explain1

83 Two voltmeters X and Y contain identical galvanometers and different multiplier resistances, so what is the correct statement that describes the motions of their pointers when each of them is connected individually between the two points A and B in the opposite circuit?



(a) The pointer of device X deflects with a larger angle.
(b) The pointer of device Y deflects with a larger angle.
(c) Both devices' pointers deflect with the same angle.
(d) Both devices' pointers don't deflect.



84 ✱ An electric circuit contains a 10 Ω resistor which is connected in parallel with a voltmeter of 50 Ω resistance. When an electric current of intensity 0.6 A passes in the circuit, the voltmeter shows full scale deflection, so:

(i) The voltmeter reading is ..... .

(a) 2 V (b) 3 V (c) 5 V (d) 9 V

(ii) The maximum potential difference that can be measured by the voltmeter if its coil is connected in series with a resistance of 4950 Ω equals ..... .

(a) 100 V (b) 250 V (c) 370 V (d) 500 V

85 ✱ An electric circuit contains a constant resistor of 6 Ω across which a voltmeter of 30 Ω resistance is connected in parallel. When a current of 0.2 A passes in the circuit, the voltmeter shows full-scale deflection, so if a resistance of 144 Ω is connected in series with the voltmeter and a current of the same intensity passes in the circuit:

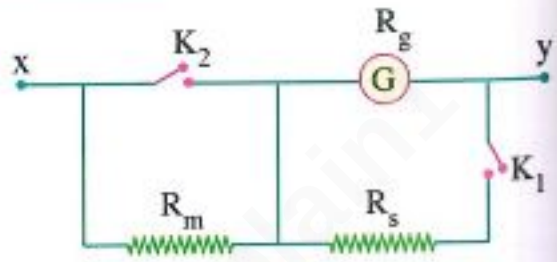
(i) The reading of the voltmeter in this case equals ..... .

(a) 3.48 V (b) 2.34 V (c) 1.16 V (d) 0.98 V

(ii) The maximum potential difference that can be measured by the device after connecting it to the multiplier resistance equals ..... .

(a) 7.2 V (b) 9.6 V (c) 11.2 V (d) 5.8 V

86 An electric device xy consists of a galvanometer, multiplier resistance (R_m), shunt resistance (R_s) and two switches K_1, K_2 as shown in the opposite figure, when the two switches are opened, the sensitivity of the device to measure the potential difference decreases to quarter but when the two switches are closed, the sensitivity of the device to measure the current decreases to quarter, then the ratio of $\left(\frac{R_m}{R_s}\right)$ equals ..... .



(a) 3 (b) 4 (c) 9 (d) 16

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87 ✳ A sensitive galvanometer, the resistance of its coil is 4 Ω, measures a current up to a maximum value of 1 mA, its coil has been connected in parallel to a resistance of 1 Ω where they form one device and that device is connected in series to a resistor of 999.2 Ω to form a voltmeter, so the maximum potential difference that can be measured by this voltmeter equals ..... .

(a) 2 V (b) 5 V (c) 7 V (d) 9 V

88 A milli-ammeter gives full scale deflection when a current of 10 mA passes through its coil. If the device consists of a resistance of 0.2 Ω that is connected in parallel to a galvanometer of resistance 33 Ω, then the value of the resistance which is required to be connected in series to convert the milli-ammeter into a voltmeter that measures a potential difference up to 10 V equals ..... .

(a) 880.2 Ω (b) 950.3 Ω (c) 999.8 Ω (d) 1250.4 Ω

89 ✳ An electric circuit contains an electric cell of emf 10 V whose internal resistance is negligible, connected with two resistors of 16 Ω, 40 Ω in series and when a voltmeter is connected in parallel with the 40 Ω resistor, its pointer has deflected to 6 V:

(i) So, the resistance of the voltmeter equals ..... .

(a) 25 Ω (b) 53 Ω (c) 60 Ω (d) 67 Ω

(ii) If the maximum reading of the voltmeter is 7.5 V, the value of the shunt resistance that leads to convert it into an ammeter measuring a current up to a maximum value of 5 A equals ..... .

(a) 0.6 Ω (b) 1.54 Ω (c) 2.17 Ω (d) 3.72 Ω

90 A galvanometer of resistance R_g is connected separately to voltage multipliers 950 Ω and 3950 Ω to convert it into two voltmeters ① and ②. If the ratio between the maximum voltage that each voltmeter can measure $\left(\frac{V_1}{V_2}\right)$ is $\frac{1}{4}$, then the resistance of the galvanometer R_g is equal to ..... .

(a) 20 Ω (b) 36 Ω (c) 50 Ω (d) 100 Ω

91 A galvanometer has a maximum measurable voltage V_g. When it is connected separately to voltage multipliers R_1 and R_2, the maximum voltage each device can measure is nV_g and mV_g, respectively. The ratio of $\left(\frac{R_1}{R_2}\right)$ is equal to ..... .

(a) $\frac{n-1}{m-1}$ (b) $\frac{n+1}{m+1}$ (c) $\frac{m-1}{n-1}$ (d) $\frac{m+1}{n+1}$

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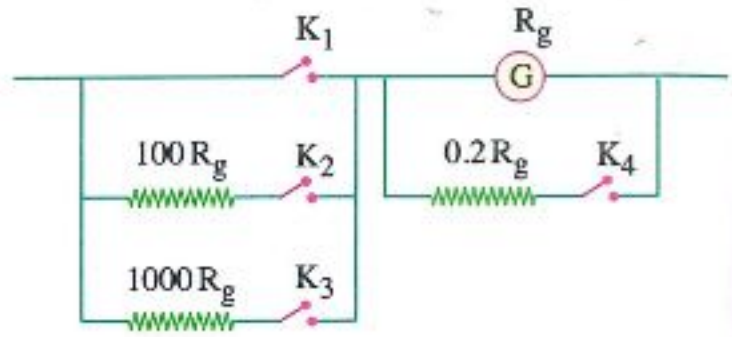
92 In the opposite figure, to convert the galvanometer into a voltmeter to measure the maximum potential difference, so the two switches must be closed are ..... .



ⓐ K_1, K_4 ⓑ K_1, K_3

ⓒ K_3, K_4 ⓓ K_2, K_4

The ohmmeter

93 The ohmmeter pointer deflects to its maximum scale when the ohmmeter circuit is closed, so the measured resistance is ..... .

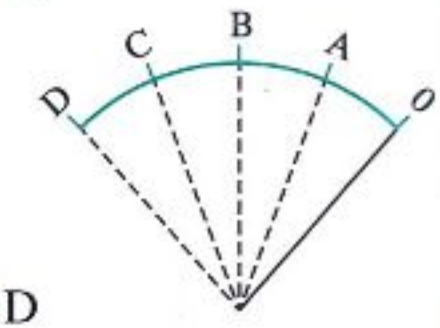
ⓐ very large ⓑ small ⓒ zero ⓓ infinite

94 A resistor R is connected between the terminals of an ohmmeter, hence its pointer has deflected to half its current scale, so the value of the resistor R is ..... .

ⓐ infinite ⓑ equal to the ohmmeter resistance

ⓒ equal to zero ⓓ greater than the ohmmeter resistance

95 The opposite figure represents an equal divisions of the ohmmeter scale which its pointer is adjusted at zero position.



(i) Which of the shown marks on the scale can represent the resistance of ohmmeter?

ⓐ A ⓑ B ⓒ C ⓓ D

(ii) When the pointer settled at the mark C, it means that the value (C) is ..... .

ⓐ less than the resistance of ohmmeter

ⓑ equal to the summation of the ohmmeter's resistance and the resistance which is connected to its terminals

ⓒ double the resistance of ohmmeter

ⓓ equal to the resistance that is connected to the terminals of ohmmeter

96 ✱ A milli-ammeter of 4 Ω resistance has a coil that can withstand a current up to a maximum intensity of 16 mA, it is wanted to be converted into an ohmmeter using a dry cell of emf 1.5 V whose internal resistance is 1.75 Ω, so:

(i) The value of the standard resistance which is required to be used equals ..... .

ⓐ 25 Ω ⓑ 43 Ω ⓒ 88 Ω ⓓ 95 Ω

(ii) The external resistance that makes its pointer deflect to 10 mA equals ..... .

ⓐ 311.75 Ω ⓑ 150.9 Ω ⓒ 112.5 Ω ⓓ 56.25 Ω

(iii) The intensity of the electric current that passes through it if it is connected to an external resistance of 300 Ω equals ..... .

ⓐ 2×10^{-3} A ⓑ 3.8×10^{-3} A ⓒ 5×10^{-3} A ⓓ 6.4×10^{-3} A

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97 ✱ A galvanometer of coil resistance 250 Ω that shows a full-scale deflection when a 400 μA current passes through its coil is connected to an electric cell of emf 1.5 V, a constant resistance of 3000 Ω and a variable resistance (R_V), so:

(i) The obtained value from the variable resistor, so that the galvanometer would be converted into an ohmmeter, equals ..... .

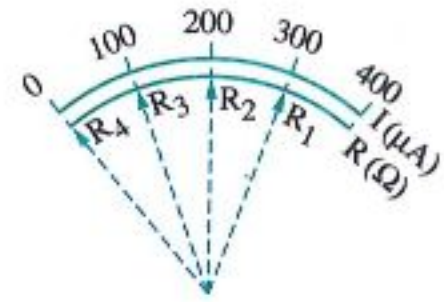
(a) 2000 Ω (b) 1500 Ω (c) 1000 Ω (d) 500 Ω

(ii) The value of the resistance, that if connected to the terminals of the ohmmeter makes the pointer deflect to the quarter of its scale, equals ..... .

(a) 3750 Ω (b) 7500 Ω (c) 15315 Ω (d) 11250 Ω

---

98 In the opposite figure, the ohms graduation scale is added to the ammeter graduation scale, so if the total internal resistance of the ohmmeter is 3750 Ω and the maximum value of current intensity on its scale is 400 μA:



(i) The resistance of R_1 equals ..... .

(a) 5317 Ω (b) 3750 Ω (c) 1250 Ω (d) 999 Ω

(ii) The resistance of R_2 equals ..... .

(a) 1250 Ω (b) 2500 Ω (c) 3750 Ω (d) 5412 Ω

(iii) The resistance of R_3 equals ..... .

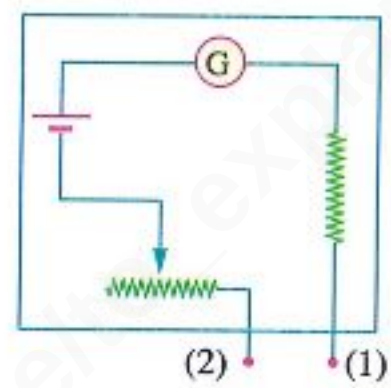
(a) 3750 Ω (b) 7500 Ω (c) 9713 Ω (d) 11250 Ω

(iv) The expected resistance of R_4 and the reason for this expectation are ..... .

	The value	The reason
(a)	∞	because the current intensity vanishes
(b)	∞	because the current intensity becomes maximum
(c)	0	because the current intensity vanishes
(d)	0	because the current intensity becomes maximum

---

99 The opposite figure shows the components of an ohmmeter where the full scale deflection of the galvanometer pointer is 600 μA at connecting the ends of the ohmmeter (1), (2) together, if a resistance R_x which equals double of the total resistance of the circuit was inserted between the terminals of the ohmmeter, then, the reading of the galvanometer pointer equals ..... .



(a) 200 μA (b) 300 μA (c) 600 μA (d) 1200 μA

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100 An ohmmeter of total resistance R_o contains a battery of emf V_B that has a negligible internal resistance, when an unknown resistance R has been connected between the terminals of the ohmmeter, the pointer of the device has deflected to $\frac{1}{5}$ of its current scale, then the value of the ohmmeter's resistance (R_o) equals ..... .

(a) 5 R (b) $\frac{R}{5}$ (c) 4 R (d) $\frac{R}{4}$

---

101 If a resistance of 200 Ω makes the ohmmeter's pointer deflects to $\frac{1}{2}$ the current scale, then the resistance that makes it deflect to $\frac{1}{3}$ of the current scale is ..... .

(a) 300 Ω (b) 400 Ω

(c) 600 Ω (d) 1200 Ω

---

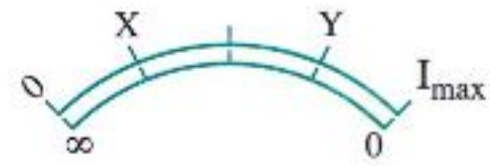
102 The opposite figure represents an equally divided ohmmeter scale. When an external resistance is connected between the two terminals of the device, its pointer has deflected to position x on the scale of the current, so the value of this resistance is ..... the resistance of the ohmmeter.

(a) one third (b) half

(c) double (d) three times

---

103 ✱ The opposite figure shows an equally divided ohmmeter scale. When this ohmmeter is used to measure an unknown resistance R, the pointer of the device is deflected to the position X on the scale, then the external resistance that makes the pointer of the device deflects to the position Y on the scale is ..... .

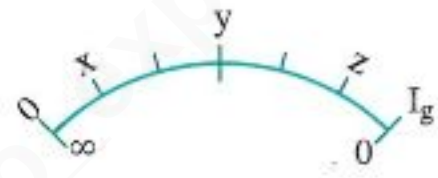


(a) $\frac{R}{3}$ (b) 3 R

(c) $\frac{R}{9}$ (d) $\frac{3R}{4}$

---

104 The opposite figure represents an equal divisions of a calibrated ohmmeter where the position y represents exactly the middle of the scale, then the ratio between the values of the resistance that is connected to the terminals of the ohmmeter $\left(\frac{R_x}{R_z}\right)$ when the pointer settles at the two positions x, z is ..... .



(a) 4 (b) 9 (c) 16 (d) 25

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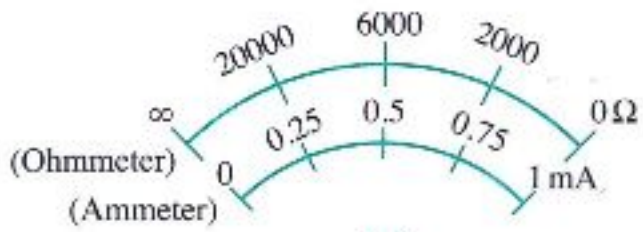
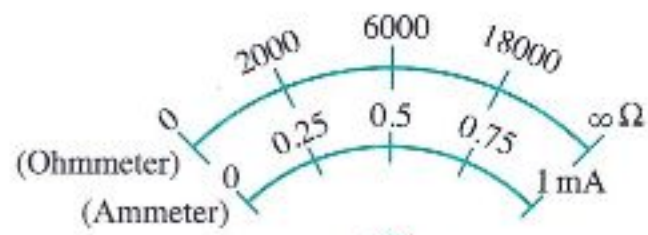
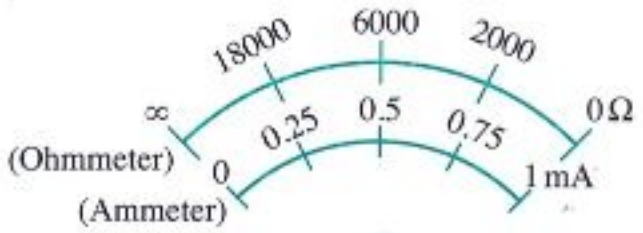
105 An ohmmeter consists of an ammeter, a standard resistance and a 6 V battery. It shows a full-scale deflection when a current of 1 mA flows through it, if an ohm graduation scale is added to the ammeter scale, the correct figure that represents the scales of the current and resistance will be ..... .



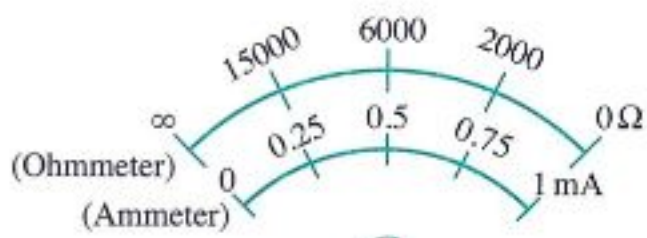
(a)



(b)

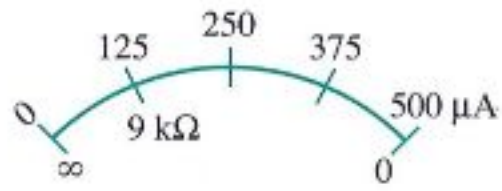


(c)



(d)

106 ✱ The opposite figure represents equal divisions on the ohmmeter graduation scale. Using the shown data:



(i) The ohmmeter resistance equals ..... .

(a) 9000 Ω (b) 6000 Ω

(c) 3000 Ω (d) 1000 Ω

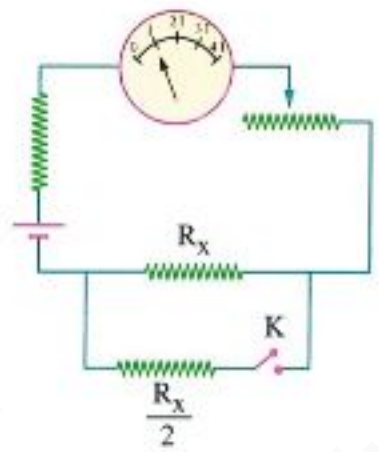
(ii) The electromotive force of the dry cell in the ohmmeter equals ..... .

(a) 1.5 V (b) 2 V (c) 2.5 V (d) 3 V

107 ✱ When 300 Ω resistor is connected to an ohmmeter, its pointer deflects to $\frac{1}{4}$ of its scale, so the resistance that makes its pointer deflect to $\frac{1}{6}$ of its scale equals ..... .

(a) 1500 Ω (b) 1000 Ω (c) 500 Ω (d) 250 Ω

108 In the shown ohmmeter circuit, when the switch K is closed, the pointer becomes ..... .



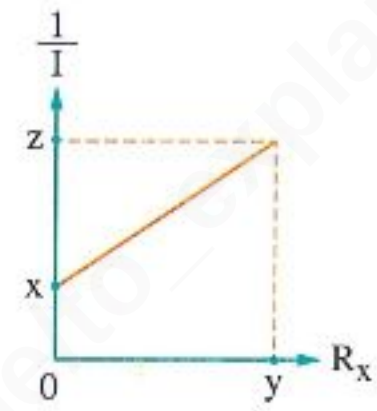
(a) at 2 I

(b) between 2 I, I

(c) at 3 I

(d) between 3 I, 2 I

109 An ohmmeter has been calibrated, and its total resistance is R_0. The opposite graph represents the relation between the reciprocal of the current $\left(\frac{1}{I}\right)$ passing through the ohmmeter circuit and the external resistance R_x connected across its terminals. Thus, the resistance of the ohmmeter R_0 is equal to ..... .



(a) $\frac{zy}{z-x}$ (b) $\frac{xy}{z-x}$ (c) $\frac{z-x}{zy}$ (d) $\frac{z-x}{xy}$

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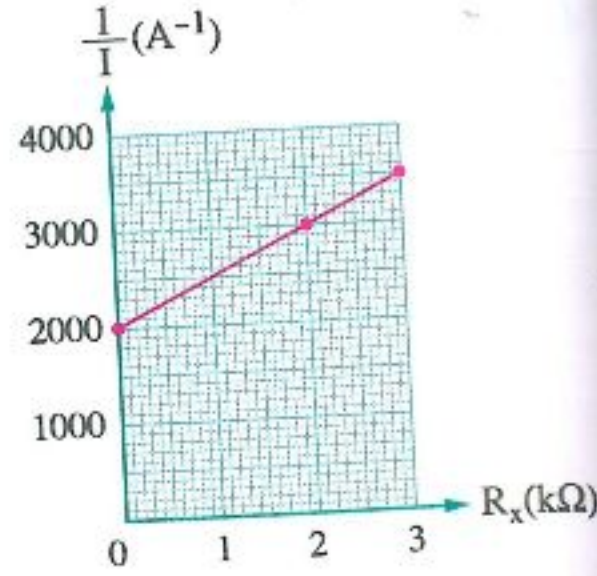
110 An ohmmeter has been calibrated, and its total resistance is R_0. The opposite graph represents the relation between the reciprocal of the current $\left(\frac{1}{I}\right)$ passing through the ohmmeter circuit and the external resistance (R_x) that connected across its terminals. Thus,



(i) The electromotive force (emf) of the battery used in the ohmmeter is equal to ..... .

(a) 0.5 V (b) 1 V
(c) 1.5 V (d) 2 V

(ii) The resistance of ohmmeter (R_0) equals ..... .

(a) 2 kΩ (b) 4 kΩ (c) 6 kΩ (d) 8 kΩ

Second Essay questions

The moving coil galvanometer

1 **In the moving coil galvanometer, explain:**

(a) The galvanometer pointer deflects when a current passes through it, then it stops at a certain reading.

(b) When the current is cut, the pointer of the galvanometer returns to the zero position.

2 **Mention two characteristics** to be considered during making a moving coil galvanometer, so its scale becomes uniform.

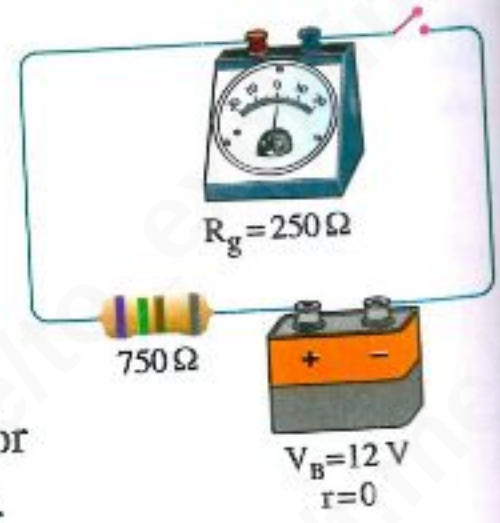
3 **Give reason:** During the rotation of a current-carrying galvanometer coil, the value of the magnetic torque acting on it remains unchanged.

4 The scale of a moving coil galvanometer is divided into 20 divisions where the current indication of each division is 200 μA. **Calculate** the intensity of the current that deflects the galvanometer pointer to the quarter of its scale.

5 **Why** is the galvanometer reading for the intensity of the current passing in an electric circuit always less than its intensity when the galvanometer is not part of it?

The ammeter

6 A galvanometer is connected in an electric circuit as in the opposite figure, if the maximum reading on its scale is 20 μA:



(a) **Explain why** such a galvanometer is not suitable for measuring the intensity of the current passing in that circuit when the switch is closed.

(b) **Suggest a method** that makes such galvanometer suitable for measuring the intensity of the current passing in that circuit.

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7 A galvanometer can measure an electric current of maximum intensity 0.01 A. If its coil resistance is 30 Ω, **calculate** the resistance of the shunt which is required to convert it into an ammeter that can measure a current of maximum intensity 1 A and also the total resistance of the ammeter in that case.

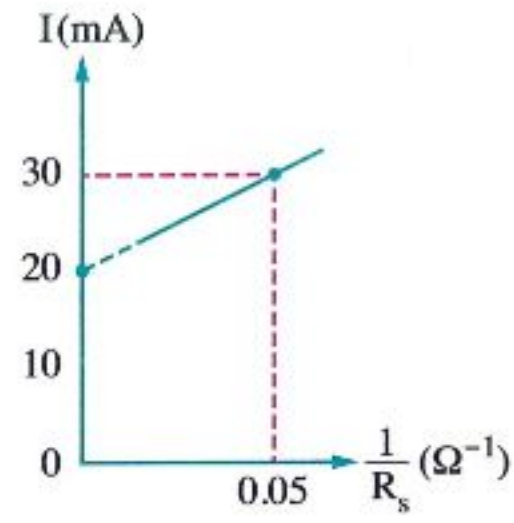
---

8 A galvanometer of resistance R_g, the maximum reading on its scale is I_g is connected to a shunt of resistance R_s, so the total resistance of the device becomes $\frac{R_g}{4}$ and the maximum current that it can measure becomes I. **Determine the ratio between:**

(a) The two resistances $(\frac{R_s}{R_g})$. **(b)** The two currents $(\frac{I}{I_g})$.

---

9 A sensitive galvanometer whose coil can be connected to different shunt resistances each separately where the opposite graph represents the relation between the maximum current intensity that the ammeter can measure (I) and the reciprocal of the shunt resistance $(\frac{1}{R_s})$. **Calculate:**



(a) The maximum current intensity that the galvanometer can measure (I_g).

(b) The resistance of the galvanometer (R_g).

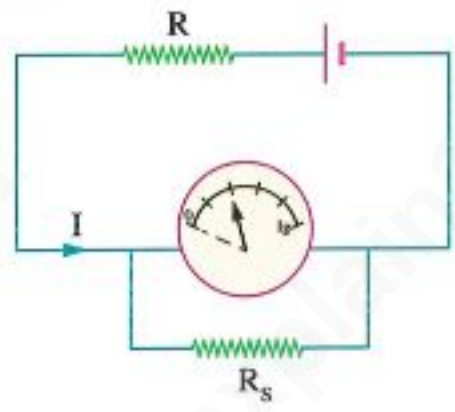
(c) The resistance of the shunt that makes the ammeter measures a current of maximum intensity 0.3 A.

---

10 When a galvanometer is connected to a shunt of resistance R_s, its maximum measuring range becomes 0.06 A and when it is connected to a shunt resistance of $4\ R_s$, its maximum measuring range becomes 0.03 A, **so what** is the maximum current intensity that can be measured by the galvanometer before connecting any shunt resistance?

---

11 A moving coil galvanometer of resistance R_g has a scale divided into five divisions each indicates 0.01 A. When the galvanometer is connected to a shunt of resistance $0.2\ R_g$ and gets embedded in an electric circuit, its pointer has deflected as in the opposite figure. **Calculate:**



(a) The current intensity I that passes in the circuit.

(b) The maximum current intensity that can be measured by the ammeter.

---

12 An ammeter of resistance 24 Ω, **calculate** the resistance of the shunt that is required to decrease the sensitivity of such ammeter to $\frac{1}{9}$ of its value.

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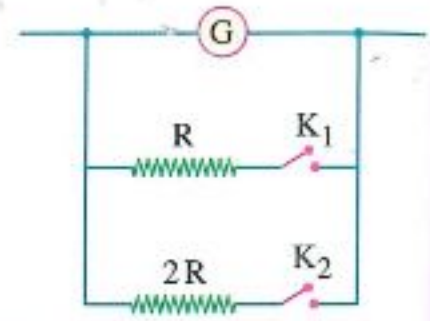
13 In the opposite figure, when switch K_1 is closed, the sensitivity of the device becomes half that of the galvanometer. **Calculate** the ratio between the sensitivity of the device and that of the galvanometer when the switch K_2 only is closed.



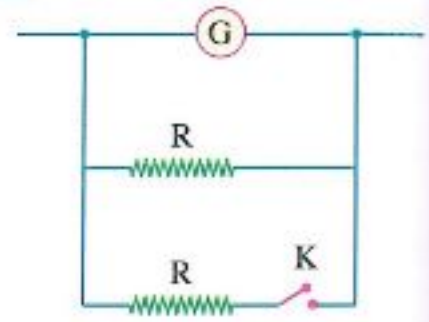
14 **The opposite figure shows the structure of an ammeter. What happens to each of the following when the switch K is closed:**

(a) Resistance of the ammeter?

(b) The maximum current intensity that can be measured by the ammeter?

(c) Accuracy of the ammeter?

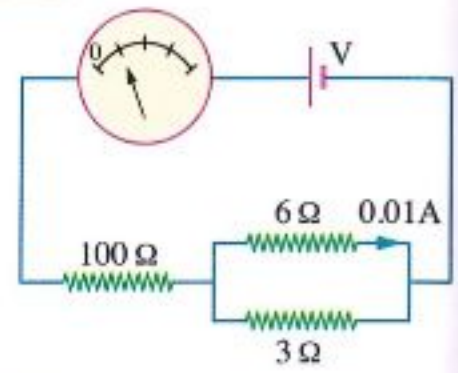
(d) Sensitivity of the ammeter?



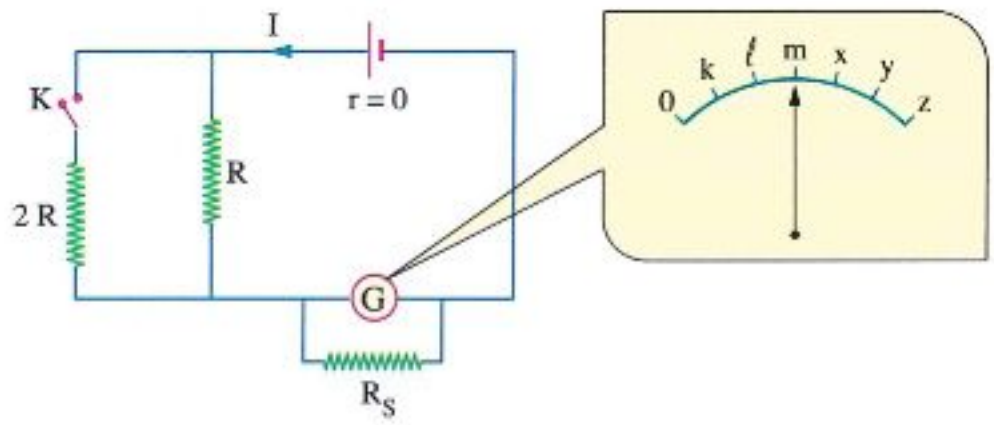
15 In the opposite figure, a galvanometer of resistance 50 Ω is connected to an electric circuit:

(a) **What** is the maximum reading of that galvanometer?

(b) **How** can it be converted into an ammeter that can measure a current of maximum intensity 0.6 A?



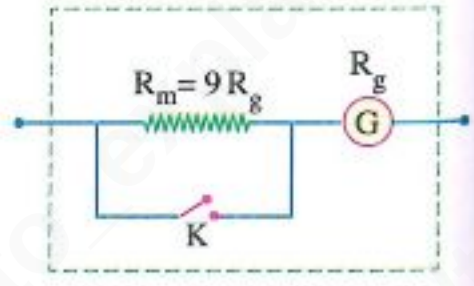
16 The following figure shows the position of the pointer of a galvanometer of resistance R, that is connected to a shunt of resistance 0.5 R and embedded in an electric circuit.



Deduce the deflection position of the pointer when the switch (K) is closed.

The voltmeter

17 The opposite figure represents a device that can measure a potential difference of maximum value 1 V while the switch (K) is opened. **What** is the maximum potential difference can be measured by the device when the switch (K) is closed?



18 **Explain:** The voltmeter is connected in parallel with the conductor which is required to measure the potential difference across its ends.

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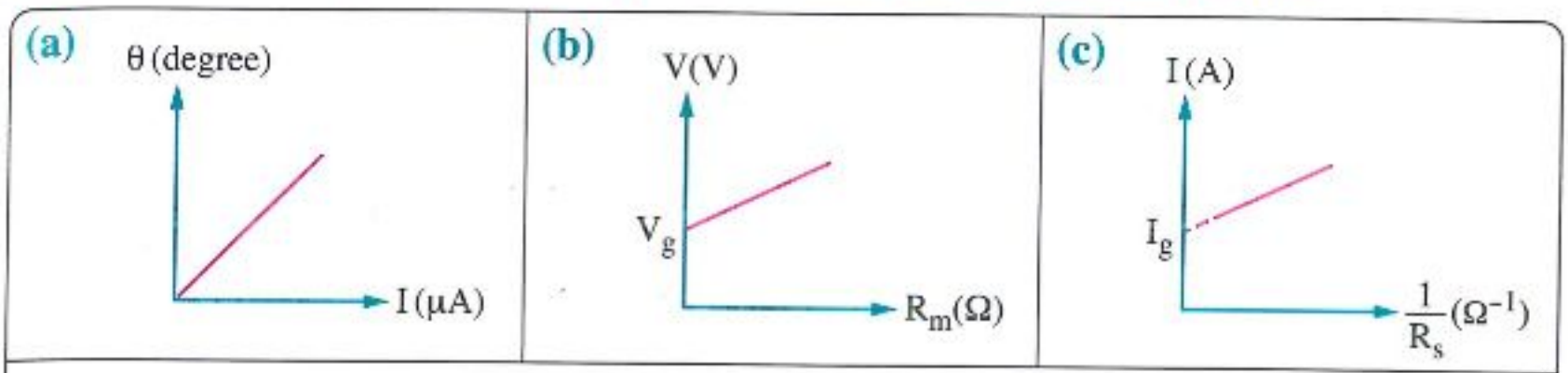
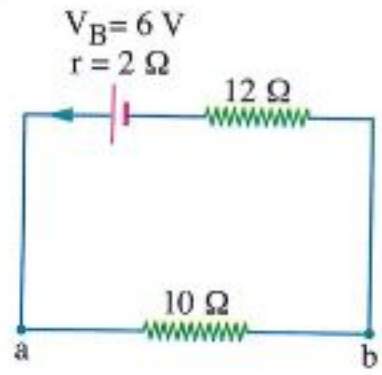
19 **Write the mathematical relation which is represented by each of the following graphs and the equivalent for slope of the straight line in each graph:**

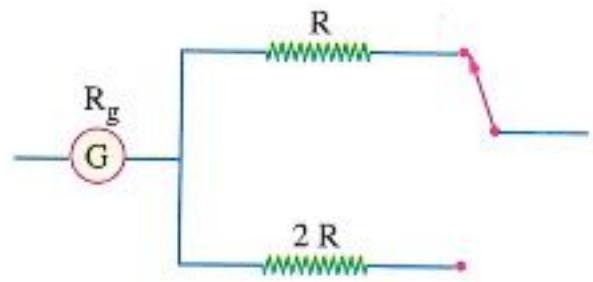


(Where: (θ) is the deflection angle of the galvanometer, (I) is the electric current intensity, (V) is the potential difference, (V_g) is the maximum potential difference at the ends of the galvanometer, (R_m) is the multiplier resistance, (R_s) is the shunt resistance, (I_g) is the maximum current intensity that can be withstood by the galvanometer).

20 In the opposite electric circuit, **compare between** the total current intensity and also the potential difference across the 10 Ω resistance before and after connecting a voltmeter of resistance 190 Ω across the points a, b. **Explain your answer.**



21 The opposite figure represents a voltmeter that consists of a galvanometer of resistance R_g, two multiplier resistors of resistances R, 2 R and a two way switch that can connect either of them to the galvanometer. **Show which of the two multiplier resistors gives the greater:**



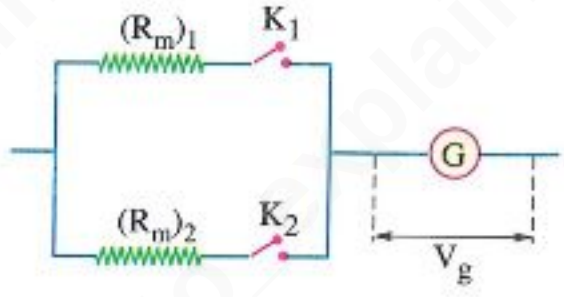
(a) Measuring range.

(b) Accuracy in measuring the potential difference.

(c) Greater sensitivity.

22 In the opposite figure, a galvanometer can measure a potential difference of maximum value V_g. When switch (K_1) only is closed, the device can measure a potential difference up to 7 V_g and when closing the two switches (K_1), (K_2) together, it can measure a potential difference up to 3 V_g

Determine the ratio between the two resistances $\left(\frac{(R_m)_1}{(R_m)_2}\right)$.



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The ohmmeter

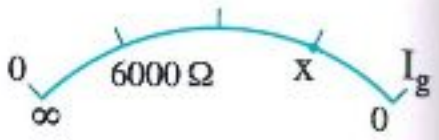
23 **In the ohmmeter:**

(a) **Why** must the emf of the electric cell be constant?

(b) When the standard value of emf of the electric cell gets decreased, **show with explanation** what is noticed when the ends of the ohmmeter are connected together?

24 **Compare with explanation between** the scales of the microammeter and the ohmmeter in terms of the regularity of the scale.

25 The opposite figure represents equal divisions on the scale of an ohmmeter that consists of a standard resistance and an electric cell of emf 2 V with negligible internal resistance. **Calculate:**



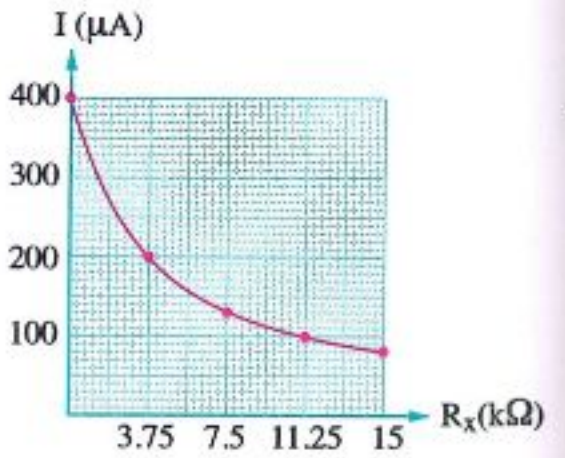
(a) The maximum reading on the scale of the galvanometer (I_g).

(b) The resistance of the external resistor that when connected to the ends of the ohmmeter, its pointer deflects to mark (x) on its scale.

26 An ohmmeter of resistance R_o contains an electric cell of emf V_B. When its ends are connected to a resistance R_x, a current of intensity I passes in its circuit.

Prove that: $R_x = \frac{V_B}{I} - R_o$

27 The opposite graph represents the relation between the electric current intensity (I) which is passing in the ohmmeter and the external resistance (R_x) which is connected to its ends. **Determine:**



(a) The maximum current that can pass through the ohmmeter.

(b) The ohmmeter resistance.

(c) The resistance of the resistor R_x which when connected to the ohmmeter, a current of 50 μA passes through it.

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Questions of the Previous Years Exams ? on Lesson 4

The moving coil galvanometer

1 In two galvanometers, if a current (I) passes therefore the pointer of the first device deflects by an angle 30° and the second deflects by 10° more than that of the first. So, by passing a current of (2 I), which of the following statements is correct after increasing the current to (2 I) in both galvanometers? *(1st session 24)*

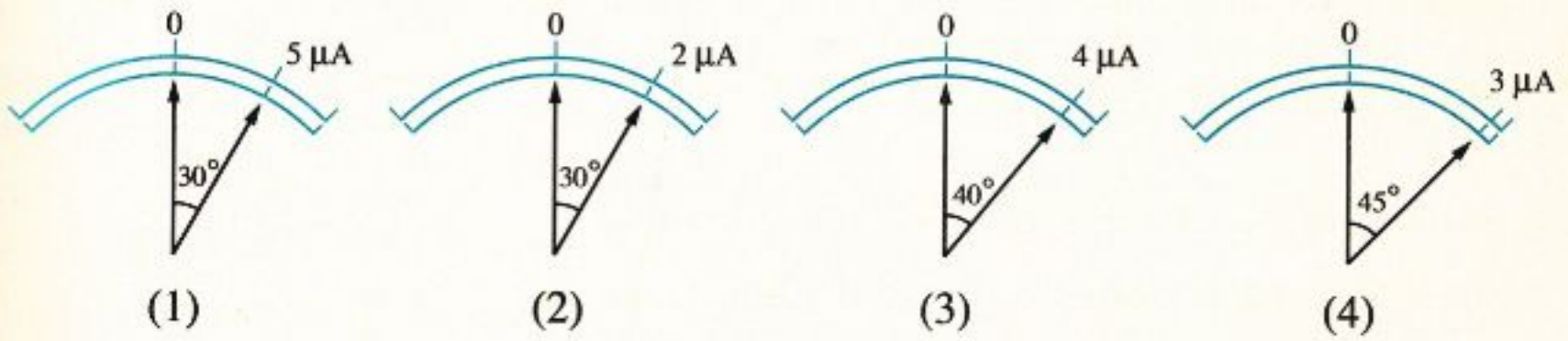
(a) The angle of deflection of the first galvanometer equals 20°

(b) The sensitivity of the first galvanometer is $\frac{60}{I}$

(c) The sensitivity of the second galvanometer is $\frac{40}{I}$

(d) The angle of deflection of the second galvanometer equals 40°

2 The figures show the deflection of the pointers in four galvanometers by passing different values of electric current. *(2nd session 24)*



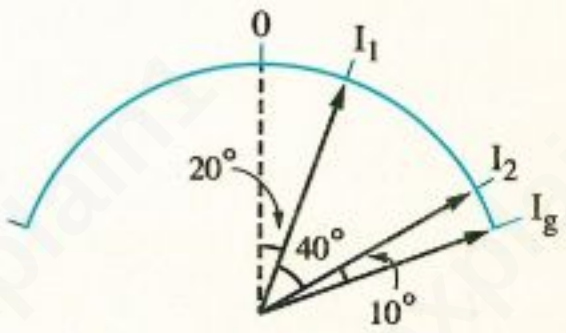
(1) (2) (3) (4)

Which galvanometers having the same sensitivity?

(a) (1), (3) (b) (1), (4) (c) (2), (4) (d) (3), (4)

3 The opposite figure represents a schematic diagram of the deflection angles of the pointer in a moving-coil galvanometer in two direct current circuits carrying two currents of intensities I_1 and I_2, respectively.

The ratio of $\left(\frac{I_1}{I_2}\right)$ is equal to ..... *(Exp. 25)*



(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{1}$ (d) $\frac{3}{1}$

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4 You have an old sensitive galvanometer in the lab with a full-scale reading of 200 μA. When a current of 50 μA passes through its coil, the pointer indicates 60 μA . Which of the following is most likely to have happened to the galvanometer as a result of frequent use? *(Exp. 25)*

(a) Decrease in the magnetic permeability of the iron cylinder.

(b) Damage of the spring coils.

(c) The friction with agate base increases.

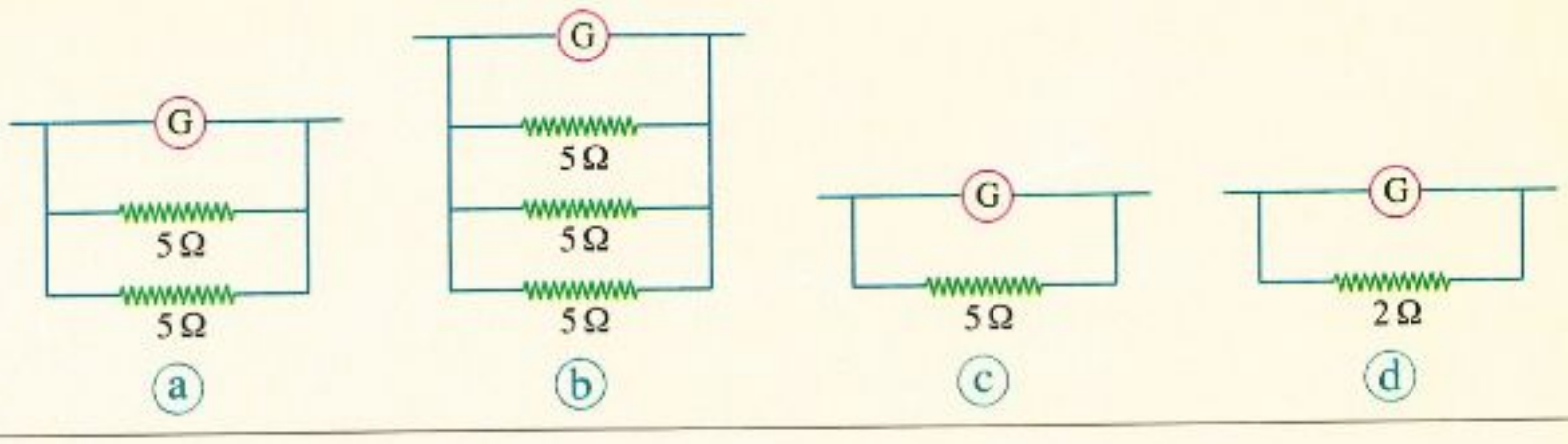
(d) The weakness of the magnetic field strength.

5 A moving-coil galvanometer where each 5 divisions indicate a current of 1 mA, and each 20 divisions indicate a voltage of 1V. The resistance of the galvanometer is equal to ..... . *(Exp. 25)*

(a) 250 Ω (b) 500 Ω (c) 40 Ω (d) 25 Ω

Ammeter

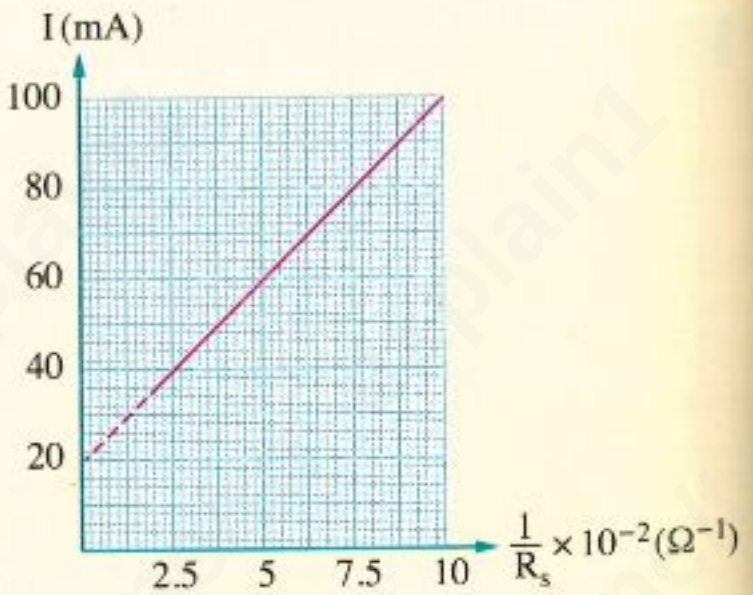
6 A sensitive galvanometer of resistance 15 Ω was connected to different shunts to convert it into an ammeter of different range in each time. Which of the following figures represents the ammeter that has the maximum range scale? *(Exp. May 21)*



7 The graph represents the relation between the maximum current intensity measured by an ammeter and the reciprocal of its shunt resistor, so the maximum potential difference between the shunt terminals equals ..... . *(Exp. June 21)*

(a) 0.1 V (b) 0.8 V

(c) 1.2 V (d) 1 V



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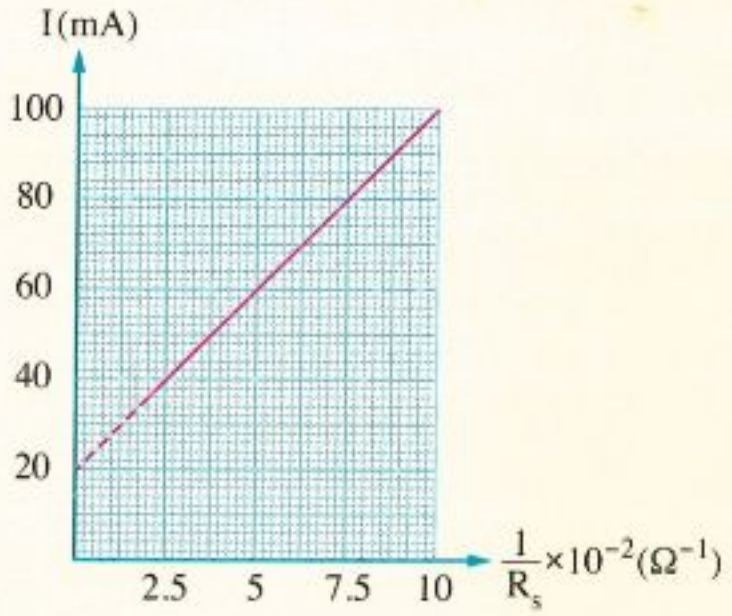
8 The opposite graph represents the relation between the maximum current intensity that could be measured by an ammeter and the reciprocal of its shunt resistor, so the value of the galvanometer resistance R_g equals .....



ⓐ 20 Ω *(1st session 21)*

ⓑ 40 Ω

ⓒ 80 Ω

ⓓ 100 Ω

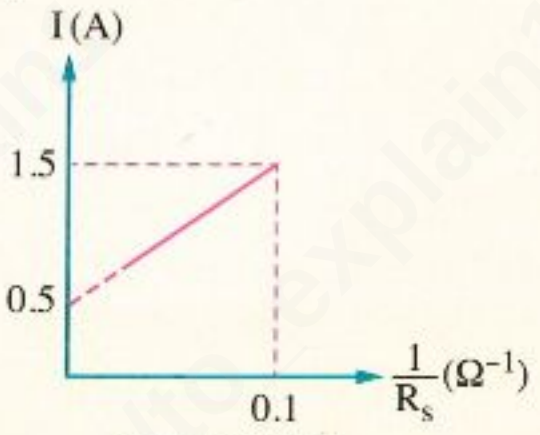
9 A galvanometer, the resistance of its coil is (R_g), measures a maximum current of I_g. When a shunt resistance of value R_1 is connected to its coil, its sensitivity gets reduced to $\frac{3}{4}$ of its original value. When the shunt resistance R_1 is replaced by another of resistance R_2, its sensitivity decreases to $\frac{3}{8}$ of its original value. So, the ratio: $\frac{\text{value of shunt } R_1}{\text{value of shunt } R_2}$ equals .....

ⓐ 2 ⓑ 3 ⓒ 4 ⓓ 5 *(2nd session 21)*

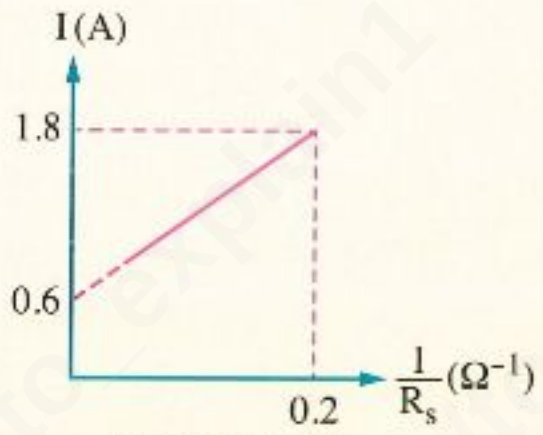
10 A galvanometer's coil has resistance (R_g) in which a current of (I_g) causes full scale deflection. When a shunt of value (R) is used, it measures a current up to ($4\ I_g$). If the shunt resistor is replaced by another of value (3 R), so the maximum current that can be measured equals ..... *(1st session 22)*

ⓐ $1.5\ I_g$ ⓑ $3\ I_g$ ⓒ $2.5\ I_g$ ⓓ $2\ I_g$

11 The graphs illustrate the relation between maximum current intensities that can be measured by two different ammeters and the reciprocal of shunt resistance $\left(\frac{1}{R_s}\right)$ in each of them, so the ratio between galvanometer's resistance in the first ammeter to that in the second one $\left(\frac{(R_g)_1}{(R_g)_2}\right)$ equals ..... . *(2nd session 22)*



Ammeter (1)



Ammeter (2)

ⓐ $\frac{1}{3}$ ⓑ $\frac{2}{1}$ ⓒ $\frac{3}{1}$ ⓓ $\frac{1}{2}$

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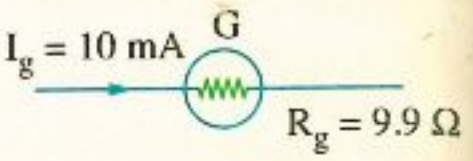
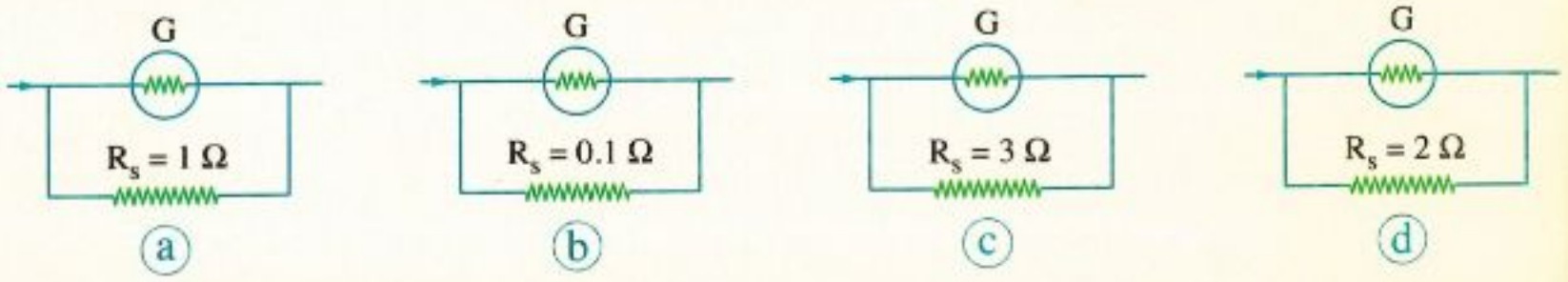
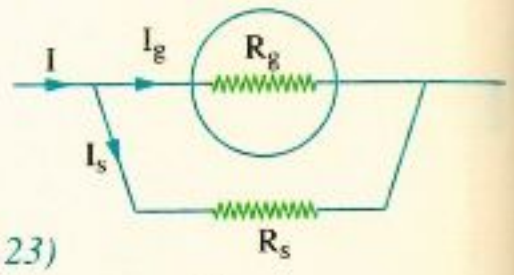
12 The figure represents a sensitive galvanometer.
Which of the following figures correctly represents the modification to the galvanometer to become capable of measuring a maximum current of 1A? *(Exp. 23)*





13 In the opposite figure:
If the shunt is replaced to increase the sensitivity of the device keeping the current (I) constant, which of the ratios below increases? *(1st session 23)*



ⓐ $\frac{I_g}{I_s}$ ⓑ $\frac{V_g}{V_s}$ ⓒ $\frac{R_g}{R_{eq}}$ ⓓ $\frac{R_g}{R_s}$

14 The opposite table represents different values of shunt resistances R_s that are used one at a time with the same galvanometer to form direct current ammeters W, X, Y and Z, so what is the correct order of these ammeters according to their sensitivities? *(2nd session 23)*

	R_S
W	20 Ω
X	5 Ω
Y	40 Ω
Z	10 Ω

ⓐ Y > W > X > Z ⓑ X > Z > W > Y
ⓒ Y > W > Z > X ⓓ W > Y > Z > X

15 A galvanometer has coil resistance (R_g) is connected to a shunt resistance of value ($\frac{1}{2} R_g$), then the galvanometer is reconnected to another shunt resistance of value ($\frac{1}{4} R_g$).
So, the ratio: $\frac{\text{Sensitivity of ammeter in first case}}{\text{Sensitivity of ammeter in second case}}$ = ... *(1st session 24)*

ⓐ $\frac{1}{5}$ ⓑ $\frac{3}{5}$ ⓒ $\frac{1}{3}$ ⓓ $\frac{5}{3}$

16 A galvanometer, the resistance of its coil equals 60 Ω , so the value of the shunt resistor that decreases its sensitivity to $\frac{1}{6}$ its value = ... *(2nd session 24)*

ⓐ 24 Ω ⓑ 6 Ω ⓒ 3 Ω ⓓ 12 Ω

17 The resistance of a microammeter coil is 100 Ω and the maximum current that its coil can measure is 100 μA. So, its range can be increased to measure electric currents up to 0.1 A by connecting it to a shunt resistor of resistance ..... . *(Exp. 25)*

ⓐ 0.5 Ω ⓑ 0.1 Ω ⓒ 0.05 Ω ⓓ 0.01 Ω

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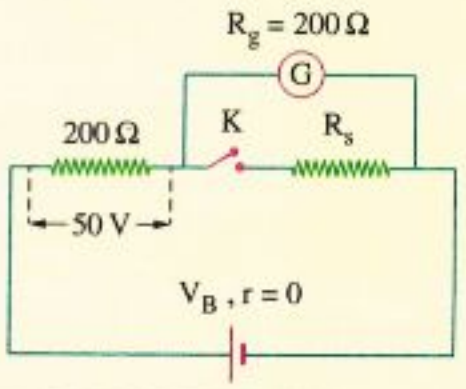
18 A galvanometer with a coil resistance of 100 Ω has a scale divided into number of divisions (N). When a current of intensity (I) passes through it, its pointer deflects to the end of the scale. When a 20 Ω resistor is connected in parallel to the galvanometer to convert it into an ammeter, and the same current (I) is passed, its pointer deflects to only two divisions. Then the number of divisions on the galvanometer scale equals ..... . *(Exp. 25)*

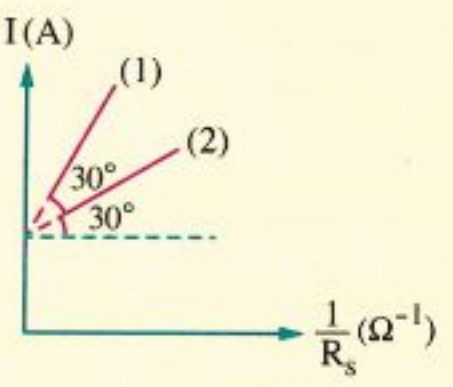
(a) 2 (b) 6 (c) 12 (d) 24

19 In the opposite figure, if switch K is closed, the sensitivity of the galvanometer decreases to one-fifth. Then, the values of R_S and V_B respectively are ....., ... *(Exp. 25)*



(a) 40 Ω, 100 V (b) 100 Ω, 60 V
(c) 50 Ω, 100 V (d) 40 Ω, 60 V

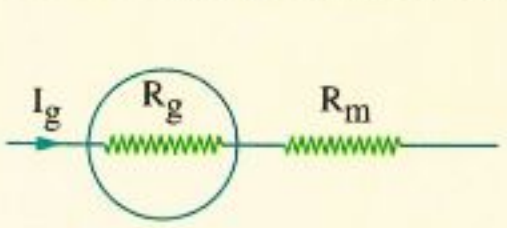
20 The opposite graph represents the relation between the maximum measurement range of two ammeters (I) and the reciprocal of its shunt resistor $\left(\frac{1}{R_s}\right)$ which connected to the galvanometer coil in each of them. The ratio between the resistances of the two galvanometers $\left(\frac{(R_g)_1}{(R_g)_2}\right)$ equals ..... . *(Exp. 25)*



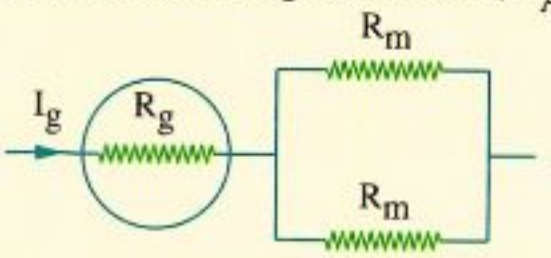
(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{1}{3}$ (d) $\frac{3}{1}$

The voltmeter

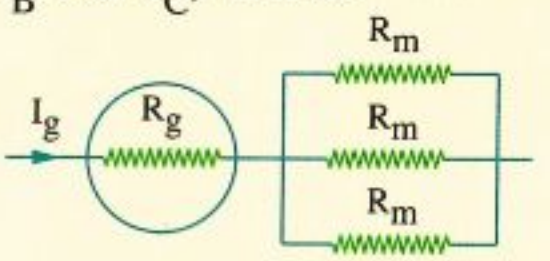
21 Three galvanometers of equal coil resistances R_g were connected to three multipliers to convert them into three voltmeters (A, B and C) as shown in the following figures, so the correct arrangement for the maximum readings of them (V_A, V_B and V_C) will be .....



Voltmeter (A)



Voltmeter (B)



Voltmeter (C)

(a) $V_B > V_A > V_C$ (b) $V_A < V_C < V_B$
(c) $V_C > V_B > V_A$ (d) $V_C < V_B < V_A$ *(Exp. June 21)*

22 A galvanometer that has a coil of 50 Ω resistance was connected to a multiplier of 450 Ω, hence its maximum reading was 1 V and when it was connected to another multiplier (R_{m2}), its maximum reading became 18 V, the value of R_{m2} = ... *(1st session 21)*

(a) 9000 Ω (b) 8950 Ω (c) 9050 Ω (d) 9500 Ω

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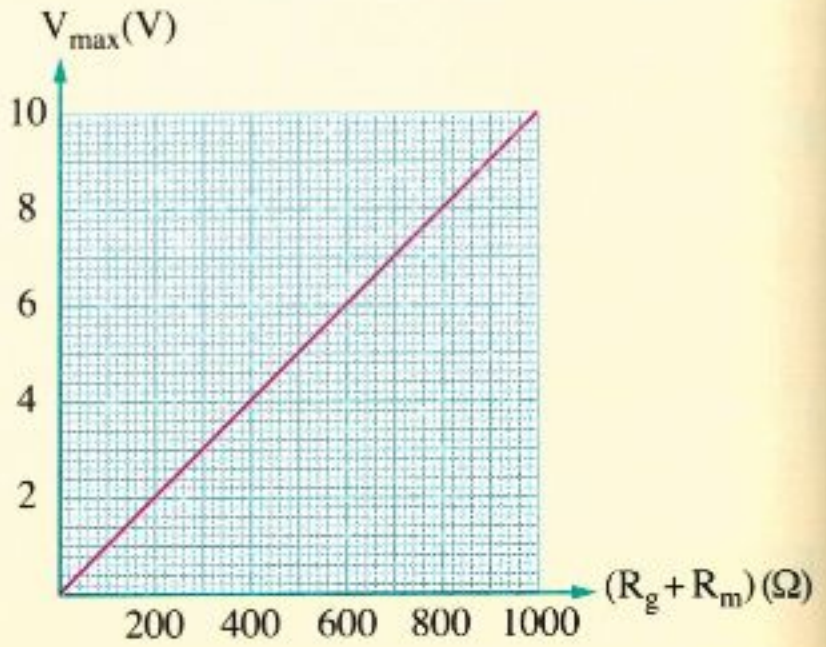
23 A galvanometer measures 0.1 volt of maximum potential difference when a maximum current of 2 mA passes in it, each division of its scale indicates 0.01 V, if it is connected to a multiplier resistance of 450 Ω, each division will indicate ..... . *(2nd session 21)*

(a) 0.01 V (b) 1 V (c) 0.1 V (d) 0.001 V

24 A galvanometer that can withstand maximum potential difference of 1 volt across its coil, was connected to several multipliers to convert it into voltmeter.
The graph illustrates the maximum measured potential difference (V_{max}) versus the total resistance of the voltmeter ($R_g + R_m$). So, the resistance of the galvanometer's coil (R_g) equals ..... . *(1st session 22)*



(a) 100 Ω (b) 1000 Ω (c) 500 Ω (d) 50 Ω

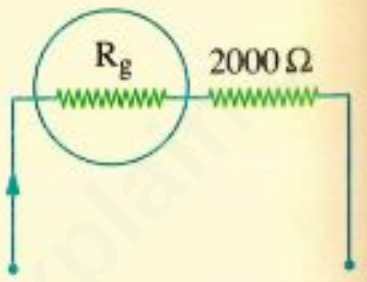
25 A voltmeter, its resistance is 100 Ω and the maximum voltage that can be measured by it is 1 V. The value of multiplier resistance that should be connected to increase the measured voltage by 10 times equals ..... . *(2nd session 22)*

(a) 0.9 kΩ (b) 10 kΩ (c) 1.1 kΩ (d) 1 kΩ

26 A voltmeter, the resistance of its coil is 40 Ω, reaches its full-scale deflection when a current of intensity 0.1 A passing through it. Then the value of the multiplier resistance of the device that makes the maximum potential difference reaches 100 V between its two ends is ..... . *(Exp. 23)*

(a) 25 Ω (b) 2.5 Ω (c) 960 Ω (d) 1040 Ω

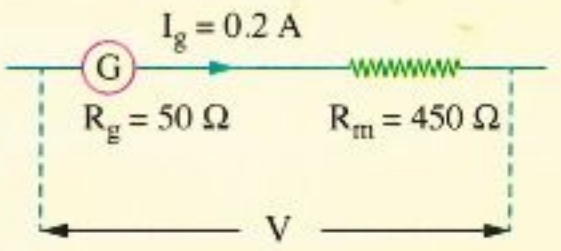
27 A galvanometer of maximum reading 0.01 A is connected in series to a resistor of 2000 Ω to convert it into voltmeter as shown in the figure so that the maximum potential difference that can be measured by the voltmeter was 20.5 V. In order to measure a maximum potential difference 10.25 V, the 2000 Ω resistor must be replaced by a resistor of resistance equal to ..... . *(1st session 23)*



(a) 1025 Ω (b) 1000 Ω (c) 975 Ω (d) 4000 Ω

https://t.me/to_explain1

28 According to the data shown in the figure, the potential difference measured by the voltmeter = ...



(a) 50 V (b) 100 V
(c) 20 V (d) 10 V *(2^{nd} session 23)*

29 A voltmeter of total resistance 1200 Ω and the maximum voltage that its coil can withstand is 3 V, if a voltage multiplier (R_m) is connected to its coil, the maximum voltage that its coil can withstand is 10 V, then the value of the voltage multiplier (R_m) is equal to ..... . *(Exp. 25)*

(a) 1800 Ω (b) 2400 Ω (c) 2800 Ω (d) 4000 Ω

30 A moving coil galvanometer with coil resistance R_g and a maximum voltage (V_g) it can withstand. When it is connected in series to a resistance R to convert it into a voltmeter with range V_1. And when the same galvanometer is connected in series to a resistance of 2 R to convert it into a voltmeter with range of V_2 , then ..... . *(Exp. 25)*

(a) $V_2 = V_1 - 2V_g$ (b) $V_2 = 2V_1 - V_g$ (c) $V_2 = 2V_1 + V_g$ (d) $V_2 = 2V_1$

31 A moving coil galvanometer has 15 divisions. If every 5 divisions represent 5 mA, and every 2 divisions represent 10 mV, the value of the resistance should be connected in series to the galvanometer coil so that each one division represents 1 V is ..... . *(Exp. 25)*

(a) 995 Ω (b) 99.5 Ω (c) 9.95 Ω (d) 9950 Ω

Ohmmeter

32 An ohmmeter was connected with an external resistor (x) of resistance 400 Ω, so its pointer deflected to $\frac{3}{4}$ of the galvanometer scale. If (x) is replaced with another resistor (y) of 6000 Ω, the pointer deflects to ..... of the galvanometer scale. *(Exp. May 21)*

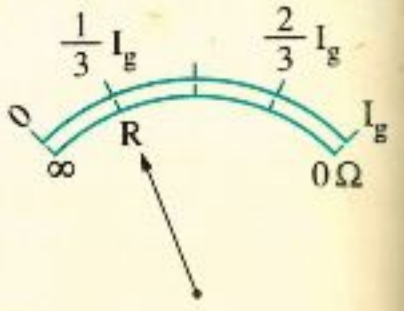
(a) $\frac{1}{6}$ (b) $\frac{3}{5}$ (c) $\frac{1}{5}$ (d) $\frac{5}{6}$

33 An ohmmeter contains a galvanometer that shows full-scale deflection when a current I_g passes in it and when an external resistor 12 kΩ is connected to its test terminals, the passing current becomes $\frac{1}{5} I_g$, so if a resistor of 1.5 kΩ is connected to the test terminals, the passing current becomes ..... . *(Exp. June 21)*

(a) $\frac{2}{3} I_g$ (b) $\frac{1}{8} I_g$ (c) $\frac{1}{5} I_g$ (d) $\frac{3}{4} I_g$

https://t.me/to_explain1

34 The opposite figure represents the scale of a galvanometer in an ohmmeter, when it is connected with external resistance R, the pointer has deflected to $\frac{1}{3}$ I_g, so the resistance of the device equals ..... .

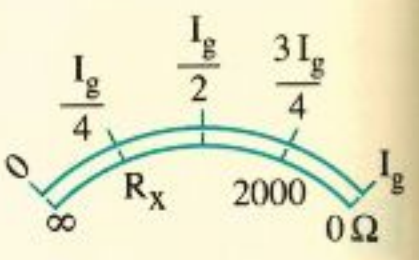


(a) 0.5 R (b) R

(c) 2 R (d) 3 R

(1st session 21)

35 The opposite figure represents an equal division on the scale of the galvanometer in the ohmmeter circuit, so the value of R_x equals ..... .



(a) 6000 Ω (b) 18000 Ω

(c) 12000 Ω (d) 10000 Ω *(2nd session 21)*

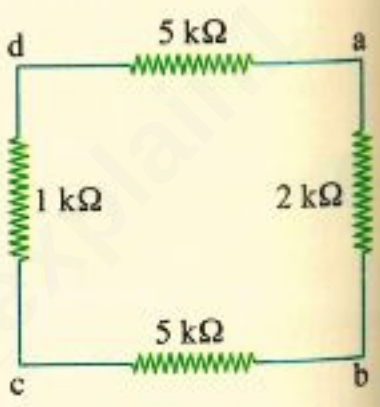
36 An ohmmeter contains a galvanometer that shows a full-scale deflection when a current I_g passes in it, when an external resistor 50 kΩ is connected to its two terminals, the passing current becomes $\frac{1}{3}$ I_g, so the external resistance that makes the current passing in the ohmmeter become $\frac{3}{4}$ I_g equals ..... . *(1st session 22)*

(a) $\frac{25}{3}$ kΩ (b) $\frac{225}{2}$ kΩ (c) $\frac{50}{3}$ kΩ (d) $\frac{50}{4}$ kΩ

37 An ohmmeter contains a galvanometer of current full-scale deflection I_g. When an external resistor (R) is connected to its two terminals, the passing current becomes $\frac{3}{4}$ I_g, then when the resistor (R) is replaced with another resistor of value (3 R), the passing current becomes ..... . *(2nd session 22)*

(a) $\frac{1}{4}$ I_g (b) $\frac{1}{3}$ I_g (c) $\frac{4}{9}$ I_g (d) $\frac{1}{2}$ I_g

38 Four electric resistances are connected as in the figure, the pointer of ohmmeter reads the same reading when the device is connected between ..... . *(Exp. 23)*



(a) the two points (c), (b) or the two points (b), (d)

(b) the two points (a), (c) or the two points (a), (d)

(c) the two points (a), (c) or the two points (b), (d)

(d) the two points (a), (d) or the two points (c), (d)

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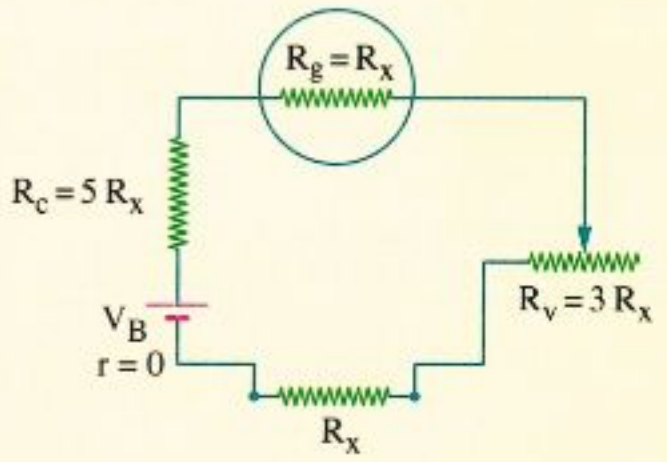
39 Ohmmeter of internal resistance 3000 Ω, its pointer deflects by an angle (θ) when its terminals are connected together and when it is connected with resistance R_1, the pointer deflects by an angle $(\frac{\theta}{3})$ and by replacing R_1 by another resistance R_2, the pointer deflects by an angle $(\frac{\theta}{4})$, so the values of R_1 and R_2 respectively equal ..... . *(Exp. 23)*

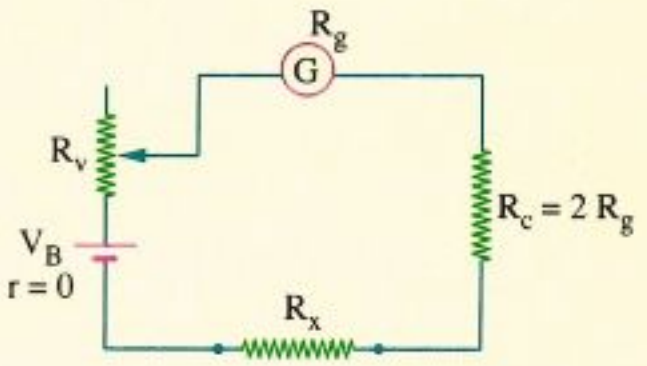
(a) 3000 Ω, 9000 Ω
(b) 6000 Ω, 12000 Ω
(c) 3000 Ω, 12000 Ω
(d) 6000 Ω, 9000 Ω

40 In the ohmmeter circuit shown in the figure, when another resistance is connected to the unknown resistance (R_x) in series, the pointer deflects to $\frac{3}{5}$ from the scale of the galvanometer. Then the value of the connected resistance is ..... . *(1st session 23)*



(a) $6 R_x$
(b) $5 R_x$
(c) $\frac{2}{3} R_x$
(d) $3 R_x$

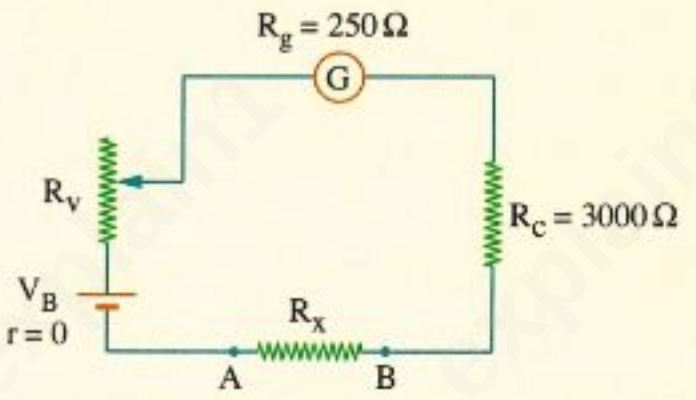
41 The opposite figure represents an ohmmeter circuit containing a galvanometer that the resistance of its coil is (R_g), when it is connected to an external resistance (R_x) that equals $(15 R_g)$ the pointer of the galvanometer deflects to $\frac{1}{5}$ of its full current scale deflection. Therefore the value of the resistance taken from the rheostat (R_v) = ...



(2nd session 23)

(a) $3.75 R_g$
(b) $0.75 R_g$
(c) $0.25 R_g$
(d) $3.25 R_g$

42 The opposite figure illustrates the structure of an ohmmeter, and the maximum reading on the scale of the galvanometer is 900 μA if known that an external resistance (R_x) of 10 kΩ causes a current of intensity 300 μA passes through the device.



Calculate:

(a) The value of resistance taken from rheostat (R_v).

(b) The value of emf of the ohmmeter battery (V_B). *(1st session 24)*

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43 An ohmmeter of internal resistance 3750 Ω.

Calculate:

(a) The value of the external resistance R_x that makes the pointer of the ohmmeter deflect to $\frac{I_g}{3}$

(b) The value of the resistance (R) that should be connected in parallel to R_x to make the pointer deflect to $\frac{3\,I_g}{4}$ *(2nd session 24)*

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44 An ohmmeter of a resistance 1500 Ω and the pointer of the galvanometer deflects to its full scale deflection when a current of 200 mA passes through it. At that moment, the angle of deflection of the pointer from the zero position is 80°. *(Exp. 25)*

Calculate:

(a) The deflection angle of the galvanometer pointer when an external resistance of 4500 Ω is connected across the terminals of the ohmmeter.

(b) The electric current intensity passing through the galvanometer that causes the pointer to deflect at an angle of 60°.

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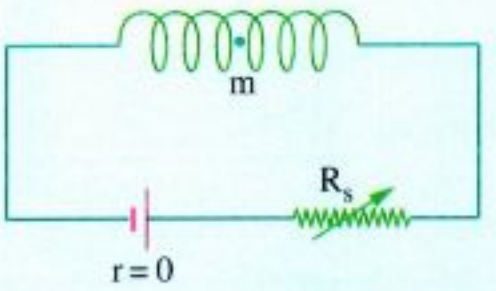
Test on Chapter 2

Answered

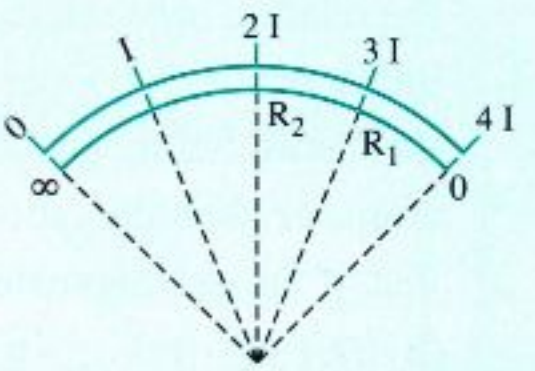
First Choose the correct answer

1 In the opposite circuit, a solenoid is connected to a variable resistance (R_s) and a battery of negligible internal resistance, if the resistance R_s is increased, the magnitude of the magnetic field due to the solenoid at its center (point m) will ..... .



(a) increase (b) decrease (c) not change (d) vanish

2 The opposite figure shows an ohmmeter scale of equal divisions, so the ratio $\left(\frac{R_1}{R_2}\right)$ is ..... .



(a) $\frac{1}{3}$ (b) $\frac{2}{3}$

(c) $\frac{3}{2}$ (d) $\frac{1}{2}$

3 When a solenoid of length ℓ and number of turns N is connected to a battery of negligible internal resistance, a magnetic flux of density B is formed at the center of the solenoid, so which of the following causes the magnetic flux density at the center of the solenoid to become 3 B?

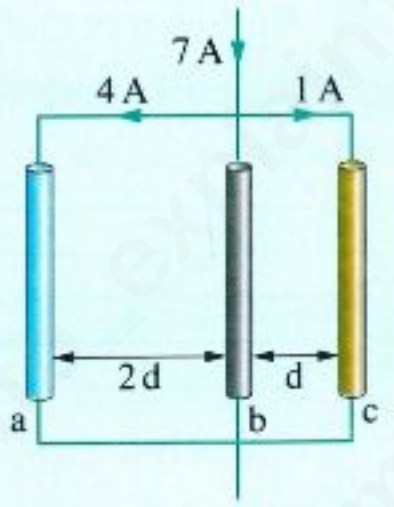
(a) Compressing the solenoid turns to decrease its length to its one third.

(b) Increasing the length of the solenoid to three times its initial value.

(c) Increasing the radius of the solenoid turns to three times its initial value while keeping its length and number of turns unchanged.

(d) Cutting off one third of the solenoid and connecting the remaining part to the same battery.

4 Three parallel straight wires a, b and c are made of different materials and they have the same dimensions in the same plane if they are connected to an electric circuit, an electric current passes through them as shown in the opposite figure, which of them is affected by a resultant magnetic force in the same direction?



(a) Wires a, b (b) Wires c, b

(c) Wires a, c (d) The three wires.

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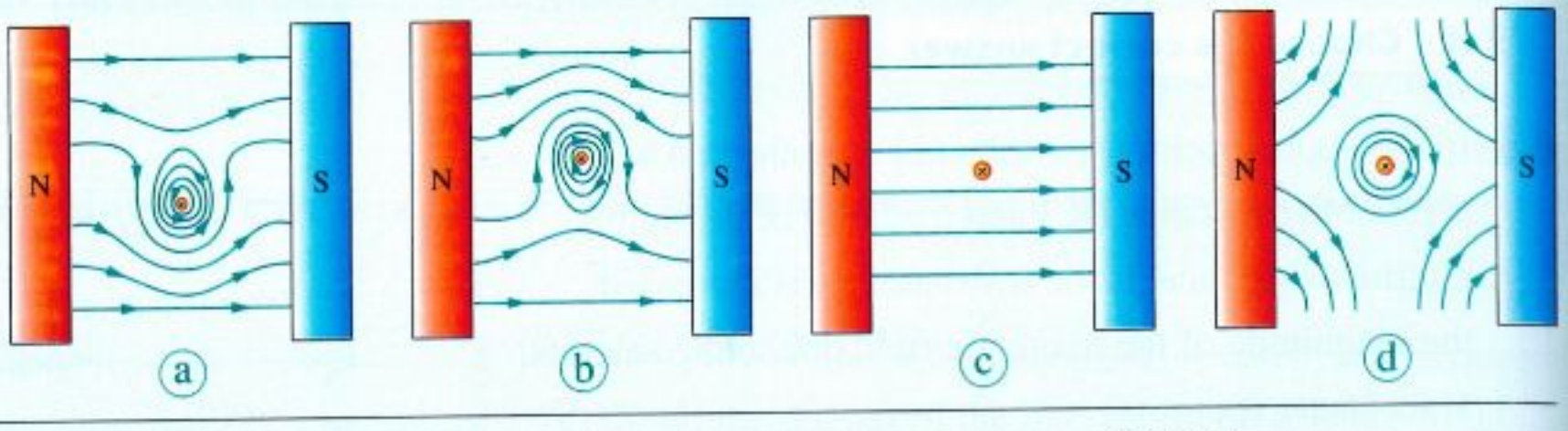
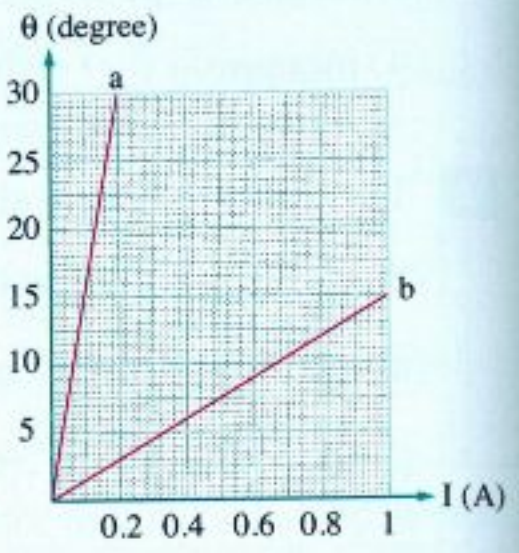
5 Which of the following figures represents correctly the magnetic flux lines when a straight wire carries an electric current is placed between the two poles of a magnet into the page?



6 A galvanometer is connected to an electric circuit, the two graphical lines a, b shown in the opposite figure represent the relation between the deflection angle (θ) of the galvanometer's pointer and the current intensity (I) in the circuit before and after converting the galvanometer into ammeter, then the ratio between the ammeter's sensitivity to that of the galvanometer respectively equals ..... .

ⓐ 0.01 ⓑ 0.02

ⓒ 0.1 ⓓ 0.2



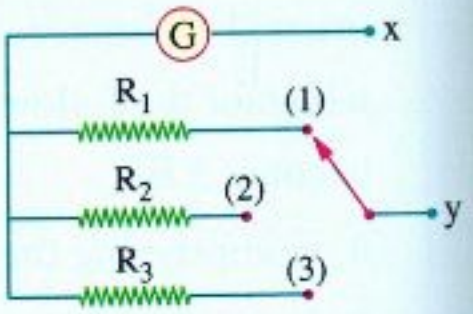
7 The opposite schematic diagram represents an electric device (xy) which is ..... .

ⓐ multi-scale ammeter

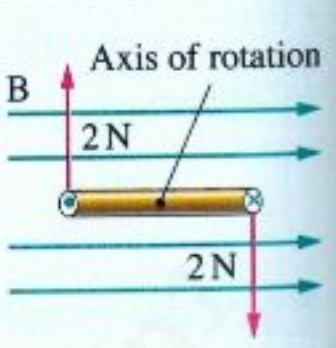
ⓑ multi-scale voltmeter

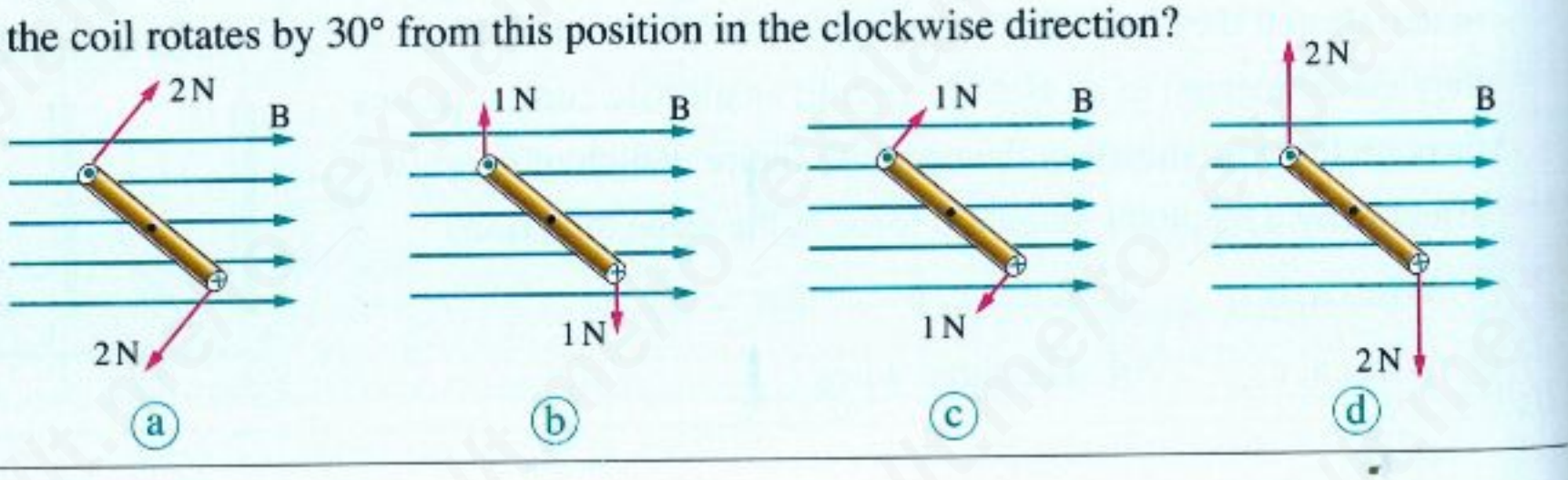
ⓒ digital ammeter

ⓓ ohmmeter



8 A rectangular coil carries an electric current and is placed parallel to a uniform magnetic field (B) and the opposite figure represents the magnitude and the direction of the two forces affecting on the two sides of the coil parallel to its axis of rotation, which of the following figures represents the magnitude and the direction of these forces if the coil rotates by 30° from this position in the clockwise direction?





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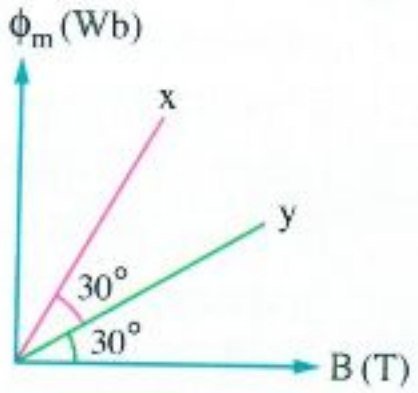
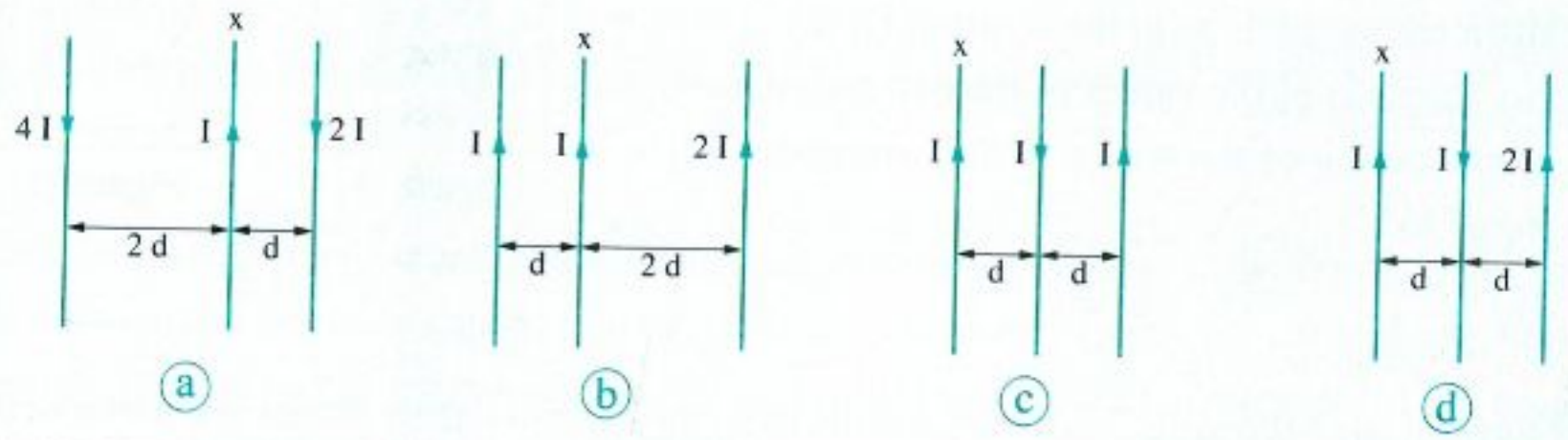
9 Two circular rings x, y are placed perpendicular to a uniform magnetic field of changeable flux density, the opposite graph represents the relation between the magnetic flux (ϕ_m) that passes through the two rings and the magnetic flux density (B) that affected on them, then the ratio between the two diameters of the two rings $\left(\frac{d_x}{d_y}\right)$ is equal to ..... .

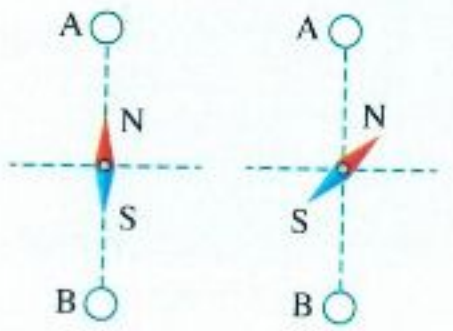


(a) $\frac{1}{3}$ (b) $\frac{3}{1}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\frac{\sqrt{3}}{1}$

10 Each of the following figures represents the position of wire x with respect to the other two wires, if you know that the wires are parallel and in the same plane and carry electric currents, so which of the following figures, the wire x is affected by a resultant magnetic force?



11 A magnetic needle is in the plane of the magnetic meridian, if it was placed at the mid distance between two straight vertical wires (A), (B), the needle deflected as in figure (1) and affected by the Earth's magnetic field when no electric current passes through each of them. When an electric current of the same intensity passes through each of them, the needle deflected as in figure (2), then the directions of the currents through two wires (A), (B) respectively are ..... .



(a) into the page, into the page

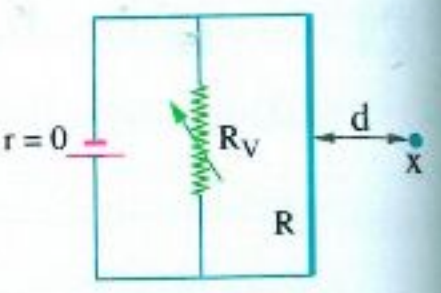
(b) into the page, out of the page

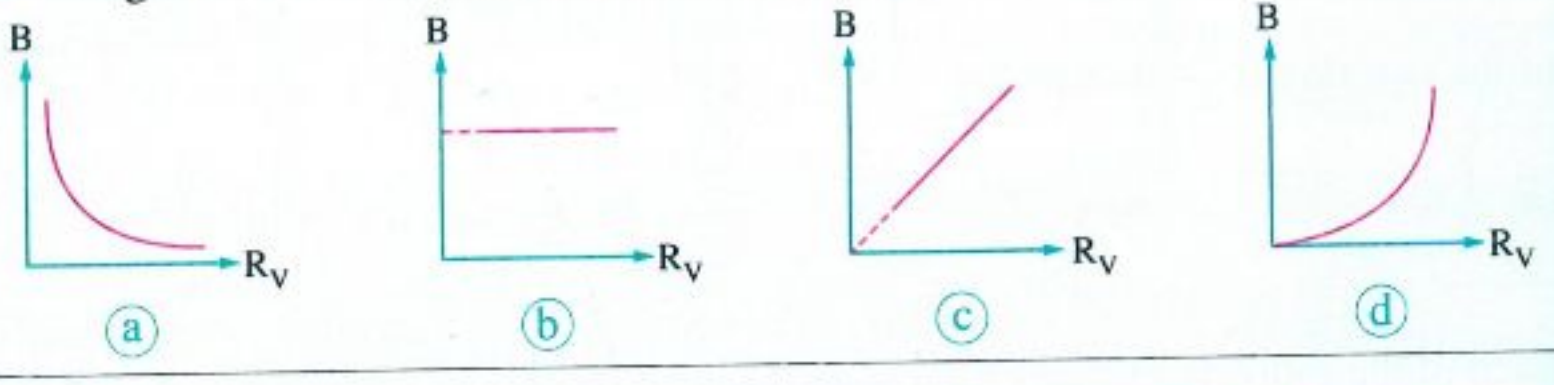
(c) out of the page, into the page

(d) out of the page, out of the page

https://t.me/to_explain1

12 The opposite figure represents an electric circuit consists of a straight wire of resistance R, variable resistance R_v and a battery of negligible internal resistance. So, which of the following graphs represents the relation between the magnetic flux density (B) at point x due to the flow of an electric current in the straight wire and the variable resistance of R_V?





13 Two similar straight wires x, y where the resistance of each of them is R are connected together and to a battery of negligible internal resistance in two different methods as in the figures (1), (2).
So, the ratio of the values of the two magnetic forces acting on the wire x in the two cases $\left(\frac{F_1}{F_2}\right)$ is equal to ..... .

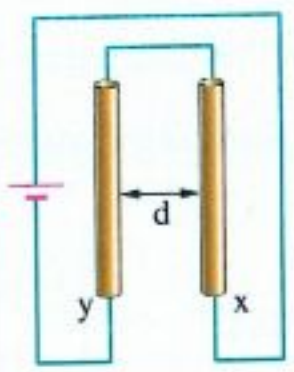


Figure (1)

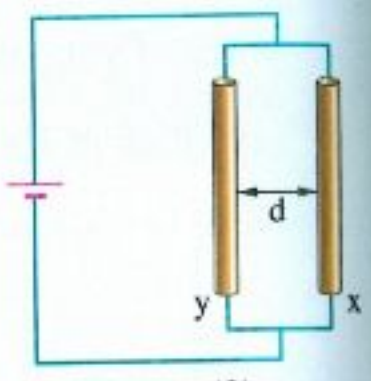
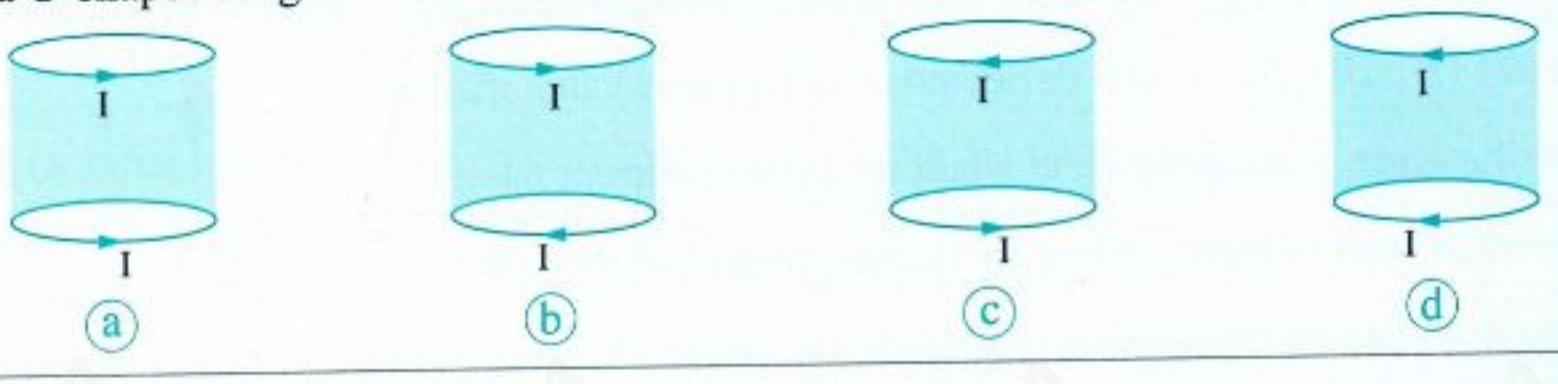


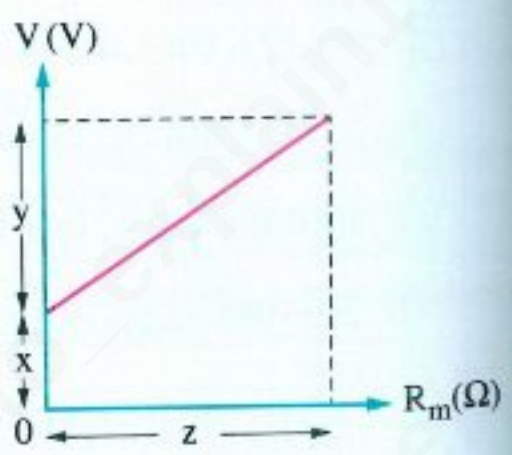
Figure (2)

ⓐ $\frac{1}{2}$ ⓑ $\frac{2}{1}$ ⓒ $\frac{1}{4}$ ⓓ $\frac{4}{1}$

14 Each of the following figures represents two circular coils, their planes are horizontal and each has the same current intensity. In what cases, the magnetic flux pattern in the shaded region between the two coils resembles the magnetic flux pattern between the poles of a U-shaped magnet where the direction of the flux lines is upward.



15 A voltmeter consists of a galvanometer of resistance (R_g) and a multiplier resistance whose its value can be changed, the opposite graph represents the relation between the maximum voltage (V) that can be measured by the voltmeter and the multiplier resistance (R_m) inside it, then the resistance of the galvanometer (R_g) in terms of the data shown in the graph equals ..... .



ⓐ $\frac{xz}{y}$ ⓑ $\frac{yz}{x}$ ⓒ $\frac{y}{xz}$ ⓓ $\frac{z}{xy}$

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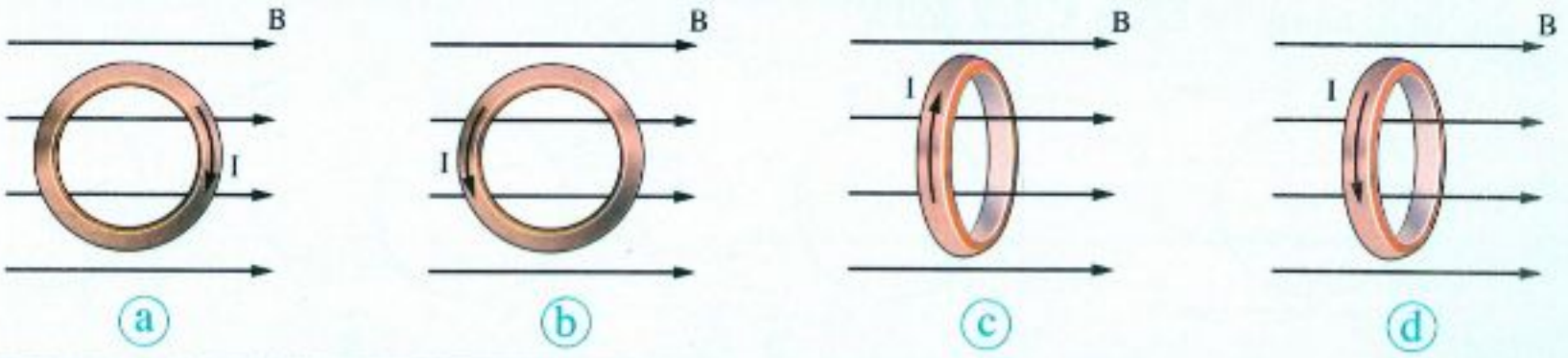
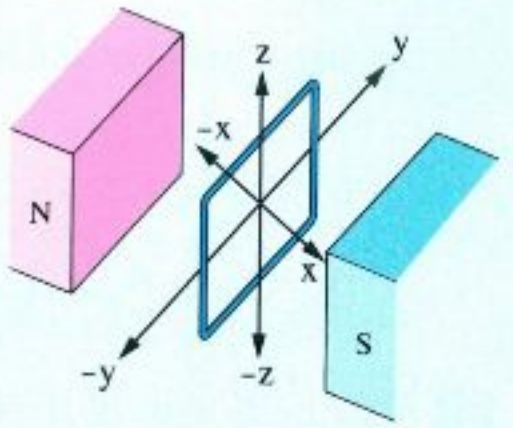
16 A metallic ring carries an electric current of intensity (I) is placed in a magnetic field of flux density (B), in which of the following cases the direction of the magnetic dipole moment of the ring is parallel to the page and rightwards?

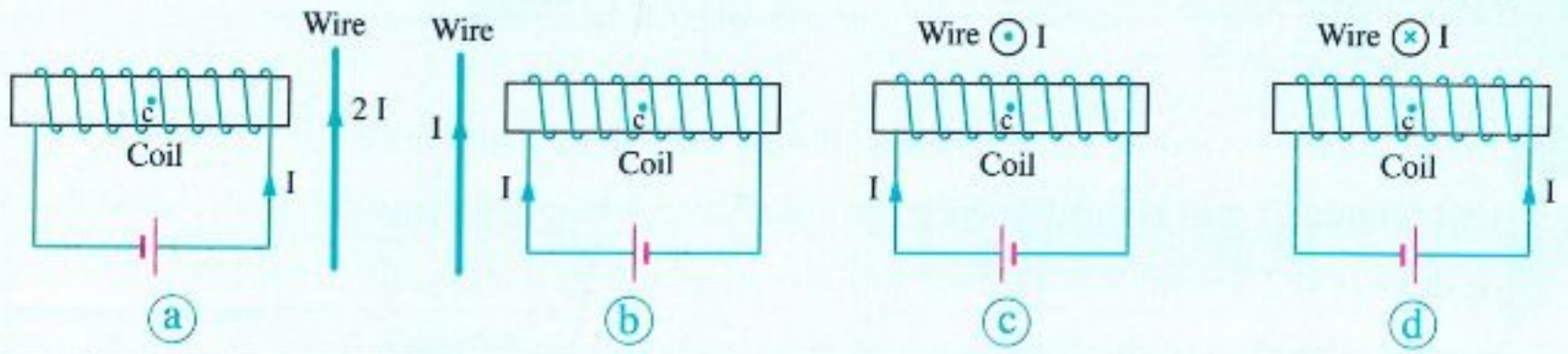


17 In the opposite figure, a coil is placed perpendicular to a magnetic field, if the magnetic flux that passes through it is ϕ_m , what procedure makes the change in the flux pass through it becomes $2\ \phi_m$?

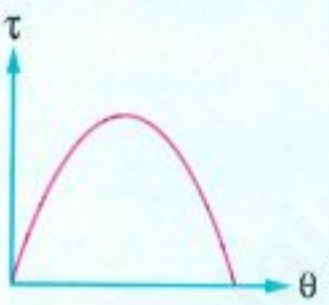


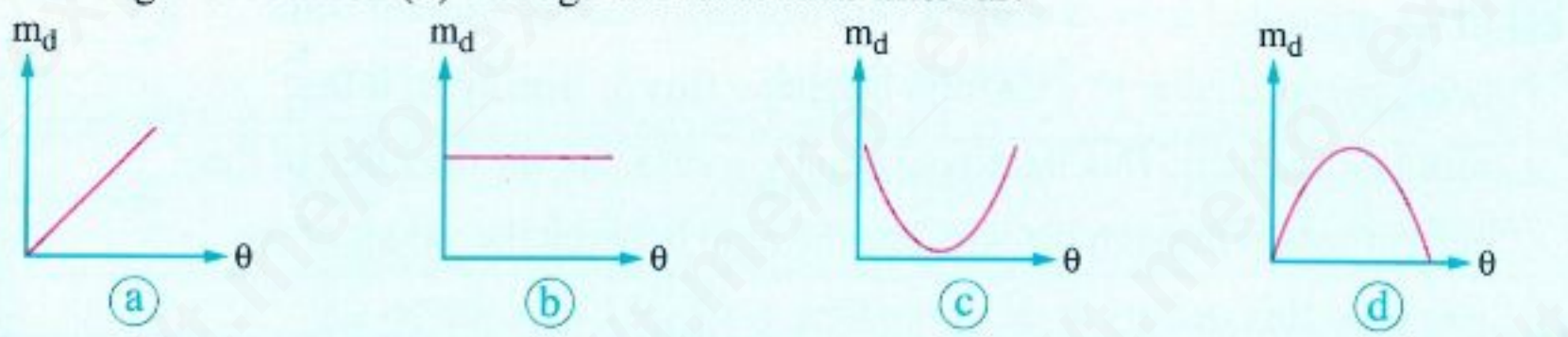
(a) Ejecting the coil from the field area in the direction of axis y
(b) Rotating the coil by 180° around axis x
(c) Rotating the coil by 180° around axis y
(d) Rotating the coil by 90° around axis z

18 Each of the following figures represents a straight wire placed close to a solenoid and each of them carries an electric current, in which of the following figures, the net magnetic flux density at the center of the solenoid (point c) is rightwards parallel to the plane of the page?



19 The opposite graph represents the variation of the torque (τ) that affects a rectangular current-carrying coil while being placed in a magnetic field versus the angle of rotation of the coil (θ) from a definite initial position, so which of the following graphs represents the relation between the magnetic dipole moment (m_d) of the coil and the angle of rotation (θ) through the same time interval?





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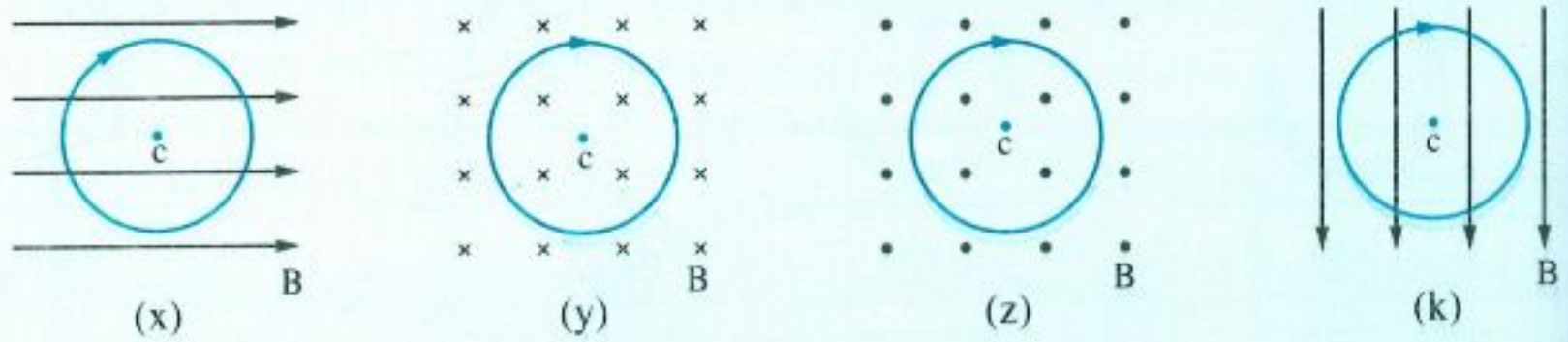
20 An electric current passes through a metallic ring that produces a magnetic field of flux density B at the center of the ring (c), if the ring is placed in a magnetic field of flux density B and the position of the ring has been changed with respect to the direction of the field as in the cases x, y, z and k.



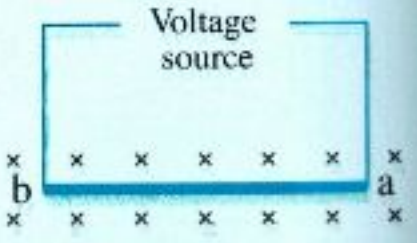
So, the correct order for the resultant of the magnetic flux density at the center of the ring in these cases .....

ⓐ $B_x > B_y > B_z > B_k$
ⓑ $B_k > B_x > B_y > B_z$
ⓒ $B_k = B_x > B_y > B_z$
ⓓ $B_y > B_k = B_x > B_z$

21 A straight wire of length 40 cm and resistance 8 Ω is coiled in the form of a square frame where a current of intensity I is passing through it and the potential difference across the ends of one of its sides equals 4 V. So, the magnetic torque that acts on the frame if it is placed parallel to a magnetic flux of density 0.1 T is equal to ..... .

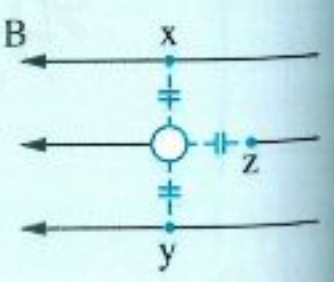
ⓐ 10^{-3} N.m
ⓑ 2×10^{-3} N.m
ⓒ 4×10^{-3} N.m
ⓓ 8×10^{-3} N.m

22 In the opposite figure, a horizontally placed wire ab of a mass per unit length 20 g/m is positioned perpendicular to a magnetic flux of density 0.2 T which is directed into the page, hence the intensity and the direction of the current which if passed through the wire will generate a magnetic force causing the wire to be apparently weightless are ..... . (Take: $g = 10\ m/s^2$)



ⓐ 1 A, from a to b
ⓑ 2 A, from a to b
ⓒ 1 A, from b to a
ⓓ 2 A, from b to a

23 In the opposite figure, a straight wire carries an electric current while being perpendicular to a uniform magnetic flux of density B, if the resultant magnetic flux density at point y = zero. So, the direction of the current passes through the wire and the ratio between the values of the magnetic flux density at the two points x, z $\left(\frac{B_x}{B_z}\right)$ are equal to ..... .



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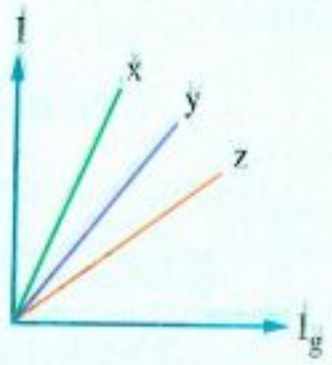
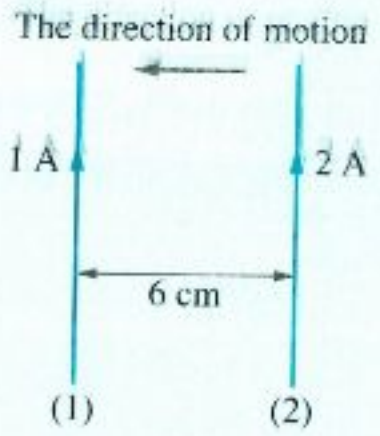
	The direction of the current passes through the wire	$\frac{B_x}{B_z}$
(a)	outward	$\frac{2}{1}$
(b)	outward	$\frac{\sqrt{2}}{1}$
(c)	inward	$\frac{2}{1}$
(d)	inward	$\frac{\sqrt{2}}{1}$

24 A multi-scale ammeter consists of a galvanometer and three resistances x, y and z, one of which can be connected in parallel as a shunt resistance, the opposite graph represents the relation between the reading of ammeter (I) and the current intensity (I_g) that passes through the galvanometer in the three cases, which of the three cases that the ammeter has a greater sensitivity?



(a) In case of shunt x
(b) In case of shunt y
(c) In case of shunt z
(d) The three cases have the same sensitivity

25 Two straight parallel wires (1), (2) carry electric currents of intensities 1 A, 2 A respectively as shown in the opposite figure, if wire (2) is moved a distance 2 cm towards wire (1), then what is the magnitude and the direction of the displacement of the neutral point?



	The value of the displacement	The direction of the displacement
(a)	$\frac{2}{3}$ cm	towards wire (1)
(b)	$\frac{2}{3}$ cm	towards wire (2)
(c)	$\frac{4}{3}$ cm	towards wire (1)
(d)	$\frac{4}{3}$ cm	towards wire (2)

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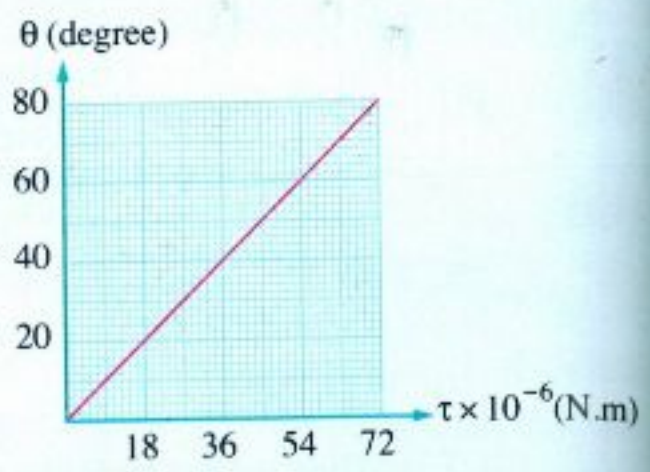
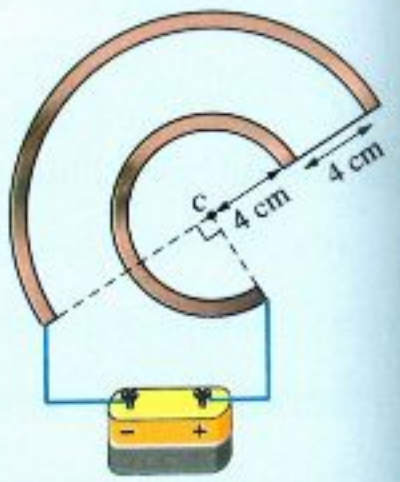
26 A coil of galvanometer consists of 1200 turns, its face area is 15 cm^2 and it rotates in a uniform magnetic field of flux density 0.01 T, the opposite graph represents the relation between the deflection angle (θ) of the galvanometer's pointer from zero position and the magnetic torque (τ) affected on the coil, then the sensitivity of the galvanometer equals ..... .



(a) 20 deg/mA (b) 50 deg/mA (c) 30 deg/mA (d) 60 deg/mA

27 Two parts of two circular metallic rings are connected in series to a battery as shown in the opposite figure, if the current intensity that passes through the battery is 2 A, then the magnetic flux density at the common center (c) equals ..... .



(a) 1.42×10^{-5} T (b) 1.57×10^{-5} T
(c) 3.14×10^{-5} T (d) 3.93×10^{-5} T

28 A uniform metallic wire of radius r_1 is divided into two equal parts (1), (2), part (1) is wrapped in the form of a solenoid which its turns are tangent to each other, while part (2) is wrapped in the form of a circular coil of center (c), number of turns is 100 turns and radius r_2 around the middle of the solenoid so that their perpendicular axes coincide with their two sections, when a current of intensity I is passed through each of the two coils, the magnetic flux density at the center of the circular coil vanishes, so the ratio of $\left(\frac{r_1}{r_2}\right)$ equals ..... .

(a) 1 (b) $\frac{1}{10}$ (c) $\frac{1}{50}$ (d) $\frac{1}{100}$

Second Answer the following questions

29 Figure (1) shows a circular metallic ring of radius 1 cm that carries an electric current of intensity I_1 where the ring is tangent to an insulated straight wire ab that carries a DC changeable electric current (I_2) and placed in the plane of the ring. The graph in figure (2) represents the relation between the net magnetic flux density (B_c) at the center of the ring (c) due to the wire ab and the ring and the electric current intensity that passes in the straight wire (I_2),

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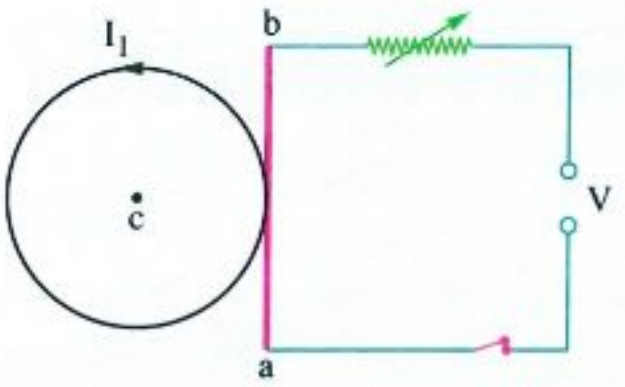


Figure (1)

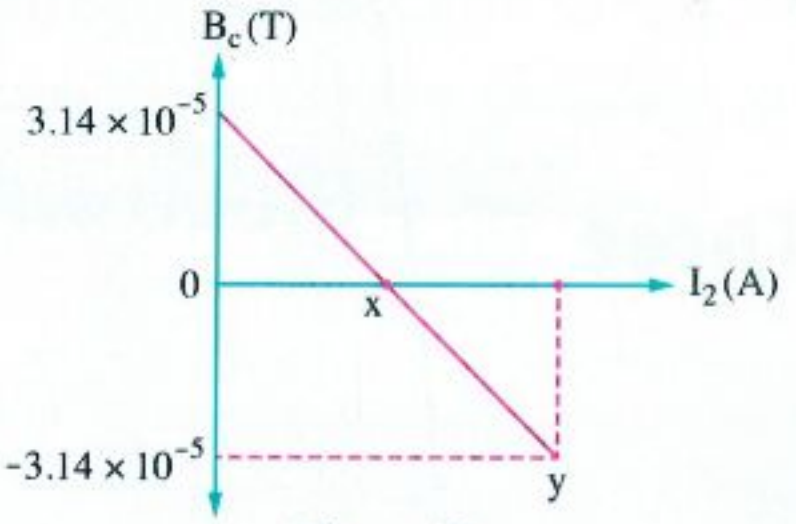


Figure (2)

(a) Find the value of the current intensity (I_1) that passes through the metallic ring.

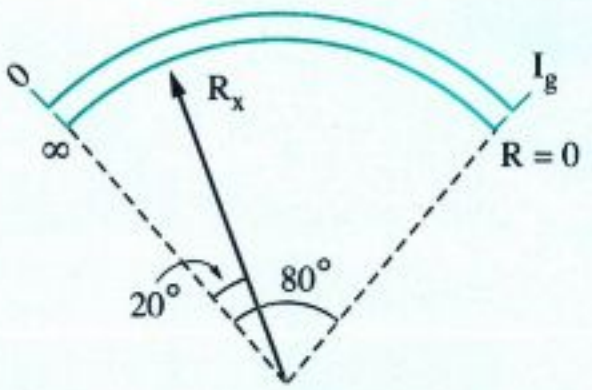
(b) Find the value of the magnetic flux density which produced due to the current (I_2) of the wire at each of the two points (x), (y) on the graph. (Where: $\pi = 3.14$)

.....

.....

.....

30 The opposite figure represents the scale of an ohmmeter of resistance 2000 Ω whose pointer has maximum deflection range of angle 80° from the zero position. When connecting the ohmmeter terminals to a resistor R_x, a current of intensity 200 μA has flowed through it and its pointer gets deflected as shown in the figure, **calculate:**



(a) The value of resistance R_x

(b) The electromotive force (V_B) of the battery used in the ohmmeter.

.....

.....

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Chapter Three

Electromagnetic Induction

Lesson One	· Faraday's Law. · The Induced Electromotive Force in a Straight Wire
Lesson Two	· Mutual Induction between Two Coils. · Self Induction of the Coil.
Lesson Three	Electric Generator (Dynamo).
Lesson Four	· The Electric Transformer. · The Electric Motor.

?
- Questions on each lesson from the Previous Years Exams.
- Test on Chapter 3

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Chapter 3

Questions on Lesson One

- Faraday's Law.
- The Induced Electromotive Force in a Straight Wire.

Interactive test

The questions signed by ✳ are answered in detail. ● Understand ○ Apply Higher Order Thinking Skills

Important guidelines

If the coil rotates from the perpendicular position

$\Delta\phi_m = -BA$, $emf = N\frac{BA}{\Delta t}$	$\Delta\phi_m = -2BA$, $emf = N\frac{2BA}{\Delta t}$	$\Delta\phi_m = -BA$, $emf = N\frac{BA}{\Delta t}$	$\Delta\phi_m = 0$, $emf = 0$
$\Delta t = \frac{T}{4}$	$\Delta t = \frac{T}{2}$	$\Delta t = \frac{3T}{4}$	$\Delta t = T$
90° ($\frac{1}{4}$ cycle)	180° ($\frac{1}{2}$ cycle)	270° ($\frac{3}{4}$ cycle)	360° (complete cycle)

Faraday's law: $emf = -N\frac{\Delta\phi_m}{\Delta t}$ **(Average induced emf)**

- If the coil is perpendicular to the field and the area changes: $\Delta\phi_m = B\Delta A$, $emf = -NB\frac{\Delta A}{\Delta t}$
- If the coil is perpendicular to the field and the magnetic flux density changes: $\Delta\phi_m = A\Delta B$, $emf = -NA\frac{\Delta B}{\Delta t}$

If the coil rotates from the parallel position

90° ($\frac{1}{4}$ cycle)	180° ($\frac{1}{2}$ cycle)	270° ($\frac{3}{4}$ cycle)	360° (complete cycle)
$\Delta t = \frac{T}{4}$	$\Delta t = \frac{T}{2}$	$\Delta t = \frac{3T}{4}$	$\Delta t = T$
$\Delta\phi_m = BA$, $emf = -N\frac{BA}{\Delta t}$	$\Delta\phi_m = 0$, $emf = 0$	$\Delta\phi_m = -BA$, $emf = N\frac{BA}{\Delta t}$	$\Delta\phi_m = 0$, $emf = 0$

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The induced emf generated in a wire moving with velocity(v)

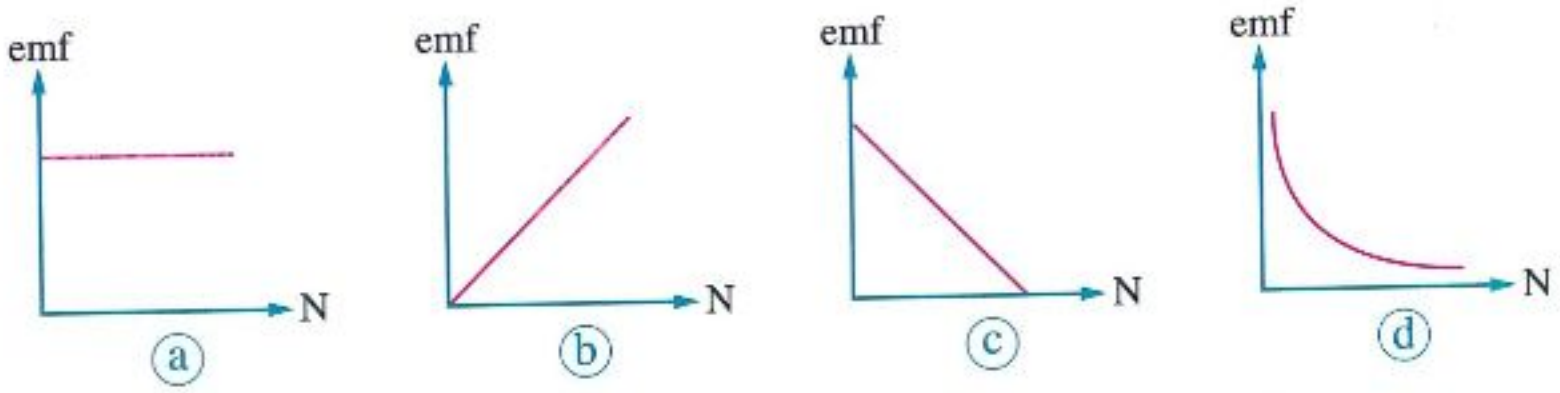
Perpendicular to the field ($\theta = 90°$)	Making angle with the field	Parallel to the field ($\theta = 0°$)
emf = $-B\ell v$	emf = $-B\ell v \sin\theta$	emf = 0

First Multiple choice questions

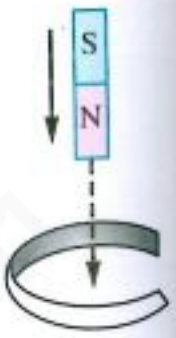
Use the following constant if it is needed: $\mu_{air} = 4\pi \times 10^{-7}$ Wb/A.m

Faraday's law and Lenz's rule

1 Which of the following graphs represents the relation between the magnitude of emf induced in a coil placed in a uniformly changing magnetic field and the number of turns of the coil (N)?



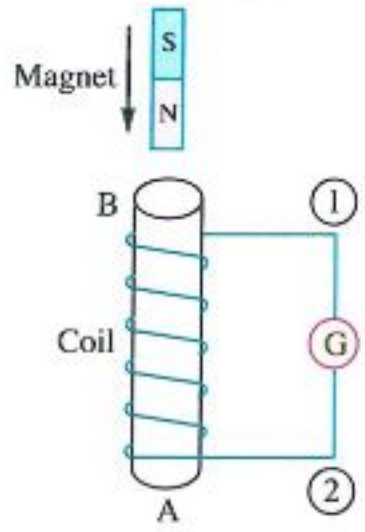
2 In the opposite figure, a magnet falls through an open ring of aluminum that is placed horizontally, so which of the following choices describes what happens between the magnet and the ring when the magnet approaches and moves away from the ring?



	When the magnet approaches the ring	When the magnet gets away from the ring
a	Repulsion force gets generated	Attraction force gets generated
b	Attraction force gets generated	Repulsion force gets generated
c	Repulsion force gets generated	Repulsion force gets generated
d	No magnetic force is generated	No magnetic force is generated

https://t.me/to_explain1

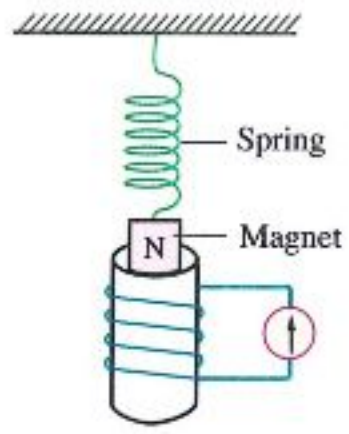
3 A bar magnet is dropped into a solenoid connected to a galvanometer as shown in the opposite figure. Which choice of the following is correct?



	Current direction through the galvanometer	The magnetic pole formed at A
(a)	From 1 to 2	North
(b)	From 1 to 2	South
(c)	From 2 to 1	North
(d)	From 2 to 1	South

4 In the opposite figure:

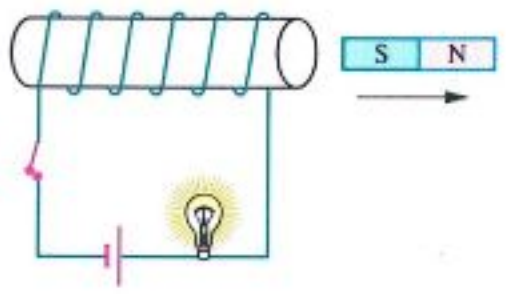
A magnet is suspended to a spring and it is free to move in and out of a coil that is connected to a galvanometer having its zero reading at the middle of its scale, so when the magnet vibrates up and down, the galvanometer's pointer ..... .



(a) swings right and left
(b) stops at left
(c) stops at right
(d) stops at zero

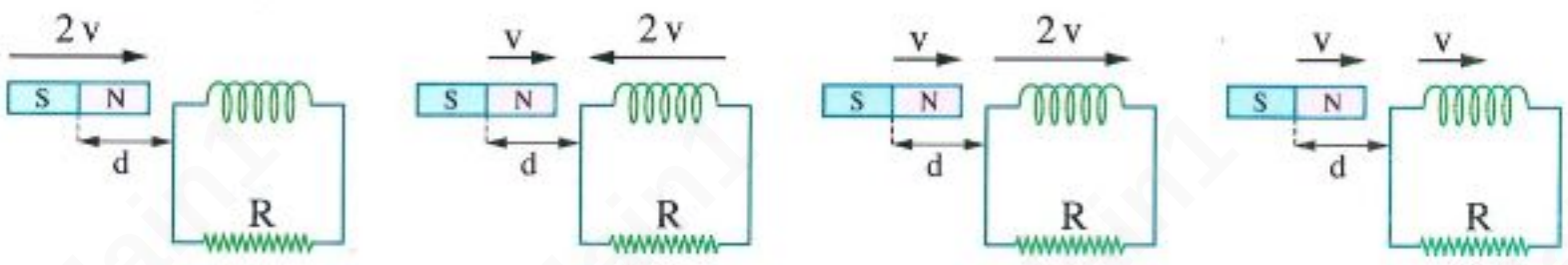
5 In the opposite figure:

During moving the magnet in the shown direction, the brightness of the bulb ..... .



(a) decreases momentarily
(b) increases momentarily
(c) vanishes
(d) remains unchanged

6 A student has carried out many trials to study the effect of direction and magnitude of the relative speed between a magnet and a solenoid on the value of the induced emf in the solenoid in Faraday's experiment:



(1) (2) (3) (4)

If the magnet moved in each trial with a uniform speed through the distance d, so the correct descending order for the values of the average induced emf in the solenoid in those trials is .....

(a) (3) ⟶ (2) ⟶ (4) ⟶ (1)
(b) (2) ⟶ (1) ⟶ (3) ⟶ (4)
(c) (1) ⟶ (3) ⟶ (2) ⟶ (4)
(d) (2) ⟶ (3) ⟶ (4) ⟶ (1)

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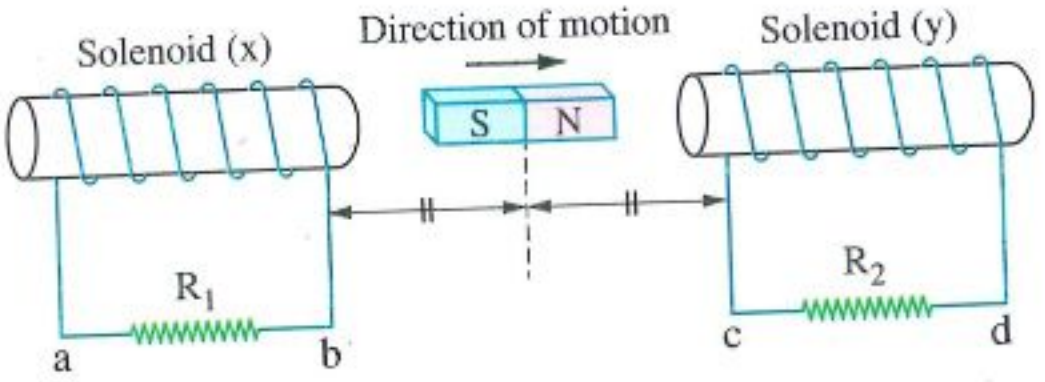
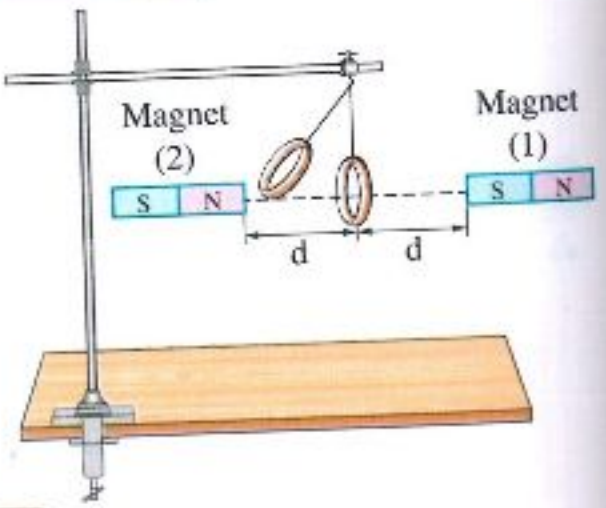
7 Two similar adjacent solenoids (x), (y) where the terminals of each are connected to a resistance R_1, R_2 respectively. A bar magnet is placed at the mid-distance between the coils on the extension of their axes as in the following figure.



When a magnet moves on the extension of the axes of the solenoids approaching the solenoid (y), an induced current passes through the resistors which its direction in:

	Resistor R_1	Resistor R_2
(a)	a ⟶ b	c ⟶ d
(b)	a ⟶ b	d ⟶ c
(c)	b ⟶ a	c ⟶ d
(d)	b ⟶ a	d ⟶ c

8 A metal ring is hung by a thread that its other end is fixed. When two similar magnets (1), (2) are moved with a uniform velocity (v) along the axis of the ring, the ring is displaced as in the opposite figure, so ..... .



	Magnet (1)	Magnet (2)
(a)	gets close to the ring	gets close to the ring
(b)	gets close to the ring	moves away from the ring
(c)	moves away from the ring	gets close to the ring
(d)	moves away from the ring	moves away from the ring

9 Two bar magnets are moving with the same uniform velocity towards a solenoid that is connected to an electric cell and a small electric bulb as in the following figures. In which of the following figures does the light intensity of the bulb increase during cutting the distance d?

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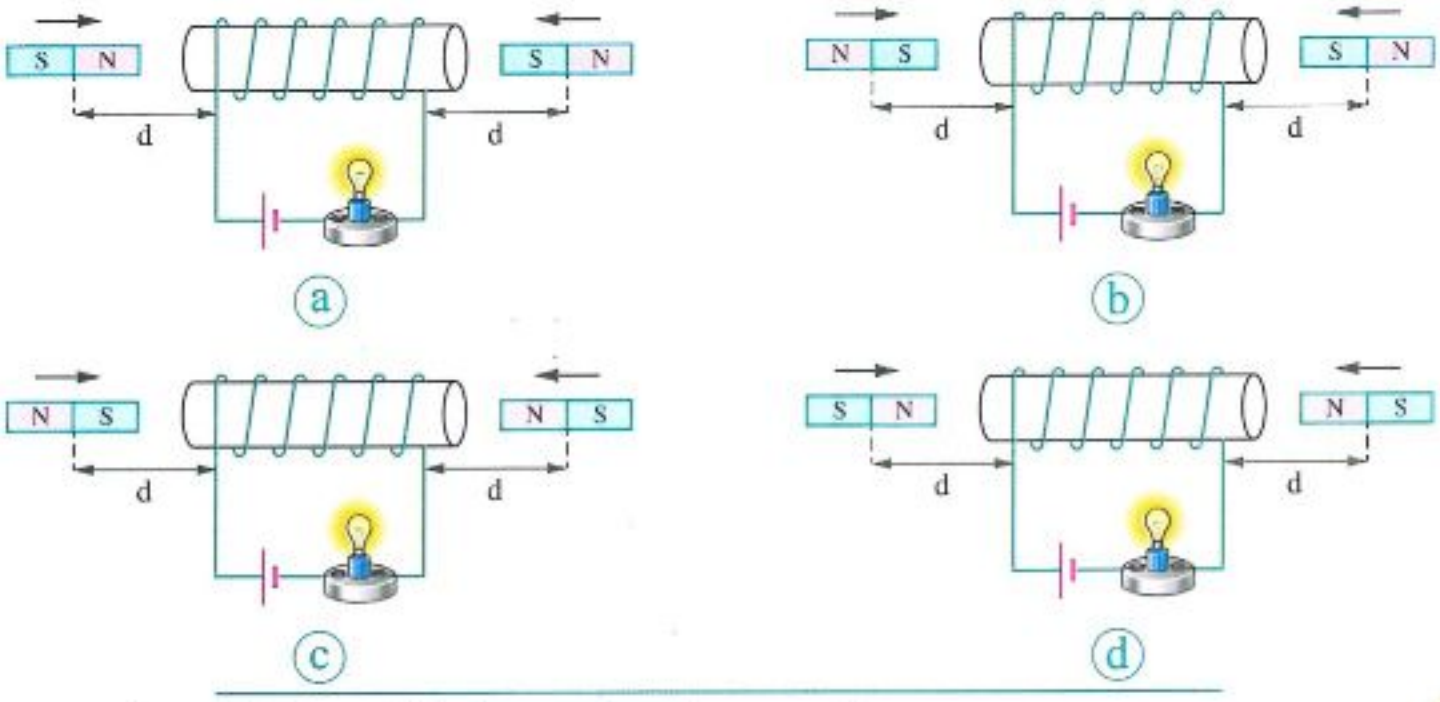
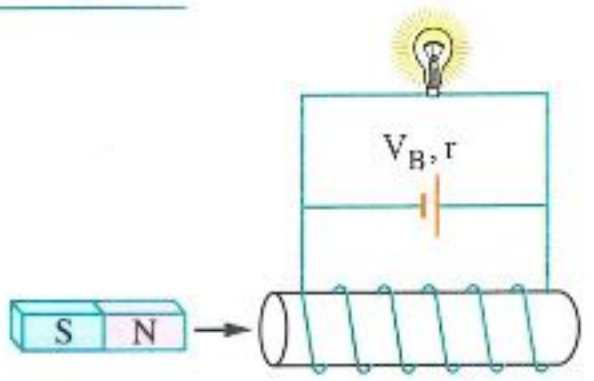
(Where: The resultant of the induced emf in the coil in all figures is less than the emf of the battery)

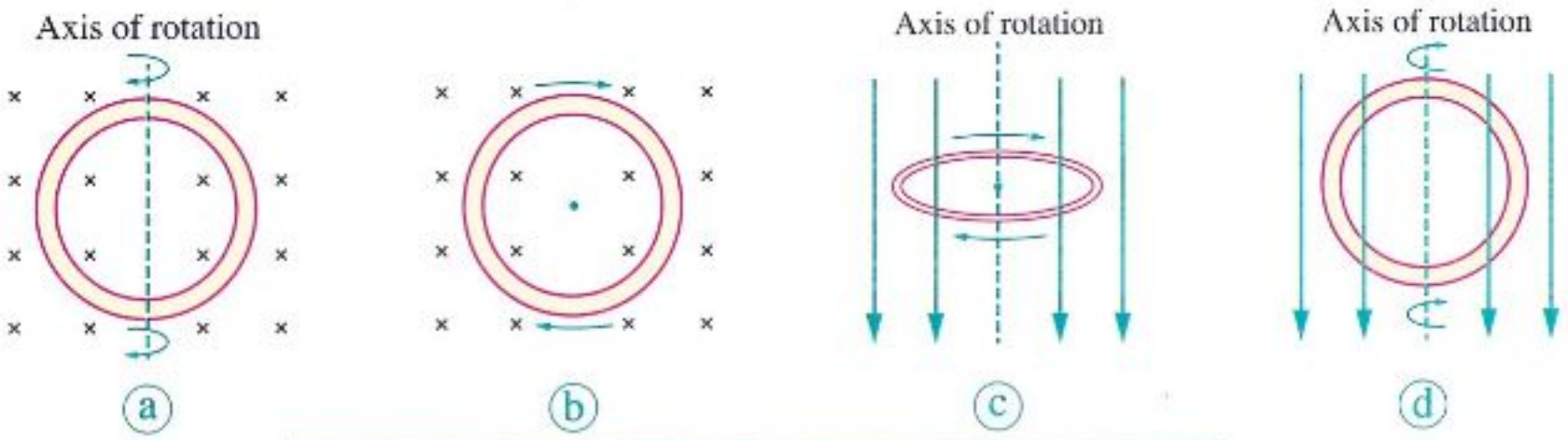


10 A battery of emf (V_B) and its internal resistance (r) is connected to an electric bulb and a solenoid of resistance (R), so when a magnet gets approached to the coil with a uniform speed as in the opposite figure, an induced emf of value less than (V_B) is generated in the coil. What happens to bulb luminosity during the movement of the magnet?

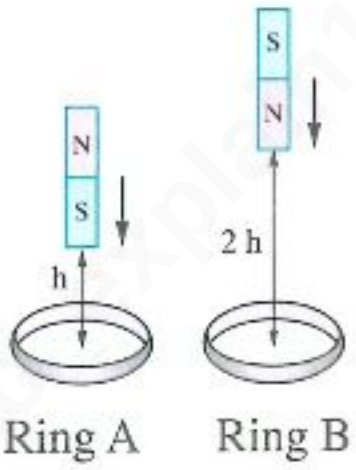


(a) Increases.
(b) Decreases.
(c) Unchanged.
(d) The answer is undeterminable.

11 The proper motion of a metallic ring in a magnetic field to produce an induced emf based on the rules of the electromagnetic induction is represented in figure ..... .



12 The opposite figure represents two identical bar magnets which are falling freely from two different heights h, 2 h along the axes of two identical metallic rings A, B respectively, so what is the statement that describes the induced current through the two rings at the moment when each of them reaches the ring's plane?



(a) The induced current intensity in ring A is greater.
(b) The induced current intensity in ring B is greater.
(c) The induced current intensities in the two rings are equal.
(d) The induced currents in the two rings are in the same direction.

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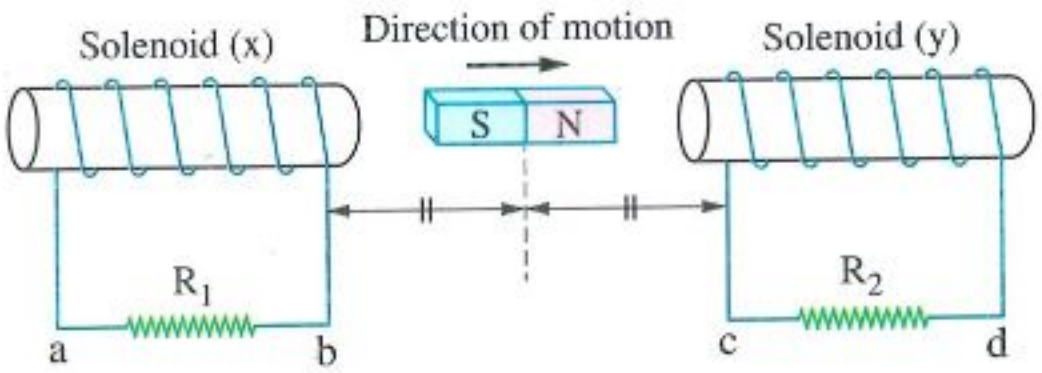
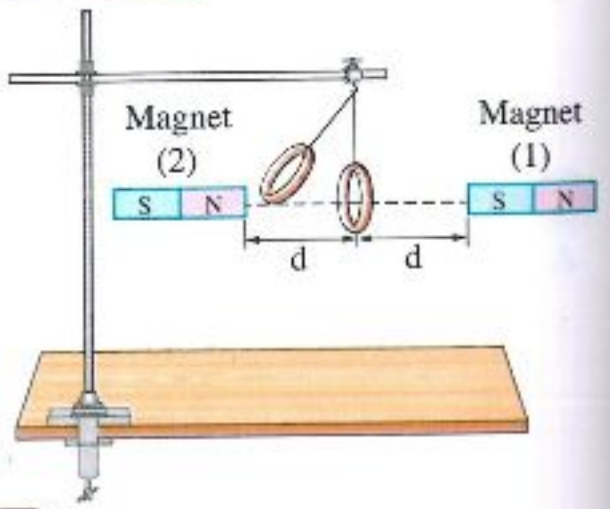
7 Two similar adjacent solenoids (x), (y) where the terminals of each are connected to a resistance R_1, R_2 respectively. A bar magnet is placed at the mid-distance between the coils on the extension of their axes as in the following figure.



When a magnet moves on the extension of the axes of the solenoids approaching the solenoid (y), an induced current passes through the resistors which its direction in:

	Resistor R_1	Resistor R_2
(a)	a ⟶ b	c ⟶ d
(b)	a ⟶ b	d ⟶ c
(c)	b ⟶ a	c ⟶ d
(d)	b ⟶ a	d ⟶ c

8 A metal ring is hung by a thread that its other end is fixed. When two similar magnets (1), (2) are moved with a uniform velocity (v) along the axis of the ring, the ring is displaced as in the opposite figure, so ..... .



	Magnet (1)	Magnet (2)
(a)	gets close to the ring	gets close to the ring
(b)	gets close to the ring	moves away from the ring
(c)	moves away from the ring	gets close to the ring
(d)	moves away from the ring	moves away from the ring

9 Two bar magnets are moving with the same uniform velocity towards a solenoid that is connected to an electric cell and a small electric bulb as in the following figures. In which of the following figures does the light intensity of the bulb increase during cutting the distance d?

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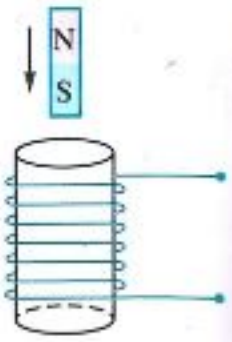
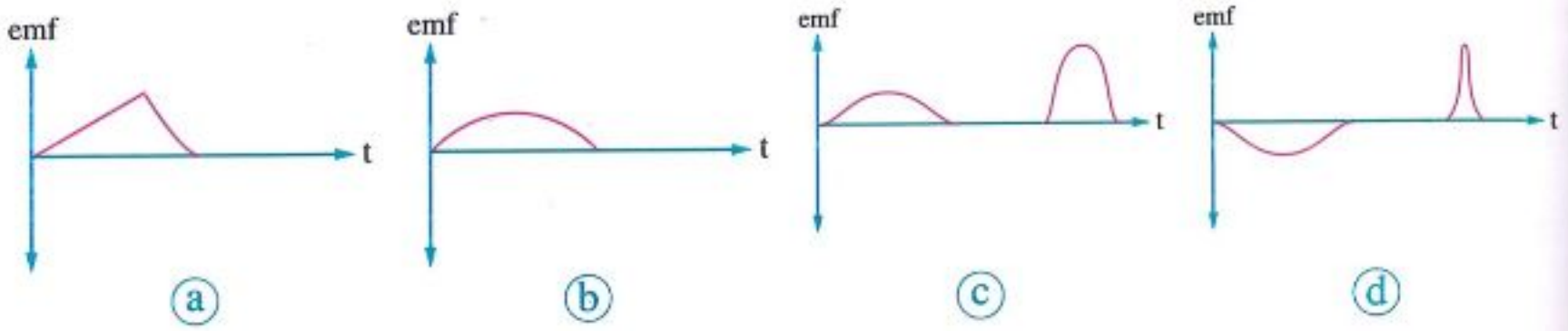
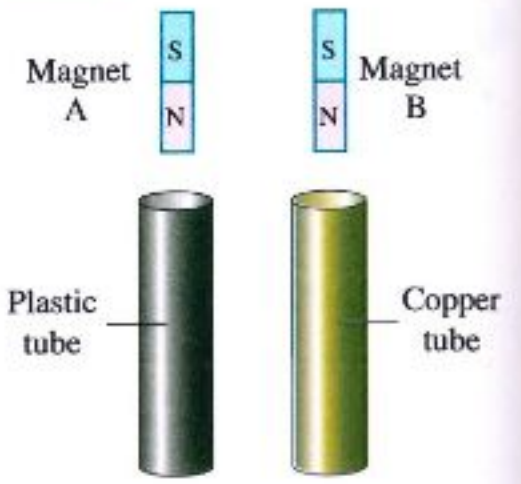
13 Which of the following graphs represents the change of the induced emf across the solenoid versus time (t) during the free fall of the magnet inside the solenoid until it gets out from the other side?





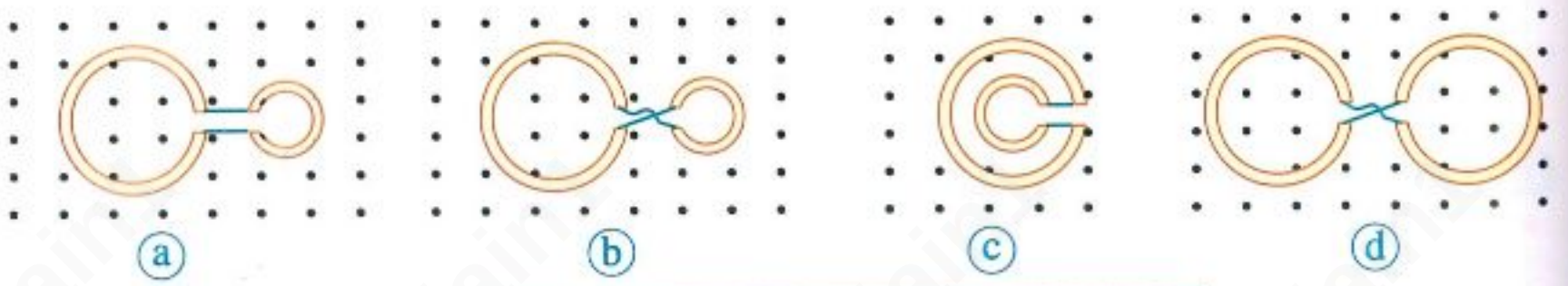
(a) (b) (c) (d)

14 The opposite figure shows two small similar magnets A, B. They have fallen at the same instant from the same level to pass through two vertical tubes having the same dimensions without touching their walls, one made of plastic while the other is made of copper. If the magnet (A) spent time t to pass through the tube, so the time spent by magnet (B) to pass through the tube is ..... .



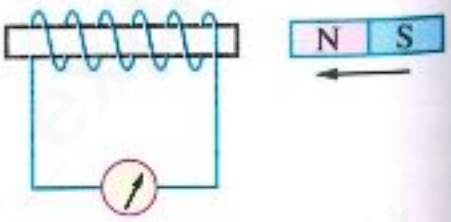
(a) greater than (t)
(b) less than (t)
(c) equals (t)
(d) the answer is indeterminable

15 Every figure of the following figures shows two incomplete metal rings in one plane which are connected together with two wires and placed in a uniform magnetic flux that is perpendicular to their planes. In which of the following figures, the most intense current passes in the rings when the magnetic flux density acting on them increases with a uniform rate?



(a) (b) (c) (d)

16 A solenoid consisting of 20 turns is connected to a galvanometer as shown in the opposite figure and when moving a magnet towards the solenoid, the magnetic flux linked with the solenoid gets increased by 0.2 Wb through 0.02 s, so the magnitude of the average induced emf in the circuit equals ..... .



(a) 0.2 V (b) 1 V (c) 20 V (d) 200 V

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17 Two rings x, y of areas 2 A, A respectively are placed perpendicular to a magnetic field whose density is changing uniformly with time, so the ratio between the induced emf in each of the two rings $\left(\frac{emf_x}{emf_y}\right)$ within the same time interval is ..... .

(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{1}{1}$ (d) $\frac{4}{1}$

18 A metal wire of uniform cross-sectional area is divided into two parts to make two rings a, b of radii r, 2 r respectively. Each of the two rings is placed perpendicular to a magnetic field. If the magnetic flux density passing through them is changed in the same rate, the ratio between:

(i) Values of the induced emf in the two rings $\left(\frac{(emf)_a}{(emf)_b}\right)$ equals ..... .

(a) $\frac{1}{4}$ (b) $\frac{4}{1}$ (c) $\frac{1}{2}$ (d) $\frac{1}{1}$

(ii) Intensities of the induced current in the two rings $\left(\frac{I_a}{I_b}\right)$ equals ..... .

(a) $\frac{1}{4}$ (b) $\frac{2}{1}$ (c) $\frac{1}{2}$ (d) $\frac{1}{1}$

19 ✱ A one turn coil of radius 0.12 m that is made of an elastic conducting wire is placed perpendicular to a uniform magnetic field of density 0.15 T as in figure (a). If the turn is pressed from its sides till its area becomes 3×10^{-3} m^2 as that in figure (b) through a time of 0.2 s, the average induced emf generated in the coil within this time interval equals ..... .

(a) (b)

(a) 0 (b) 1.12×10^{-3} V (c) 2.14×10^{-3} V (d) 31.7×10^{-3} V

20 A circular ring of radius 7 cm is placed perpendicular to a magnetic flux of density 0.1 T. If the ring is bent from its center through a time interval 2 s such that plane of one of the halves becomes parallel to the field, so magnitude of the average induced emf in the ring during that interval equals ..... .

(a) 0.1925 mV (b) 0.385 mV (c) 0.5775 mV (d) 0.77 mV

21 The following cases represent the change in flux through a circular coil of N turns, so which of them causes the greatest induced emf in the coil?

(a) A change of flux from 2 Wb to 2.1 Wb within 10^{-4} s.

(b) A change of flux from 0.2 Wb to 4 Wb within 0.2 s.

(c) A change of flux from 1 Wb to 20 Wb within 10 s.

(d) A change of flux from 0.01 Wb to 0.02 Wb within 0.2 s.

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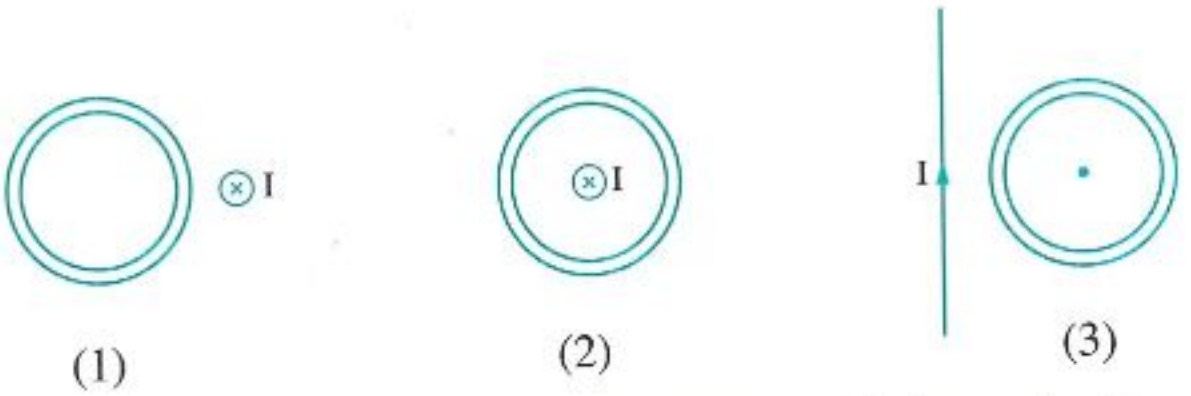
22 A coil of 100 turns is penetrated by a magnetic flux that equals 0.02 Wb. If this magnetic flux is doubled within 0.01 s, the average induced emf across the terminals of the coil equals ..... .

(a) – 400 V (b) – 350 V (c) – 275 V (d) – 200 V

23 A straight wire that carries a current of intensity I is placed in many positions with respect to a vertical metal ring as in the following figures:



(1) (2) (3)

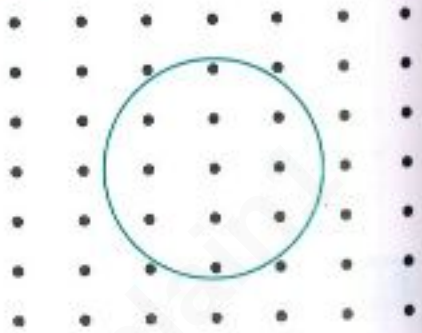
If the intensity of the electric current passing in the wire is increasing in a uniform rate, in which of the three cases an induced current is generated through the ring?

(a) Case (1) only. (b) Case (2) only. (c) Case (3) only. (d) Cases (1), (3) only.

24 Which of the following choices expresses the correct direction of the current induced in the metallic ring by the effect of the current intensity variation through the wire shown in each figure?

(a) (b) (c) (d)

25 The opposite figure shows a ring placed in the plane of the page and being affected by a uniform magnetic field whose direction is perpendicular to and out of the page, which of the following choices leads to generating an induced current in the clockwise direction through the closed metal ring?



(a) Moving the ring to the right through the magnetic field.

(b) Moving the ring upward through the magnetic field.

(c) Decreasing the density of the acting magnetic flux on the ring.

(d) Increasing the density of the acting magnetic flux on the ring.

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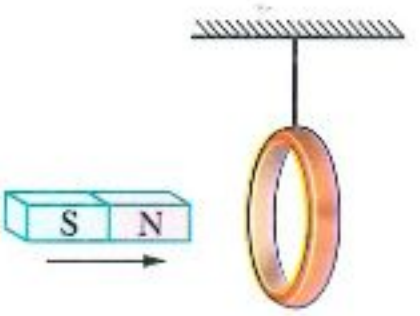
26 A copper ring is suspended freely to a thread. If a magnet is moved towards the ring as in the opposite figure, then ..... .



(a) the ring will be attracted to the magnet

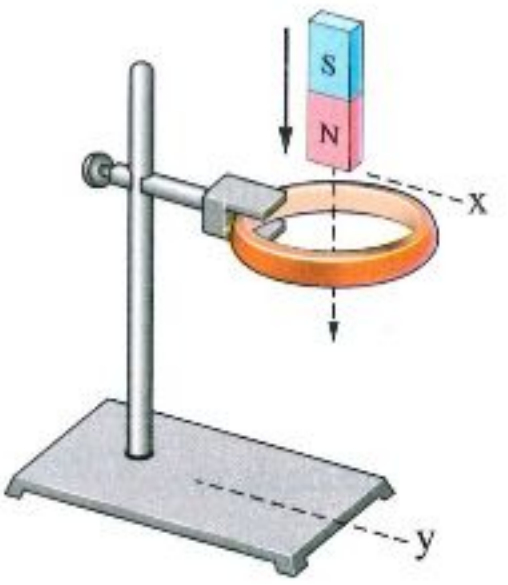
(b) the ring's face that faces the magnet becomes a north pole

(c) the ring's face that faces the magnet becomes a south pole

(d) the ring won't be affected by a force because it's made of copper

---

27 A bar magnet fell from level x to level y through an aluminum ring that is fixed horizontally to a stand as shown in the figure, so if the ring was viewed from above at the time in which the magnet was falling, the induced current in the ring would be ..... .



(a) always in clockwise direction

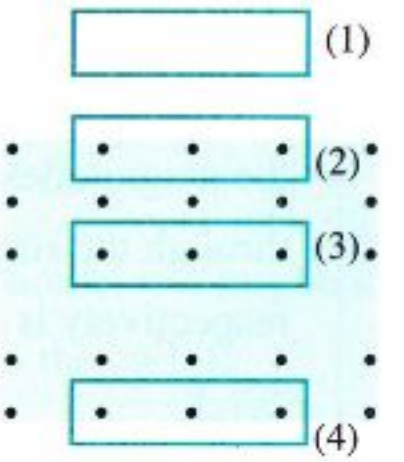
(b) always in anti-clockwise direction

(c) in clockwise direction then reverses its direction

(d) in anti-clockwise direction then reverses its direction

---

28 A rectangular metal frame is left to fall with its vertical plane to pass through a uniform magnetic field as in the opposite figure, in which of the shown positions in the opposite figure the induced emf in the frame is maximum value?



(a) Position (1).

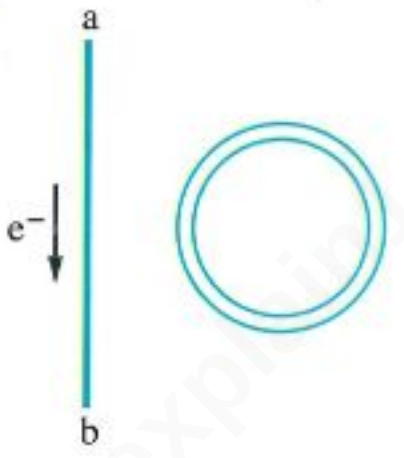
(b) Position (2).

(c) Position (3).

(d) Position (4).

---

29 A straight wire ab that carries a DC electric current is placed beside and in the same plane of a fixed metallic ring as in the opposite figure, if the direction of the free electrons movement in the wire is from terminal a to terminal b:



(i) In the shown position, ...

(a) an induced emf of constant value and variable direction is generated in the ring

(b) an induced emf that is constant in value and direction is generated in the ring

(c) an induced emf that of variable value and variable direction is generated in the ring

(d) no induced emf is generated in the ring

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(ii) When moving the wire with a uniform velocity towards the center of the ring in a direction parallel to its plane, ...

(a) an induced current is generated in the ring in the clockwise direction

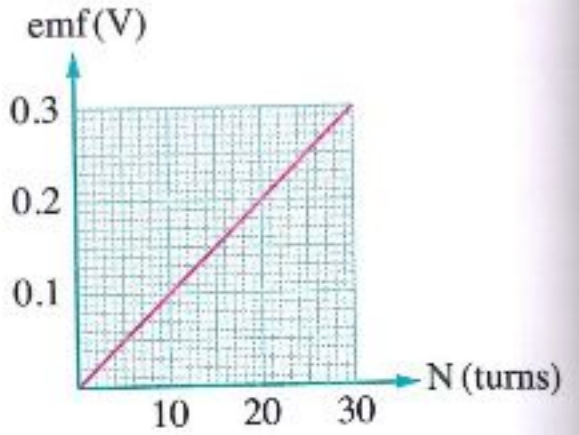
(b) an induced current is generated in the ring in the counter-clockwise direction

(c) an induced current of constant intensity is generated in the ring

(d) no induced current is generated in the ring

---

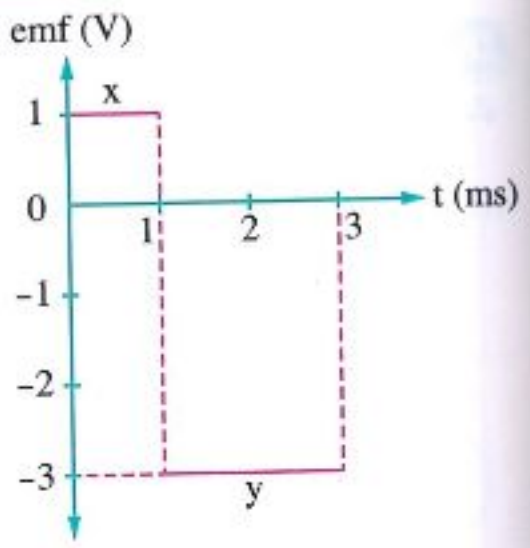
30 The opposite graph represents the relation between the average induced electromotive force (emf) in multiple coils through which a magnetic field is uniformly changing with the same rate and the number of turns of each coil (N), so the time rate of change in the magnetic flux that passes through the coils is ..... .



(a) 10 Wb/s (b) 1 Wb/s (c) 0.1 Wb/s (d) 0.01 Wb/s

---

31 The opposite graph represents the relation between the average induced electromotive force (emf) in a metallic ring and the time (t), then the ratio between the magnitudes of the change in the magnetic flux through the ring in the two intervals (x) and (y) respectively is ..... .

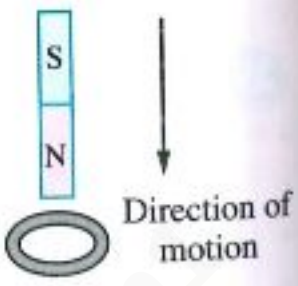


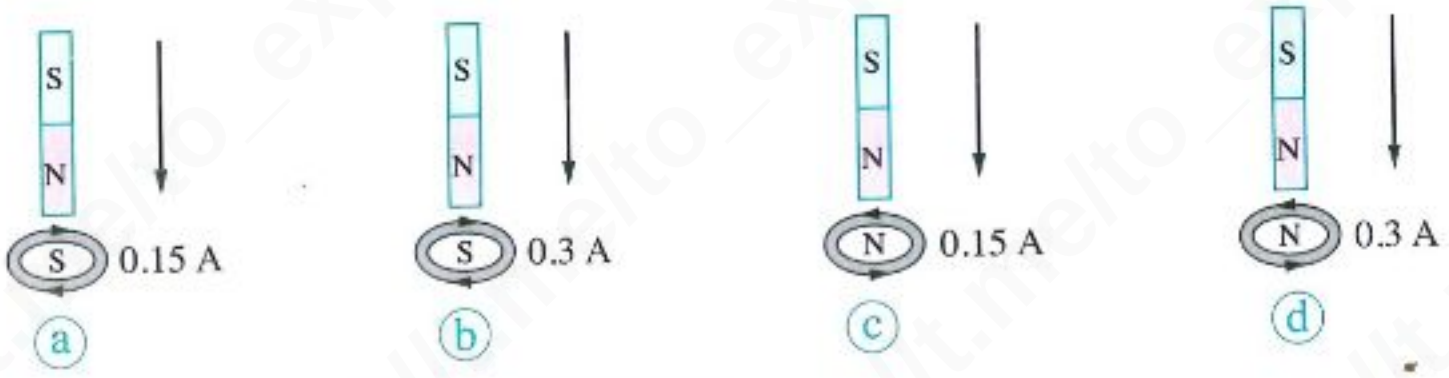
(a) $\frac{1}{3}$ (b) $\frac{3}{1}$

(c) $\frac{2}{3}$ (d) $\frac{1}{6}$

---

32 The opposite figure represents a bar magnet moving perpendicular to a horizontal circular coil of 200 turns that has resistance 10 Ω, so the magnetic flux through the coil changes from 2.5×10^{-3} Wb to 8.5×10^{-3} Wb during a time interval of 0.4 s, so the figure that illustrates correctly the intensity and the direction of the induced current in the coil as viewed from above is ..... .





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33 ✱ A solenoid coil is formed of 400 turns, the cross-sectional area of each is 4 cm^2. If its axis is parallel to a uniform magnetic field of flux density 0.3 T, then the average induced emf generated in the coil when:

(i) the magnetic flux density increases to 0.5 T within 2 ms is equal to ..... .

(a) – 16 V (b) – 8 V (c) 8 V (d) 16 V

(ii) the magnetic flux density decreases to 0.2 T within 2 ms is equal to ..... .

(a) 6 V (b) 8 V (c) 10 V (d) 12 V

---

34 A coil of 400 turns, where the area of each turn is 50 cm^2, is being penetrated by a perpendicular magnetic field of flux density 0.2 T, then the average value of the induced emf between its terminals if the magnetic flux intercepting the coil has vanished through 0.01 s is equal to ..... .

(a) 20 V (b) 40 V (c) 60 V (d) 80 V

---

35 ✱ A rectangular coil of dimensions 20 cm, 10 cm is formed of 100 turns, its plane is perpendicular to a magnetic field. When this coil is turned $\frac{1}{4}$ cycle about an axis in the same plane of the coil through a time interval of 0.2 s, an induced emf of 0.4 V is generated. So, the magnetic flux density equals ..... .

(a) 0.01 T (b) 0.03 T (c) 0.04 T (d) 0.05 T

---

36 ✱ A rectangular coil of area 75 cm^2 that consists of 150 turns is placed parallel to a magnetic flux of density 0.65 T. Then the average induced electromotive force in the coil if:

(i) the coil is turned to become perpendicular to the field for the first time within 0.02 s is equal to ..... .

(a) – 36.56 V (b) – 40.2 V (c) – 50.3 V (d) 0

(ii) the coil is inverted from the first position in the field within 0.01 s is equal to ..... .

(a) 36.56 V (b) 40.3 V (c) 73.12 V (d) 0

(iii) the coil is turned $\frac{3}{4}$ cycle from the first position to become perpendicular to the field within 0.02 s is equal to ..... .

(a) 0 (b) 36.56 V (c) 50.4 V (d) 73.12 V

(iv) the coil made a complete cycle within 0.02 s equals ..... .

(a) 0 (b) 18.28 V (c) 36.56 V (d) 73.12 V

(v) the magnetic field is vanished within 0.1 s is equal to ..... .

(a) 0 (b) 20 V (c) 40 V (d) 60 V

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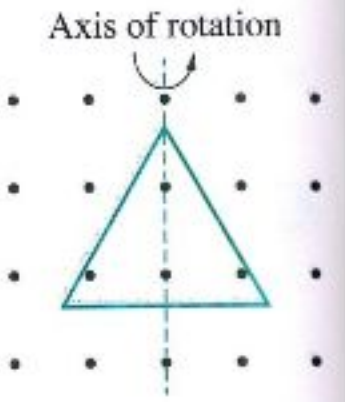
37 ✱ A coil of face area 1.8 cm^2 has 25 turns coiled on a hollow cylinder. The coil is connected to a closed circuit of resistance 3 Ω while being affected by a uniform magnetic field parallel to its axis. If the magnetic flux density has increased from zero to 0.55 tesla within a time of 0.75 s, the induced electric current intensity in the coil equals ..... .

(a) 1.1×10^{-3} A (b) 2.2×10^{-3} A (c) 3.3×10^{-3} A (d) 6.6×10^{-3} A

38 ✱ A coil of 100 turns whose face area is 20 cm^2 is placed perpendicular to a uniform magnetic field of flux density 0.2 T, if the direction of the magnetic flux is reversed through 0.2 s, then the average induced emf will be equal to ..... .

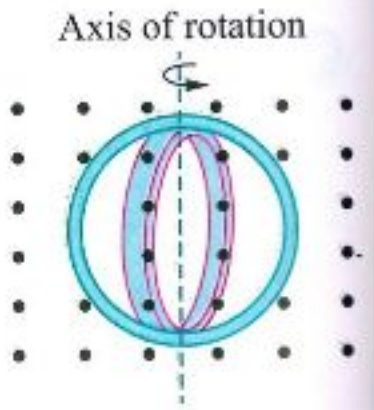
(a) 0.2 V (b) 0.4 V (c) 0.6 V (d) 0.8 V

39 ✱ A triangular frame rotates about the axis as shown in the opposite figure in a rate of 1800 turn/minute in a uniform magnetic field. If the induced emf in the frame through $\frac{1}{60}$ s of its rotation starting from the perpendicular position is 4.8 V, so the maximum flux passing through the frame equals ..... .



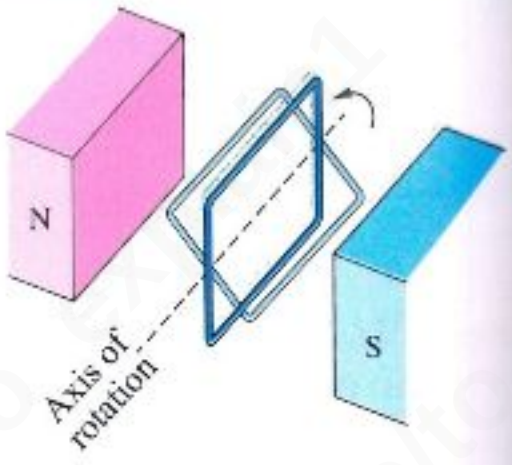
(a) 0.01 Wb (b) 0.02 Wb
(c) 0.03 Wb (d) 0.04 Wb

40 The opposite figure represents a circular metallic ring of cross-sectional area 2×10^{-3} m^2 whose plane is perpendicular to a uniform magnetic field of flux density 0.1 T, if it is rotated by an angle of 45° about an axis perpendicular to the direction of the field within 0.25 s, what is the magnitude of the average induced emf through this period?



(a) 2.34×10^{-4} V (b) 5.75×10^{-4} V (c) 8×10^{-4} V (d) 8.25×10^{-4} V

41 The opposite figure represents a rectangular metal frame of cross-sectional area 0.02 m^2 which is placed perpendicular to a uniform magnetic field of flux density 0.1 T, so if the frame is rotated by an angle θ about an axis perpendicular to the direction of the field within 0.25 s, an average emf of 4 mV is generated, what is the angle (θ) with which the coil's plane is rotated?



(a) 30° (b) 45° (c) 60° (d) 75°

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42 A rectangular coil of area 4 cm^2, resistance 50 Ω and number of turns N is placed perpendicular to a uniform magnetic field of density 0.2 T. When the coil is rotated 180° to be inverted, an electric charge of 1.6×10^{-3} C flows through a cross-section of the coil's wire, then the number of turns of the coil (N) equals ..... .

(a) 100 turns (b) 200 turns (c) 500 turns (d) 750 turns

43 A metal ring is rotating about an axis in its plane with a uniform rate in a uniform magnetic flux. During the rotation of the ring from the parallel position to the field by an angle 60° an average induced current of intensity I_1 passes through the ring, and during its rotation from the perpendicular position to the field by an angle 60° an average induced current of intensity I_2 passes through the ring, so the ratio $\left(\frac{I_1}{I_2}\right)$ equals ..... .

(a) $\frac{1}{2}$ (b) $\sqrt{3}$ (c) $\frac{\sqrt{3}}{2}$ (d) $\frac{1}{\sqrt{3}}$

44 ✱ A circular coil of face area 0.045 m^2, number of turns 150 turns is connected to a closed circuit of total resistance 0.9 Ω. If the plane of that coil is perpendicular to a uniform magnetic flux of density 8×10^{-5} T. Then, the amount of electric charge passing through a cross-section of the coil's wire if the coil has been removed away completely from the field equals ..... .

(a) 6×10^{-4} C (b) 8×10^{-4} C (c) 9×10^{-4} C (d) 9.5×10^{-4} C

45 A static solenoid is connected to the terminals of a galvanometer in which the zero point of its scale is at the middle where a static bar magnet is placed beside it. In figure (1), the bar magnet is moved with a uniform speed (v) towards the static coil, while in figure (2), the coil is moved towards the static bar magnet with the same uniform speed (v), what do you expect for the deflection of the galvanometer's pointer in figure (2) compared to figure (1)?

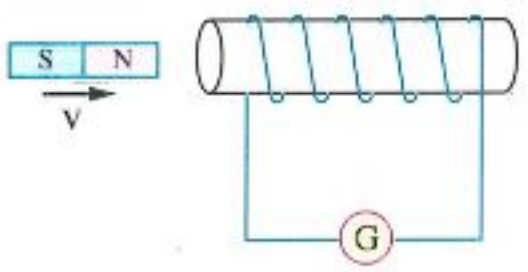


Figure (1)

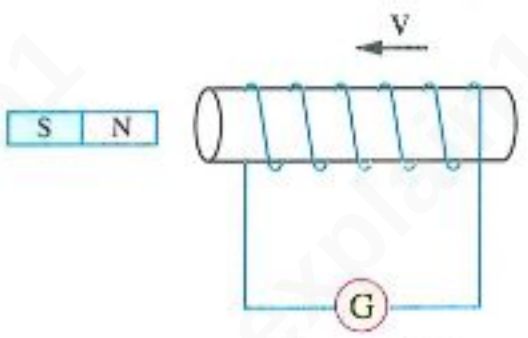
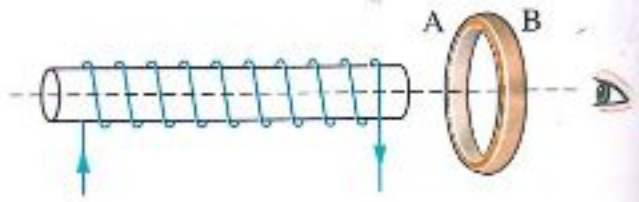


Figure (2)

(a) The pointer doesn't deflect because the magnet is stationary.
(b) It gives the same deflection in the opposite direction.
(c) It gives less deflection in the same direction.
(d) It gives the same deflection in the same direction.

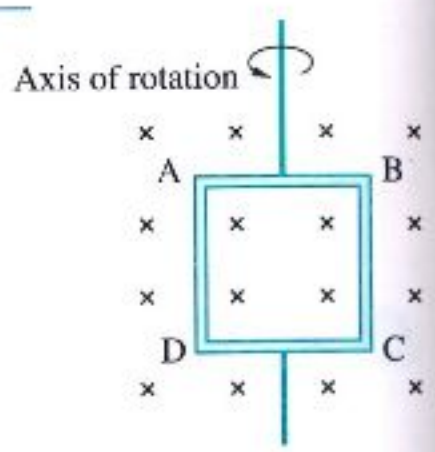
https://t.me/to_explain1

46 The opposite figure shows a solenoid that carries an electric current while being placed adjacent to a metallic ring such that the axis of the coil is perpendicular to the face (A) of the ring, so an electric current gets induced in the ring in the anticlockwise direction as the ring is viewed from face (B) when .....



(a) decreasing the current intensity gradually in the coil
(b) increasing the current intensity gradually in the coil
(c) moving the solenoid toward the ring
(d) rotating the ring about an axis normal to its plane

47 * The opposite figure shows a square metallic frame of side length 20 cm that is placed where its plane is perpendicular to a uniform magnetic field of flux density 0.4 T, so when the frame rotates in the direction that is shown in the figure until its plane becomes parallel to the field within a period of 0.08 s, the average induced electromotive force in the frame becomes ..... and the direction of the induced current in one side of it becomes .....



(a) 0.1 V, from A to B
(b) 0.1 V, from A to D
(c) 0.2 V, from A to B
(d) 0.2 V, from A to D

48 Two coils are moving in the magnetic fields that are produced due to the electric currents (I) in two very long wires as shown in figures A and B, so the induced currents in .....

	Figure A	Figure B
(a)	is in anticlockwise direction	is in clockwise direction
(b)	zero	zero
(c)	is in clockwise direction	is in clockwise direction
(d)	is in clockwise direction	zero

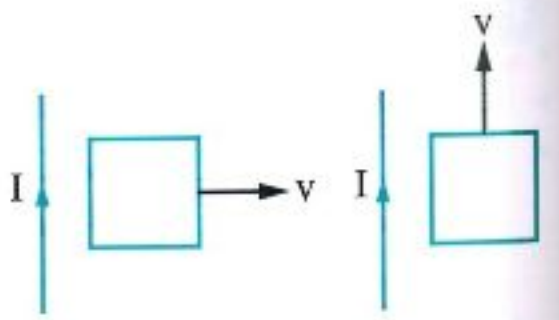
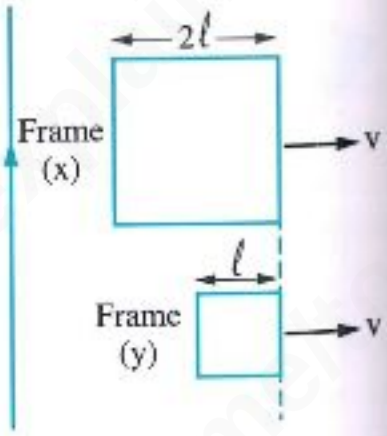


Figure (A) Figure (B)

49 Two square metallic frames x, y in the same plane, where a straight wire that is carrying electric current is placed in their plane as in the opposite figure. If the frames moved away from the wire with a speed (v), in which of the two frames the biggest induced emf will be generated?



(a) Frame x.
(b) Frame y.
(c) Equal in both frames.
(d) No emf is generated in any of the two frames.

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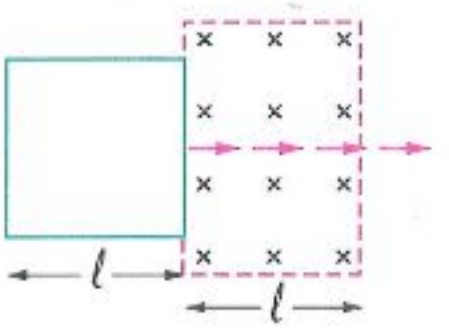
50 The opposite figure shows a square coil moving in the plane of the page and entering a region of a uniform magnetic field that is perpendicular into the plane of the page till gets out from it. So, the direction of the induced current in the coil is ..... .



(a) always in the clockwise direction

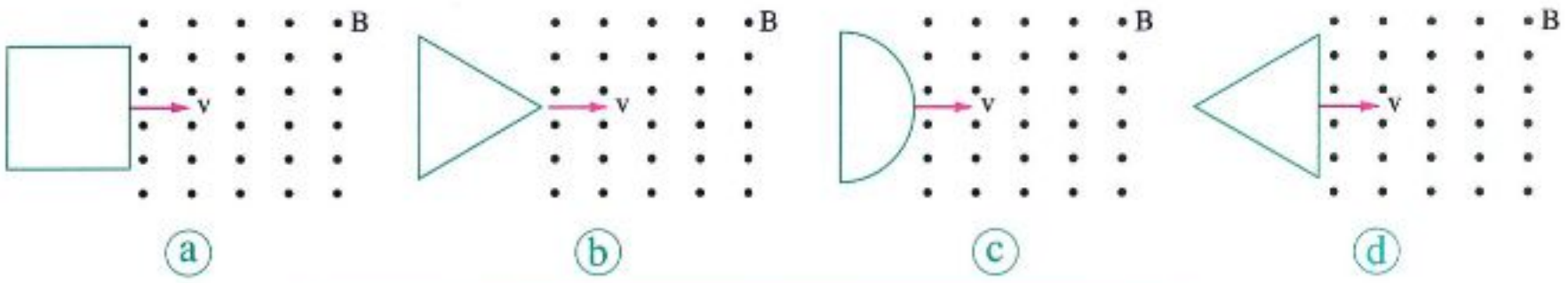
(b) always in the anti-clockwise direction

(c) in the clockwise direction then in the anti-clockwise direction

(d) in the anti-clockwise direction then in the clockwise direction

---

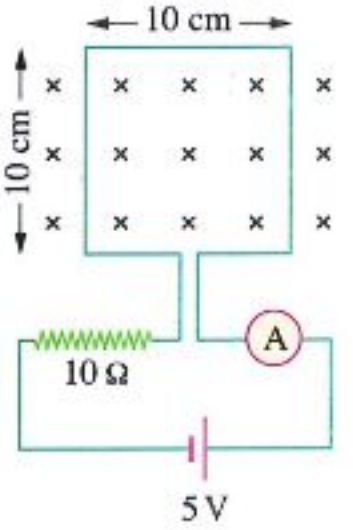
51 In each of the following figures, a metal frame is moving with a uniform velocity v perpendicular to a uniform magnetic flux of density B, then the frame in which the induced electric current intensity gets decreasing during its motion to enter the field region is ..... .



(a) (b) (c) (d)

---

52 ✱ In the circuit illustrated in the figure, a coil of one turn whose resistance is negligible is placed in a magnetic field that is directed perpendicular to the coil into the page. If the magnetic flux density gets decreasing at a uniform rate of 150 T/s, then the reading of the ammeter in the interval of decreasing the flux will be ..... .

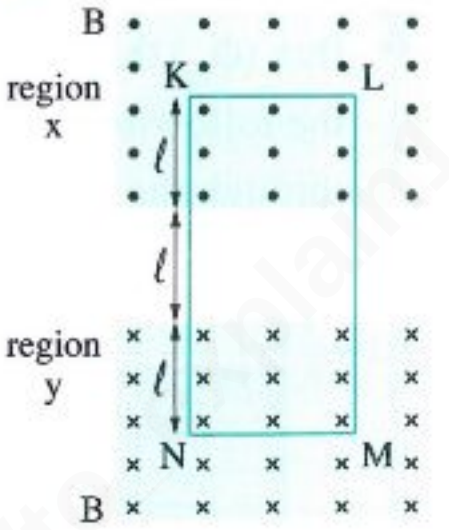


(a) 0.15 A (b) 0.35 A

(c) 0.5 A (d) 0.65 A

---

53 A rectangular coil KLMN is affected by two magnetic fields having the same magnetic flux density but in opposite directions as in the opposite figure, so during:



(i) increasing of the flux density in the region x in a certain rate and decreasing that in the region y in the same rate ..... .

(a) no induced current is generated in the coil

(b) an induced AC current of variable intensity and direction is generated in the coil

(c) an induced current in the clockwise direction is generated in the coil

(d) an induced current in the counter-clockwise direction is generated in the coil

https://t.me/to_explain1

(ii) increasing of the flux density in the two regions x, y in the same rate ..... .

(a) no induced current is generated in the coil

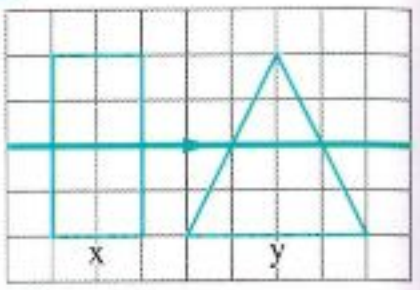
(b) an induced AC current of variable intensity and direction is generated in the coil

(c) an induced current in the clockwise direction is generated in the coil

(d) an induced current in the counter-clockwise direction is generated in the coil

---

54 Two metallic frames x, y on a horizontal table and above them a long straight wire carrying an electric current that its intensity is increasing in a uniform rate as in the opposite figure, so induced emf ..... .



(a) is generated in frame x only

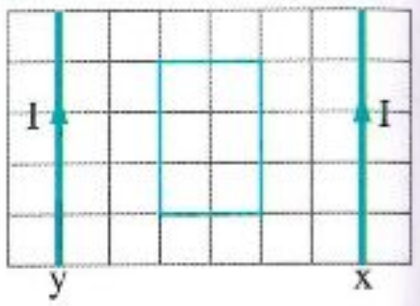
(b) is generated in frame y only

(c) is generated in both frames

(d) is generated in none of the two frames

---

55 A rectangular frame is placed in the same plane between two parallel straight wires x, y which are carrying electric currents, each of intensity I in the same direction as in the opposite figure, so during:



(i) increasing the currents of the two wires in the same rate ..... .

(a) induced current in the clockwise direction is generated in the metal frame

(b) induced current in the counter-clockwise direction is generated in the metal frame

(c) AC induced current is generated in the metal frame

(d) no induced current is generated in the metal frame

(ii) increasing the current of wire x with a certain uniform rate and decreasing that of wire y in the same uniform rate ..... .

(a) induced current in the clockwise direction is generated in the metal frame

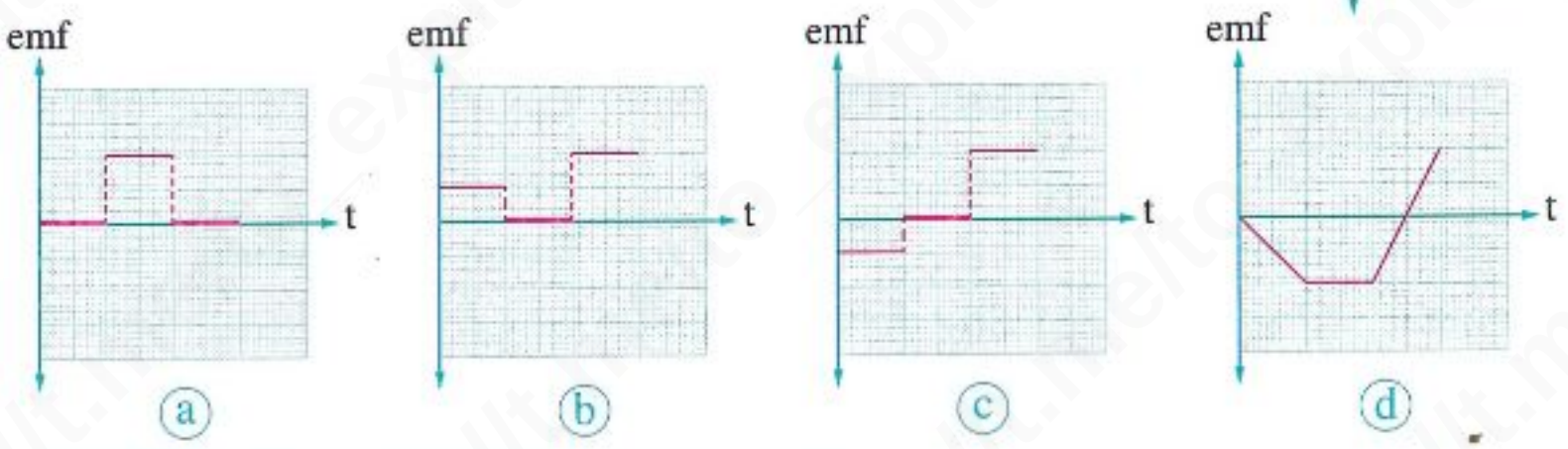
(b) induced current in the counter-clockwise direction is generated in the metal frame

(c) AC induced current is generated in the metal frame

(d) no induced current is generated in the metal frame

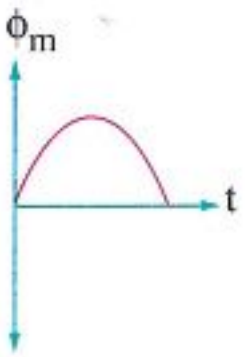
---

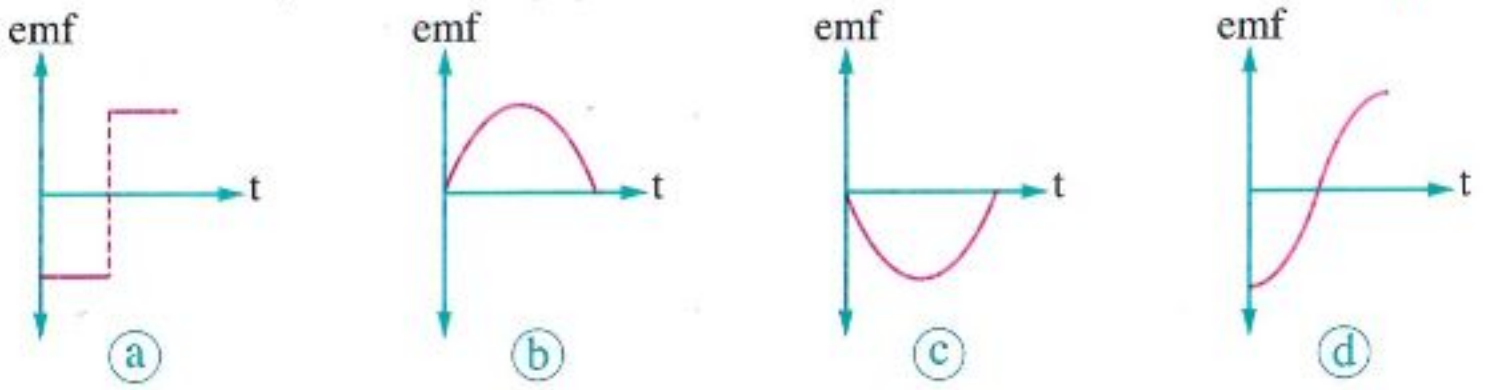
56 The opposite graph shows the relation between the magnetic flux (ϕ_m) that is penetrating a coil and time (t), so which of the following graphs represents the induced emf in the coil through the same period of time?



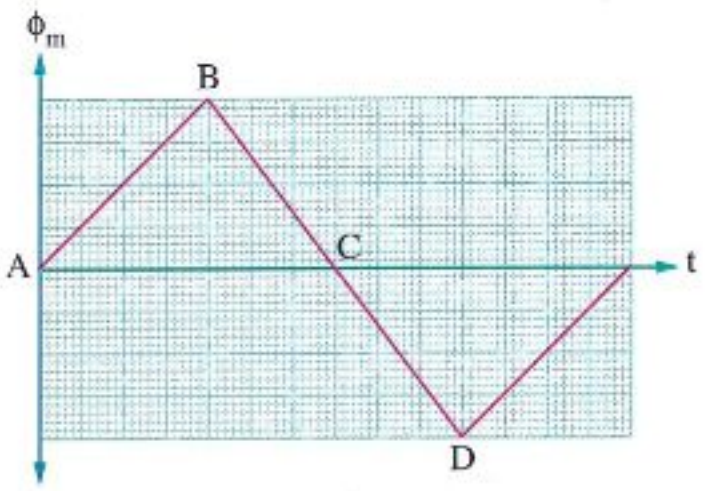
https://t.me/to_explain1

57 A circular coil is placed parallel to the direction of a magnetic field. When the coil is inverted in a uniform speed, the passing magnetic flux through the coil is changed as in the opposite graph, so which of the following graphs represents the induced emf in the coil through the same time interval?





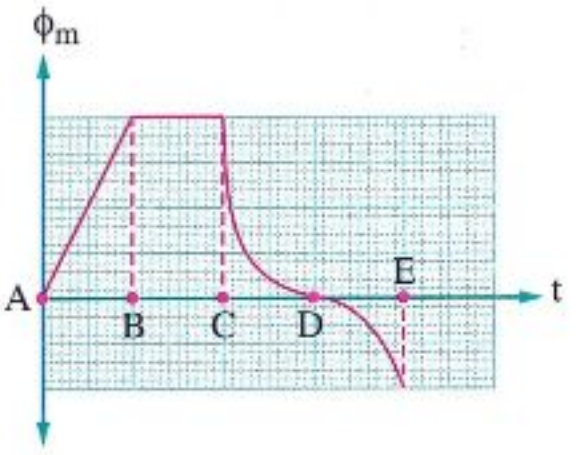
58 The opposite graph represents the variation of the magnetic flux that penetrates a circular coil when the coil is connected to a closed circuit versus time, so at which two points the induced current reverses its direction in the coil?



(a) B, A (b) C, D

(c) B, C (d) B, D

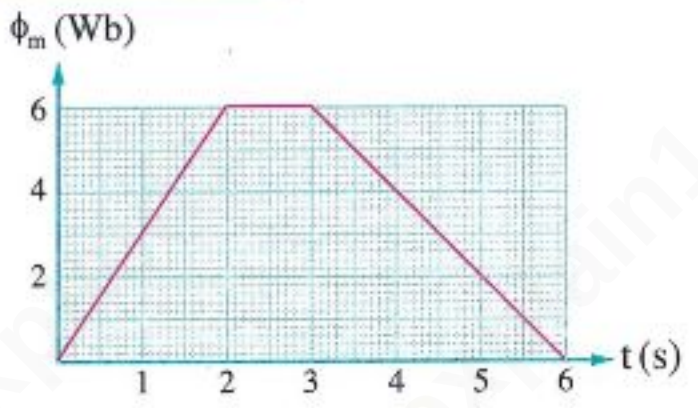
59 ✳ The opposite graph represents the change in the magnetic flux (ϕ_m) through a coil during four equal intervals of time AB, BC, CD, DE. So, the time interval in which the magnitude of the induced emf in the coil increases is ..... .



(a) AB (b) BC

(c) CD (d) DE

60 ✳ The opposite graph represents the change of the magnetic flux through a coil of 200 turns during 6 seconds, so the average induced emf through:



(i) the first two seconds equals ..... .

(a) – 300 V (b) 300 V

(c) – 600 V (d) 600 V

(ii) the third second equals ..... .

(a) 1200 V (b) 600 V (c) 400 V (d) 0

(iii) the last three seconds equals ..... .

(a) 200 V (b) – 200 V (c) 400 V (d) – 400 V

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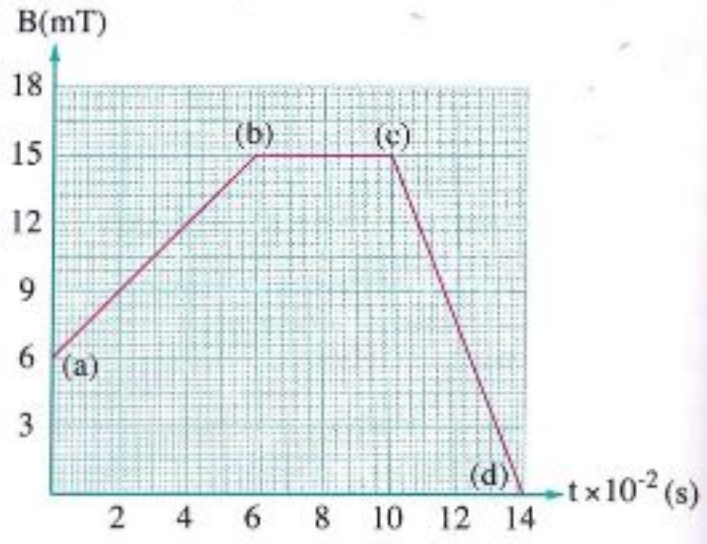
61 A coil of area 0.04 m^2 and number of turns 150 turns is placed in such a way where its plane is perpendicular to a magnetic field of flux density that changes with time according to the graph illustrated in the opposite figure, then:



(i) The ratio between the magnitudes of the average induced emf in the coil through the two stages ab and cd respectively is ..... .

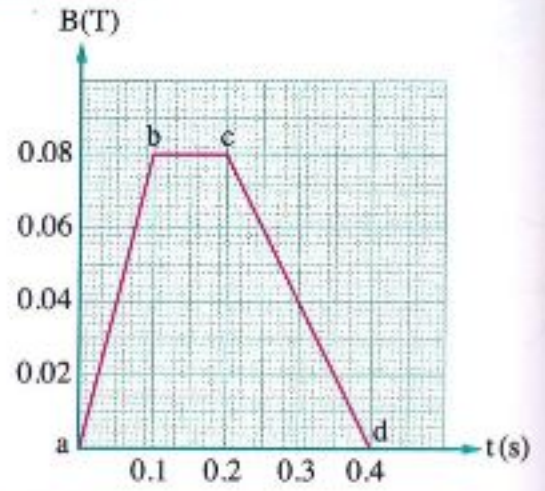
ⓐ $\frac{2}{5}$ ⓑ $\frac{5}{2}$ ⓒ $\frac{1}{3}$ ⓓ $\frac{3}{1}$

(ii) The value of the average induced emf in the coil through stage bc equals ..... .

ⓐ 0 ⓑ 1 V ⓒ 1.25 V ⓓ 2.5 V

---

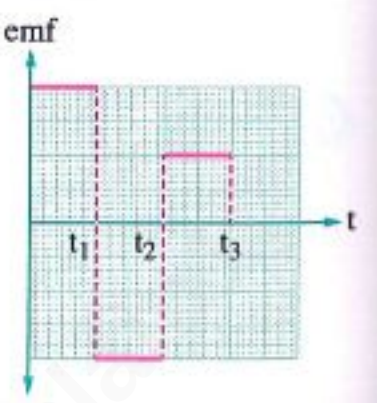
62 A magnetic flux is perpendicular into the plane of the page where a metallic ring of area 45 cm^2 is placed. If the density of the magnetic flux changes with time as shown in the opposite graph, then the magnitude of the induced emf in the ring during interval ab and the direction of the induced current in the ring during interval cd respectively are ..... .

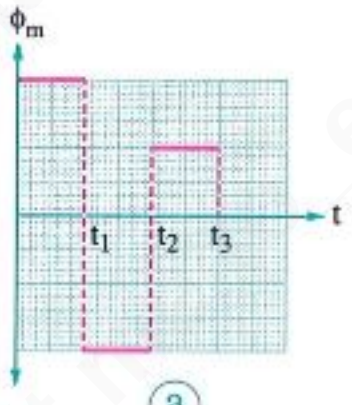


	The induced emf in the ring during interval ab	The direction of the induced current in the ring during interval cd
ⓐ	2.4×10^{-3} V	in the clockwise direction
ⓑ	2.4×10^{-3} V	in the anticlockwise direction
ⓒ	3.6×10^{-3} V	in the clockwise direction
ⓓ	3.6×10^{-3} V	in the anticlockwise direction

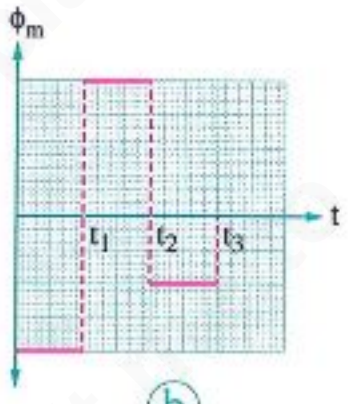
---

63 The opposite graph represents the induced emf in a coil when the magnetic flux passing through it changes through a certain interval of time, so which of the following graphs represents the magnetic flux (ϕ_m) passing through the coil during this interval?

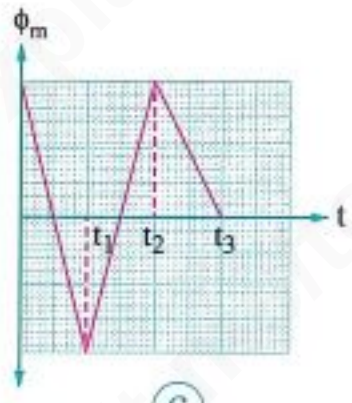




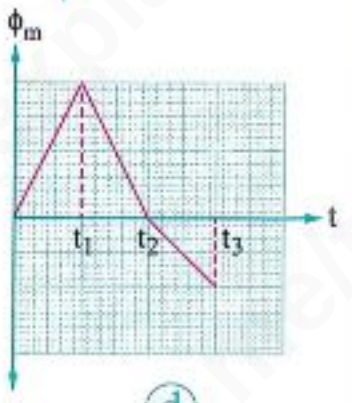
ⓐ



ⓑ



ⓒ



ⓓ

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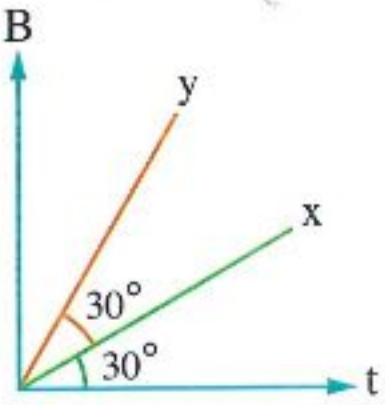
64 ✱ A metal wire of uniform cross section is used to make two rings which are placed perpendicular to a magnetic flux of constant direction but its density changes with time as represented by the opposite graph. If the ratio between the intensities of the induced current in the rings is $\left(\frac{I_x}{I_y}\right)$ equals $\frac{2}{3}$, the ratio between the areas of the two rings $\left(\frac{A_x}{A_y}\right)$ equals ..... .



ⓐ $\sqrt{2}$ ⓑ $\frac{3}{2}$ ⓒ 2 ⓓ 4

65 ✱ It is noticed that a potential difference of 5.5×10^{-3} V is generated between the terminals of the second hand in a turret clock due to being exposed to a magnetic field perpendicular to it, given that the change in area that intercepts the magnetic flux due to the rotation of the second hand for one complete revolution is $\frac{11}{14}$ m^2. Then the affecting magnetic flux density is equal to ..... .

ⓐ 0.26 T ⓑ 0.42 T ⓒ 0.53 T ⓓ 0.62 T

66 The order of energy conversions in induction furnaces is .....

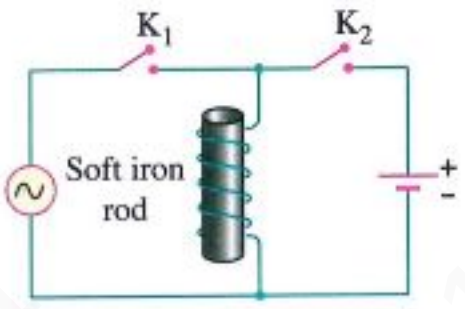
ⓐ thermal ⟶ electrical ⟶ magnetic ⟶ electrical

ⓑ electrical ⟶ thermal ⟶ electrical ⟶ magnetic

ⓒ magnetic ⟶ electrical ⟶ magnetic ⟶ thermal

ⓓ electrical ⟶ magnetic ⟶ electrical ⟶ thermal

67 An isolated rod of soft iron is placed inside a solenoid that may get connected to AC source of variable direction and intensity or DC source through one of the switches K_1, K_2 as in the opposite figure, so which of the following choices represents what happens to the soft iron rod when closing:



	Switch K_1?	Switch K_2?
ⓐ	Gets magnetized	Gets heated
ⓑ	Gets magnetized	Gets magnetized
ⓒ	Gets heated	Gets heated
ⓓ	Gets heated	Gets magnetized

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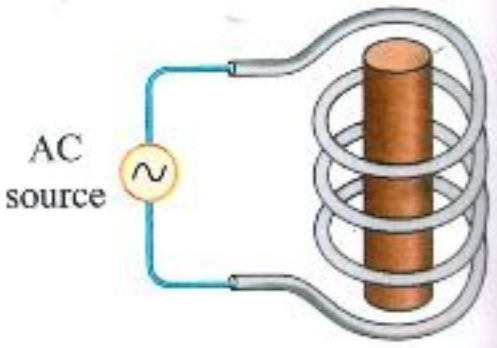
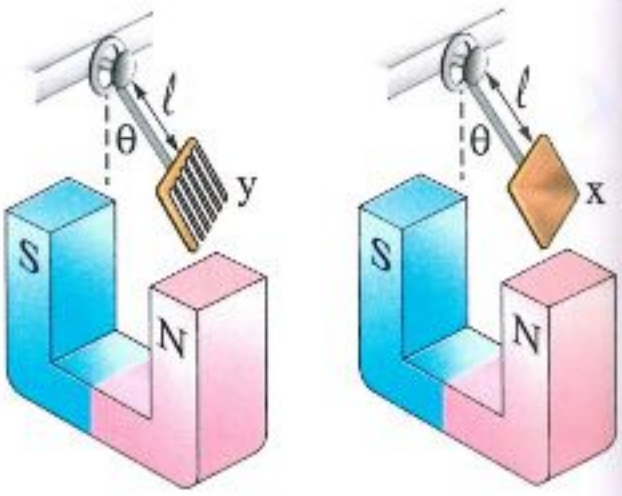
68 The opposite figure shows a coil that is coiled on a solid metal cylinder and connected to an AC source of variable direction and intensity, so if you know that the resistivity of aluminum is greater than that of copper, the produced eddy currents in the cylinder will be of higher intensity when the cylinder is ..... .



(a) thick and made of aluminum
(b) thin and made of aluminum
(c) thick and made of copper
(d) thin and made of copper

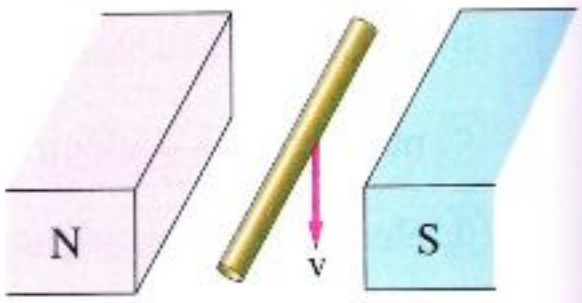
69 The opposite figure shows two aluminum slides x, y each is displaced by an angle θ from its rest position, then left at the same moment to swing in a magnetic field, which of the slides gets to rest first?



(a) Slide (x).
(b) Slide (y).
(c) The two slides get to rest together.
(d) The slides continue swinging and don't rest.

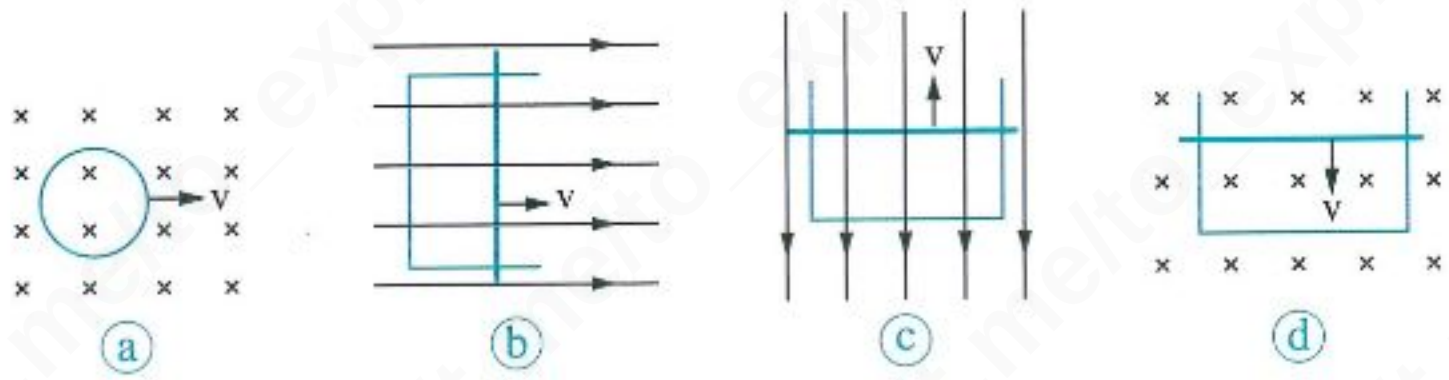
The emf induced in a straight wire

70 The opposite figure shows a metallic rod of resistance R cutting perpendicularly the magnetic flux lines at constant velocity v, so an induced electromotive force (emf) is produced across its terminals. If another rod of resistance greater than R that has the same length is used with the same velocity (v), then the value of the induced electromotive force will be ..... .



(a) greater than emf
(b) smaller than emf
(c) equal to emf
(d) zero

71 In which of the following figures an induced current is generated due to the motion of a conductor through a uniform magnetic field?



(a) (b) (c) (d)

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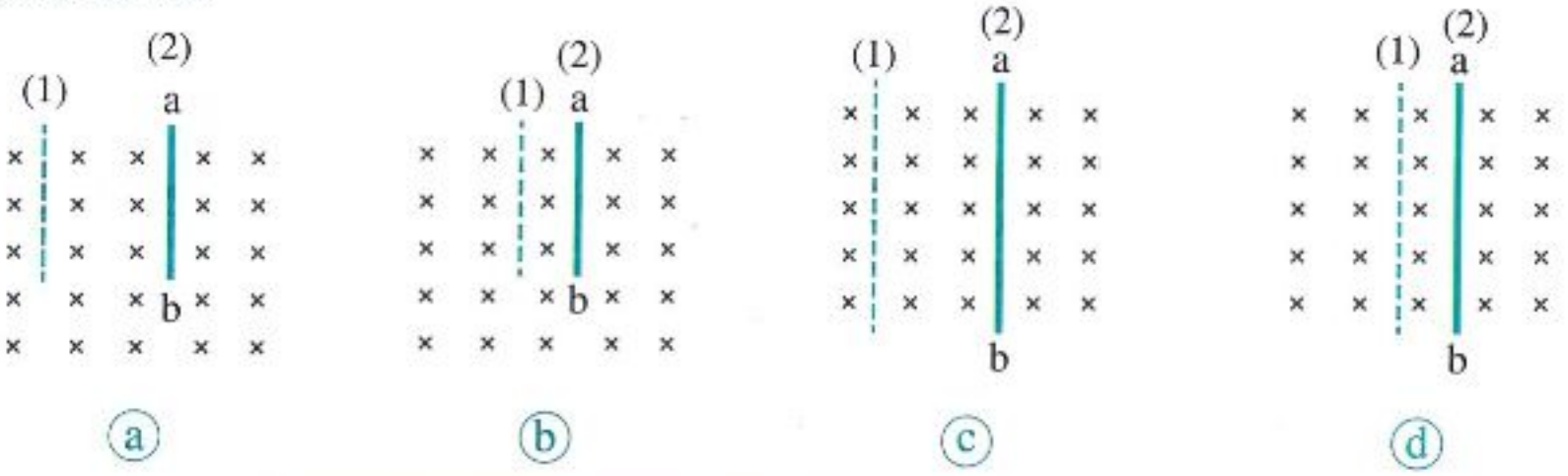
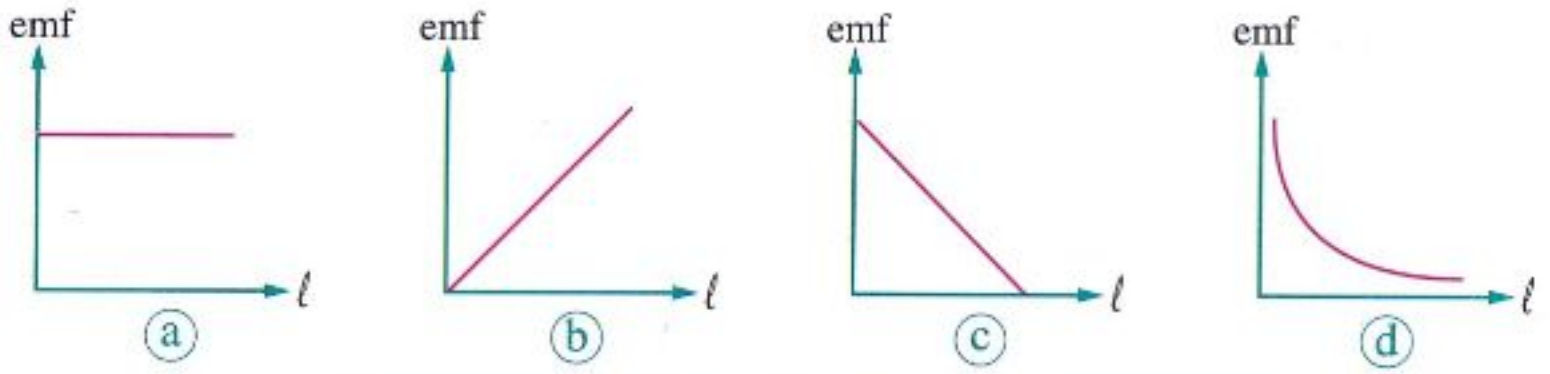
72 The following figures show four straight wires moving perpendicular to a uniform magnetic field from position (1) to position (2) during the same time interval, so the figure that illustrates the case in which the greatest induced electromotive force gets generated is ..... .



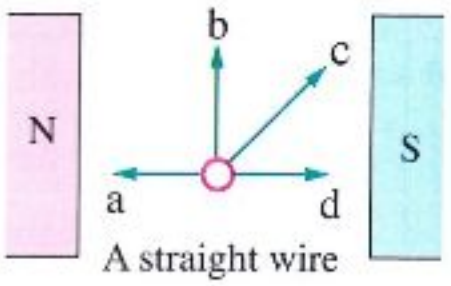
(a) (b) (c) (d)

73 Which of the following graphs represents the relation between the magnitude of the induced emf produced across the ends of a group of wires and their length (ℓ) if they are having the same cross-sectional area, made of the same material and moving at the same uniform velocity perpendicular to a uniform magnetic field?



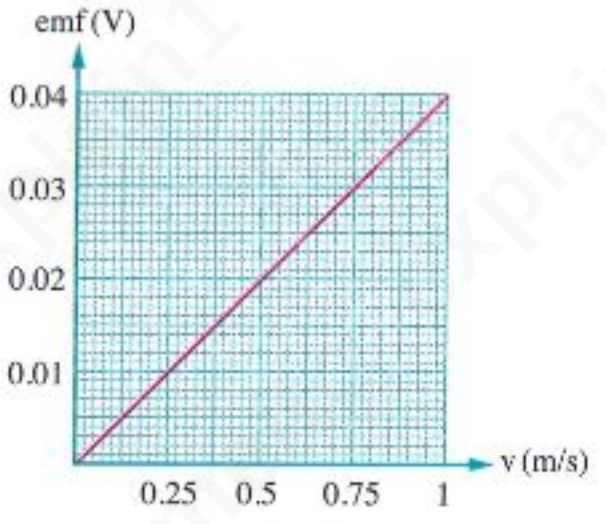
(a) (b) (c) (d)

74 The opposite figure represents a straight wire moving perpendicular to the page with a uniform velocity (v) between the two poles of a magnet, which of the directions shown in the figure represents the direction of the motion of the wire that produces a greater induced emf between its ends (terminals)?



(a) The direction (a) (b) The direction (b) (c) The direction (c) (d) The direction (d)

75 A straight wire of length 20 cm moves many times perpendicular to a uniform magnetic flux with a different uniform velocity (v) in each time. The opposite graph shows the relation between the induced emf in the wire and the velocity of the wire (v), then the magnetic flux density equals ..... .



(a) 0.1 T (b) 0.2 T
(c) 0.3 T (d) 0.4 T

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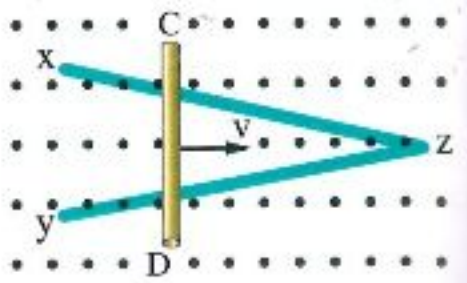
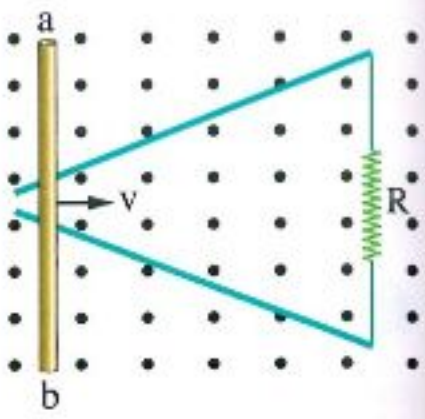
76 A metal rod (CD) of uniform cross-section and resistance R moves with constant velocity v perpendicular to a uniform magnetic field touching wire xzy of negligible resistance as in the opposite figure, then the intensity of the current which is passing in the rod during its motion ..... .



(a) equals zero
(b) remains constant
(c) increases gradually
(d) decreases gradually

77 The following figure shows a metal rod (ab) of negligible resistance sliding perpendicular to a uniform magnetic field on two metal rails of negligible resistance with a constant velocity v. The two rails are connected together through a resistor R , so magnitude of the induced current in the resistor (R) during the movement of the rod ..... .



(a) gets increased
(b) gets decreased
(c) remains constant
(d) the answer is indeterminable

78 A straight wire xy passes with a uniform velocity through two magnetic field regions a, b such that its motion direction is perpendicular to each of them as in the opposite figures:

So, the value of the induced emf between the terminals of the wire xy in ..... .

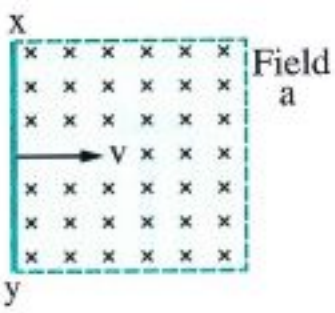


Figure (1)

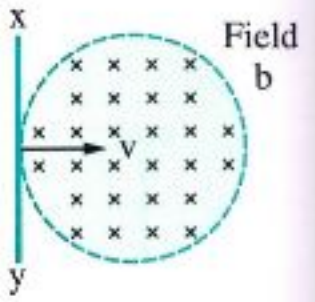
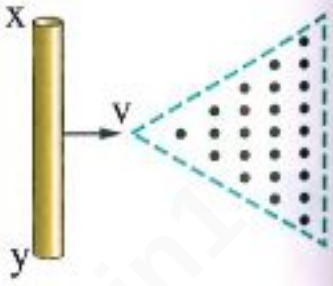
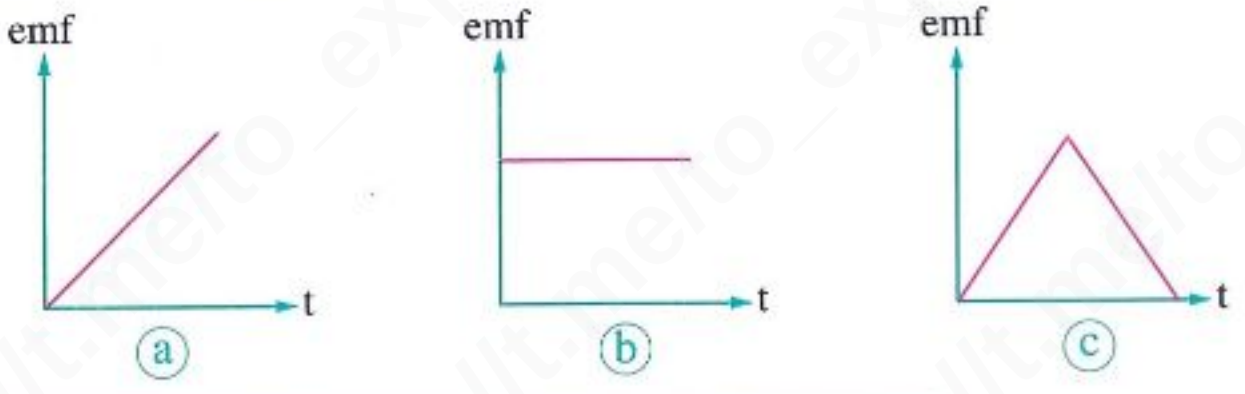


Figure (2)

	Figure (1)	Figure (2)
(a)	constant	constant
(b)	variable	constant
(c)	constant	variable
(d)	variable	variable

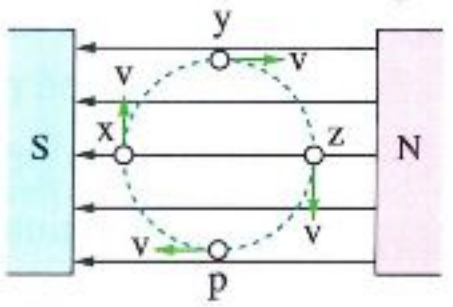
79 Wire xy is moving with a uniform velocity (v) through a uniform magnetic field that is perpendicular out of the plane of the page and confined in a triangle as shown in the opposite figure, then the graph that represents the relation between the induced emf in the wire and the time from the moment of entering the magnetic field to the moment it exits from it is ..... .

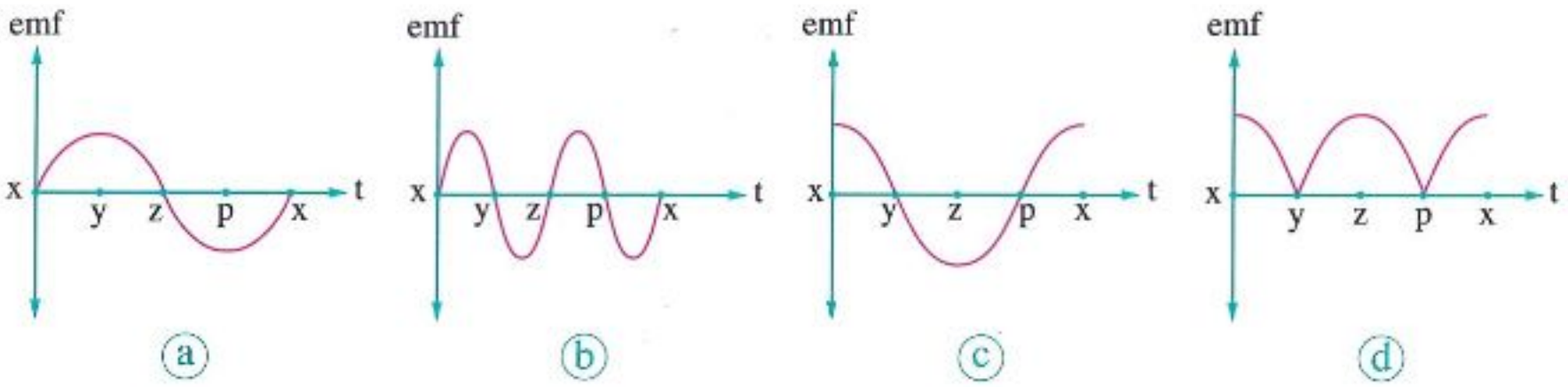




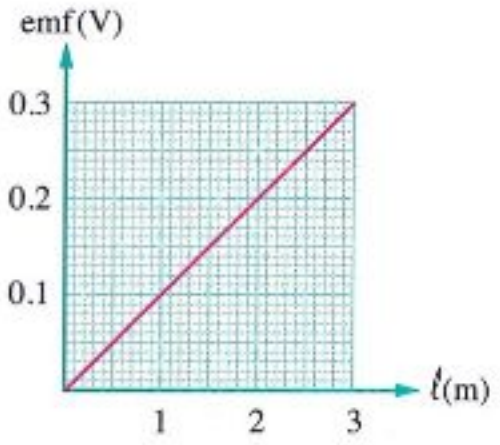
https://t.me/to_explain1

80 In the opposite figure, a straight copper wire is moving perpendicular to a uniform magnetic field with a uniform speed (v) in a circular path from point x to y to z to p to x again, so which of the following graphs represents the relation between the induced emf across the terminals of the wire during its motion and the time of motion?





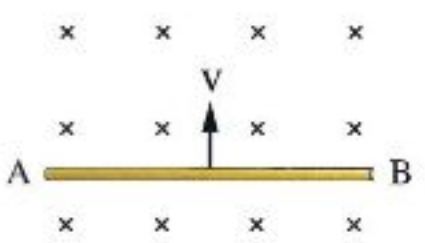
81 The opposite graph represents the relation between the induced electromotive force (emf) in a straight wire that moves with a uniform velocity v perpendicular to a magnetic flux of density 0.1 T and the length of that wire (ℓ), so the magnitude of its velocity v is ..... .



(a) 0.1 m/s (b) 0.2 m/s

(c) 1 m/s (d) 2 m/s

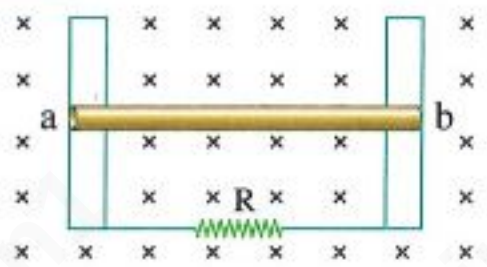
82 In the opposite figure, if the wire is moving perpendicular to the magnetic flux lines in the shown direction, then the potential of point A is ..... the potential of point B.



(a) greater than (b) less than

(c) equal to (d) can't determine the answer

83 In the opposite figure, a straight wire ab is moving in the plane of the page perpendicular to a magnetic field sliding on two metallic rails, hence an electric current is induced in the wire from terminal a to terminal b, so ..... .



	The direction of motion of the wire is	The relation between the potentials of the points a, b is
(a)	upwards of the page	$V_a < V_b$
(b)	upwards of the page	$V_a > V_b$
(c)	downwards of the page	$V_a < V_b$
(d)	downwards of the page	$V_a > V_b$

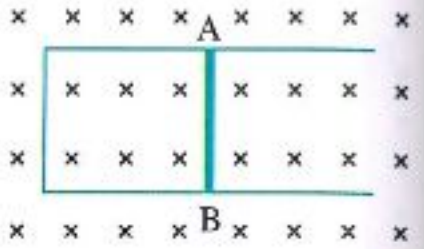
https://t.me/to_explain1

84 ✱ The opposite figure shows a metal wire (ab) of length 2 m in the plane of the page moving at a uniform velocity of 5 m/s perpendicular to a uniform magnetic field, so that the electric potential of terminal (a) becomes greater than that of terminal (b) by a value of 0.4 V, then the magnitude and the direction of the magnetic flux density acting on the wire are ..... .

(a) 0.02 T, into the page
(b) 0.02 T, out of the page
(c) 0.04 T, into the page
(d) 0.04 T, out of the page

---

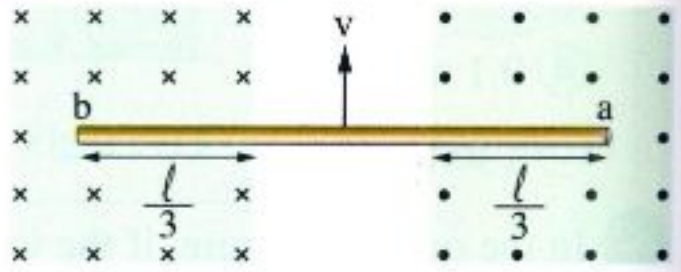
85 The opposite figure shows a metallic wire AB of length 0.15 m that is moved with uniform velocity (v) perpendicular to a magnetic flux of density 0.4 T so that an induced emf of 0.03 V is generated across its terminals leading to the flow of an electric current in the wire from terminal A to terminal B, then the velocity of the wire and its direction are ..... .



(a) 0.5 m/s, to the right of the page
(b) 0.5 m/s, to the left of the page
(c) 1 m/s, to the right of the page
(d) 1 m/s, to the left of the page

---

86 A cylindrical metal rod ab of length ℓ moves with uniform velocity (v) such that at each of its ends, part of it passes perpendicularly through a different magnetic field of flux density B as in the opposite figure, which terminal of the rod has greater electric potential?



(a) Terminal a
(b) Terminal b
(c) The two terminals have the same potential.
(d) The answer is indeterminable.

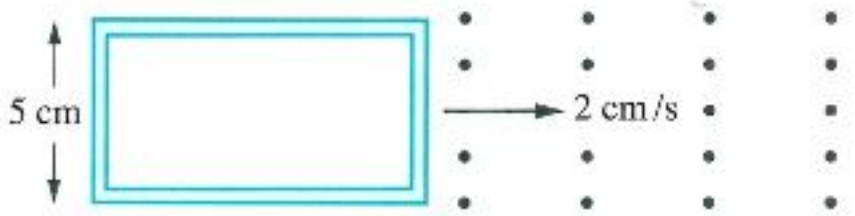
---

87 ✱ A rod of copper of length 30 cm moves with a velocity of 0.5 m/s in a magnetic field of density 0.8 tesla. Then the value of the induced emf produced across the terminals of that rod if it is moved:

	Perpendicular to the field	Parallel to the field
(a)	0.12 V	0.12 V
(b)	0.12 V	0
(c)	0	0.12 V
(d)	0	0

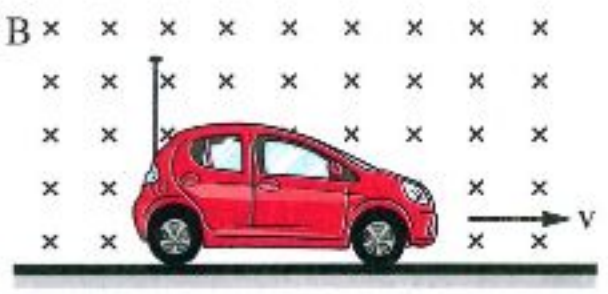
https://t.me/to_explain1

88 In the opposite figure, a rectangular metal frame of width 5 cm and electric resistance 1 Ω, enters with a uniform velocity of 2 cm/s a region of a magnetic field of density 0.5 T that its direction is perpendicular to the frame. The magnitude of the induced current in the frame during entering the field equals ..... .



(a) 0.5 mA (b) 1 mA (c) 2 mA (d) 5 mA

89 * In the opposite figure, an antenna of length one meter is fixed on a car that moves at velocity 80 km/hour in a direction perpendicular to the horizontal component of the Earth's magnetic field. An emf of 4×10^{-4} V is induced in the antenna. In such case the horizontal component of the magnetic field of the Earth is equal to ..... .

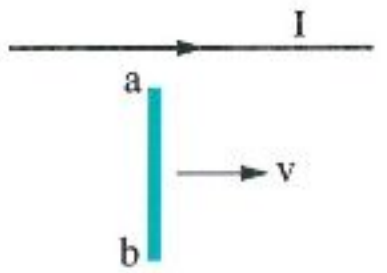


(a) 12×10^{-6} T (b) 14×10^{-6} T (c) 16×10^{-6} T (d) 18×10^{-6} T

90 When a wire of length 0.5 m is moved in a uniform magnetic field of flux density 0.4 T with a velocity of 2 m/s in a direction perpendicular to its length, an induced emf of 0.336 V is produced across its terminals, so the angle between the direction of the wire's velocity and the direction of the magnetic field is approximately ..... .

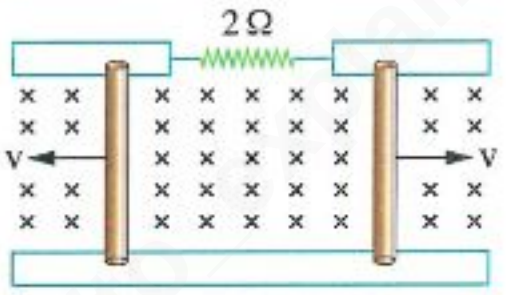
(a) 36° (b) 57° (c) 64° (d) 82°

91 The opposite figure represents a long current carrying wire and a metal rod ab that are placed in the plane of the page, so if the rod is moved at a uniform velocity v in the direction which is shown in the figure, then the relation between the electric potentials of the two points a and b is .....



(a) $V_a = V_b = 0$ (b) $V_a > V_b$ (c) $V_a < V_b$ (d) $V_a = V_b \neq 0$

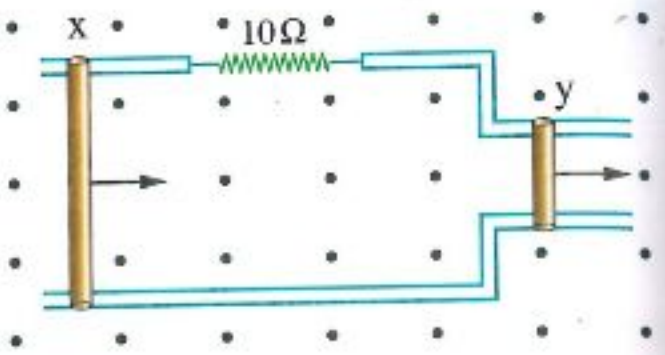
92 * The opposite figure shows two cylinderical conductors of negligible resistances where the length of each is 20 cm moving on a metallic track of negligible resistance with constant speeds of 5 m/s perpendicular to a uniform magnetic field of flux density 0.4 T, then the induced current intensity passing through the 2 Ω resistance equals ..... .



(a) zero (b) 0.8 A (c) 0.6 A (d) 0.4 A

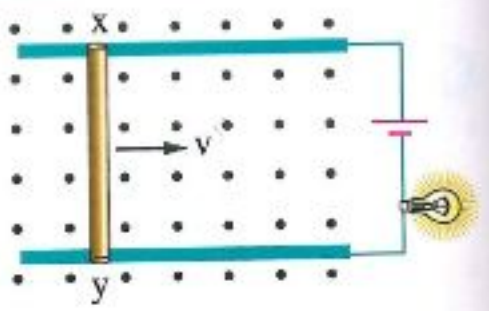
https://t.me/to_explain1

93 ✱ In the opposite figure two conductors x, y are moving in the same direction with a uniform velocity 0.5 m/s on two metal rods of negligible resistance and perpendicular to a uniform magnetic field of density 0.2 T. If the magnitude of the induced current in the resistor 10 Ω is 2.5 mA, so length of the conductor x is greater than that of y by ..... .



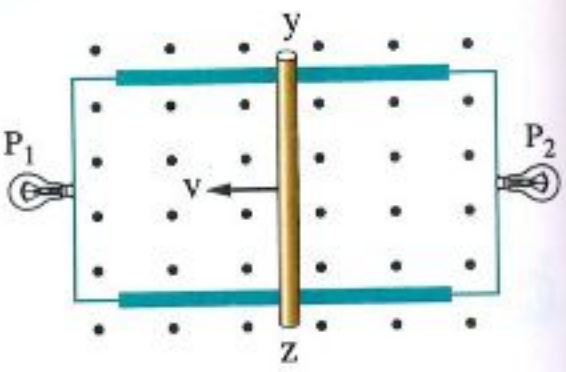
(a) 10 cm (b) 15 cm (c) 25 cm (d) 35 cm

94 In the opposite figure, what happens to the brightness of the electric lightbulb during the motion of rod xy with uniform velocity v in the shown direction?



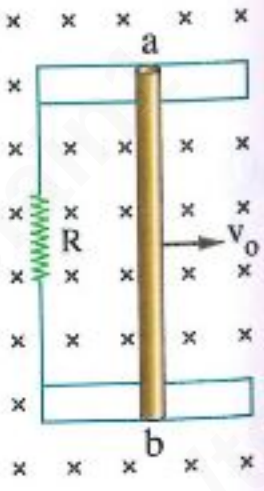
(a) Remains constant. (b) Vanishes.
(c) Decreases but does not vanish. (d) Increases.

95 The opposite figure represents a metal rod yz of resistance R placed on two frictionless rails, each of resistance 2 R, where two similar electric bulbs P_1 and P_2 are connected to the terminals of the two rails from each side. This group is placed perpendicular to a uniform magnetic field of flux density B. What happens to the brightness of each of the two bulbs during the motion of the rod with uniform velocity v in the shown direction?



	Brightness of bulb P_1	**Brightness of bulb P_2**
(a)	Decreases	Decreases
(b)	Decreases	Increases
(c)	Increases	Decreases
(d)	Increases	Increases

96 ✱ A conductor ab moves horizontally with a uniform velocity (v_o) perpendicular to a uniform magnetic field while touching two metal rods of negligible resistance and connected to each other by a resistor (R) as in the opposite figure. If the consumed power in the resistance (R) during the motion of the conductor is $(P_w)_o$, so the required force (F) to pull the conductor with a uniform velocity (v_o) equals ..... .

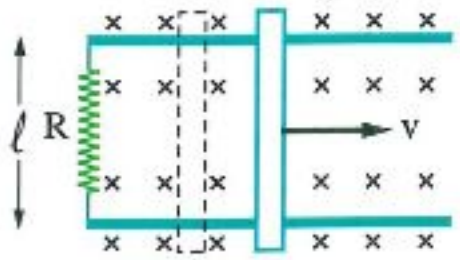


(a) $\frac{(P_w)_o}{v_o}$ (b) $(P_w)_o\, v_o$ (c) $\frac{(P_w)_o^2}{v_o}$ (d) $(P_w)_o^2\, v_o$

https://t.me/to_explain1

97 ✱ In the opposite figure:

if ℓ = 15 cm, R = 25 Ω, B = 0.6 T, v = 8 m/s, ignoring the resistances of the sliding copper rod and the two rails, then:



(i) The magnitude of the induced emf generated in the rod equals ..... .

(a) 0.72 V (b) 0.85 V (c) 1.44 V (d) 2.82 V

(ii) The electric current intensity through the resistance (R) equals ..... .

(a) 0.0288 A (b) 0.0576 A (c) 0.0864 A (d) 0.1152 A

(iii) The force that is required to keep the rod moving at the same uniform velocity (v) equals ..... .

(a) 1.43×10^{-3} N (b) 1.87×10^{-3} N (c) 2.59×10^{-3} N (d) 4.32×10^{-3} N

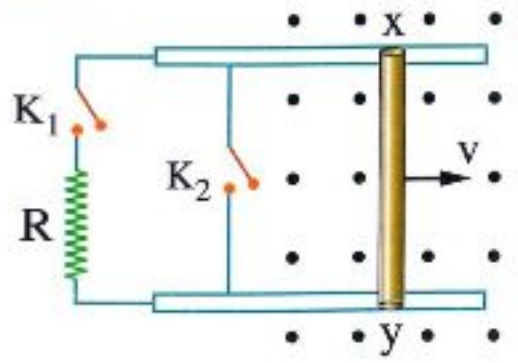
(iv) The power consumed in the resistance (R) during the rod's motion equals ..... .

(a) 0.72 W (b) 0.88 W (c) 15.6×10^{-3} W (d) 20.7×10^{-3} W

98 ✱ An electric circuit consists of a resistor of 3 Ω and two parallel thick wires at 50 cm apart. A metal rod is placed perpendicular to the wires to close the circuit. If the confined area between the wires was perpendicular to a magnetic flux of density 0.15 T, so the force which is required to move the metal rod to acquire a uniform velocity of 200 cm/s equals ..... .

(a) 1.87×10^{-3} N (b) 2.55×10^{-3} N (c) 3.75×10^{-3} N (d) 7.5×10^{-3} N

99 A cylindrical rod xy of resistance R is placed in a magnetic field and slides on two smooth rods as in the opposite figure, so the required force to move the rod with a uniform velocity v while touching the two other rods and perpendicularly to the direction of the magnetic field is less but not equal zero when ..... .



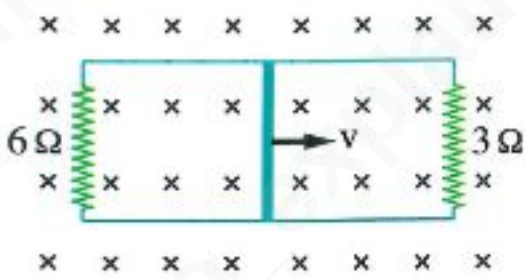
(a) the switches K_1, K_2 are opened

(b) the switches K_1, K_2 are closed

(c) the switch K_1 is opened and K_2 is closed

(d) the switch K_1 is closed and K_2 is opened

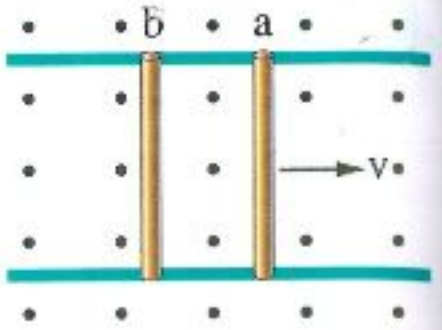
100 ✱ In the opposite figure a closed electric circuit in the form of a rectangle where a conducting rod of 1 m length is sliding on it. If the circuit is placed in a uniform magnetic field of density 2 T perpendicular to the plane of the circuit and if the resistance of the conducting rod is 2 Ω, so the required force to slide the conducting rod with a constant velocity of 2 m/s equals ..... .



(a) 2 N (b) 4 N (c) 6 N (d) 8 N

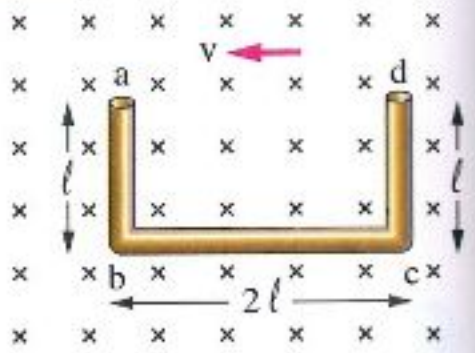
https://t.me/to_explain1

101 The opposite figure shows two similar metal cylindrical rods a, b that are movable on two frictionless metal rails in the plane of the page while being affected by a uniform magnetic field perpendicular to the plane of the page, when rod a is dragged with a uniform velocity v to the right of the page, the direction of the force acting on rod b due to the external magnetic field will be ..... .



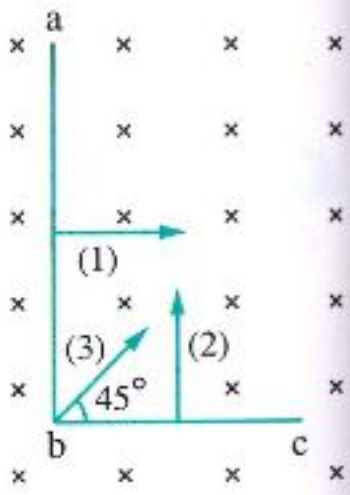
(a) in the plane of the page to the right (b) in the plane of the page to the left
(c) perpendicular into the page (d) perpendicular out of the page

102 Wire abcd is bent to be in the shape of letter U such that the length of segment ab is ℓ and the length of bc is 2ℓ, if the rod is moved with a uniform velocity v in the direction shown in the opposite figure through a uniform magnetic field of flux density B that is perpendicular to the plane of the wire, the magnitude of the induced emf across the wire between terminals a and d equals ..... .



(a) 0 (b) $B\ell v$ (c) $2B\ell v$ (d) $4B\ell v$

103 A wire abc is shaped in the form of letter L where the lengths of its parts are ℓ, 2ℓ. It is placed in a uniform magnetic field such that its plane is perpendicular to the field as in the opposite figure. When the wire moves with a uniform velocity (v) in the shown directions (1), (2), (3) each separately the potential difference between the ends of the wire becomes V_1, V_2, V_3 respectively, so which of the following relations is correct?



(a) $V_1 = V_2 = V_3$ (b) $V_3 > V_1 > V_2$ (c) $V_1 > V_3 > V_2$ (d) $V_3 > V_2 > V_1$

Second Essay questions

Faraday's law and Lenz's rule

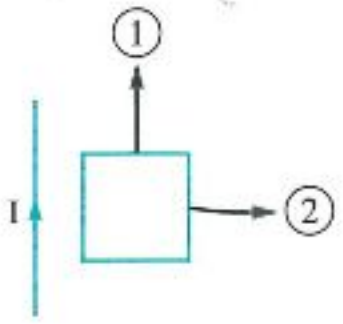
1 Figure (a) shows a copper wire carrying an electric current (I) while being in the same plane with a copper ring and figure (b) shows the copper wire when it coincides with the axis of the copper ring. **In which** case an induced current passes through the ring when the electric current passing in the wire increases? **Explain your answer.**

Figure (a)

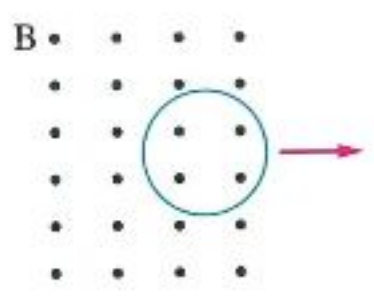
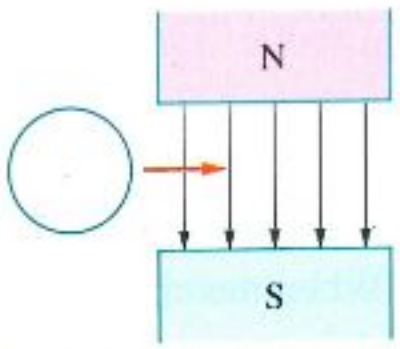
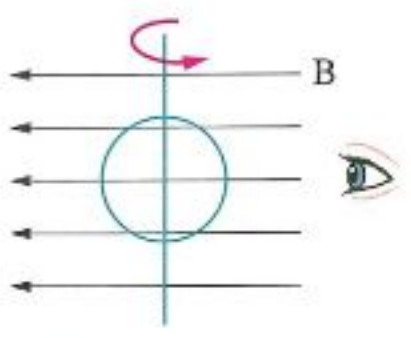
Figure (b)

https://t.me/to_explain1

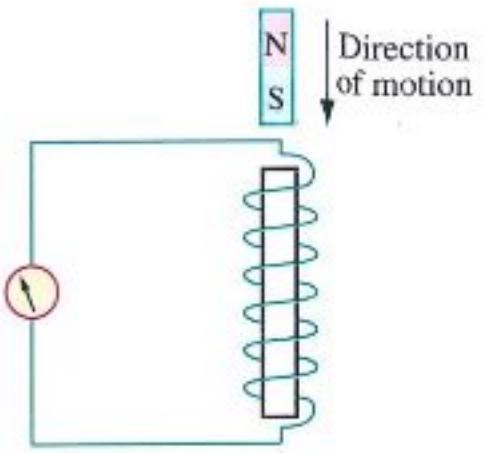
2 A square metal frame is placed in the same plane with a long straight current-carrying wire, **determine giving reasons** the direction of the induced current in the frame (if there is any) when the frame is moved once in direction (1) and another in direction (2) as shown in the opposite figure.



3 **Determine with explanation the direction of the induced current in the shown face of the ring in each of the following cases if there is any:**

		
(a) Moving the ring rightwards the page to get out of the magnetic field.	**(b)** Passing the ring between the poles of the magnet.	**(c)** Rotating the ring for a quarter cycle about an axis in its plane in the shown direction.

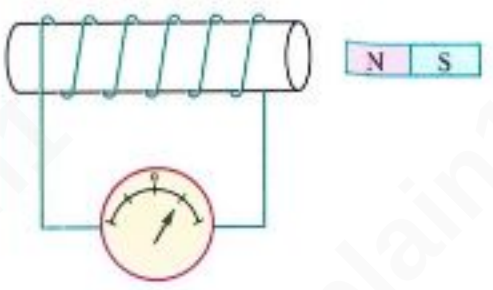
4 In the opposite figure, a magnet is being moved towards a solenoid making the galvanometer pointer to deflect instantly.



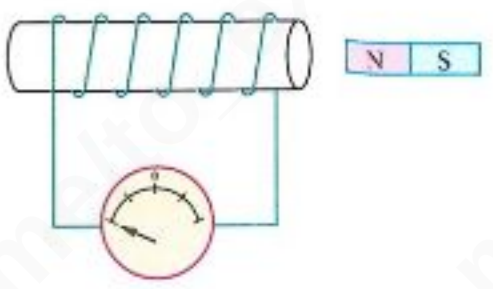
(a) **Determine** on the figure the direction of the induced electric current in the coil, its polarity **and what** is the used rule?

(b) **What** is the effect of inserting a soft iron cylinder inside the coil on the instantaneous deflection of the galvanometer pointer? **Explain.**

5 A student has moved a magnet once with a uniform velocity (v_1) for a given distance along the axis of a solenoid whose terminals are connected to a galvanometer having its zero at the middle of its scale and another time he has moved the magnet with a uniform velocity (v_2) for the same distance along the axis of the solenoid where the student observation of the maximum deflection of the galvanometer pointer in both cases was as in the opposite figure. **Compare with explanation between** the magnitudes and the directions of the magnet velocity in both cases.



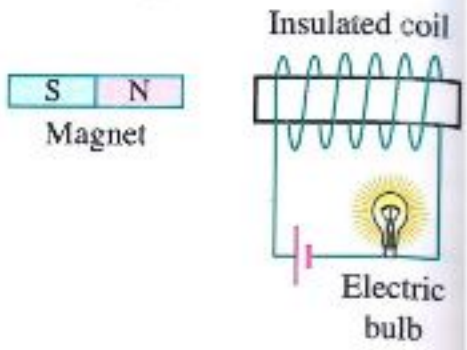
Case (1)



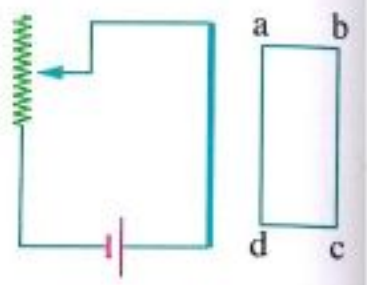
Case (2)

https://t.me/to_explain1

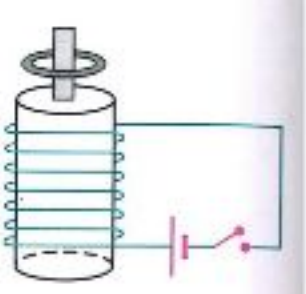
6 In the opposite figure, if the induced emf in the case of its generation is less than the emf of the battery then:
What happens to the intensity of the bulb luminosity while:
(a) moving the magnet towards the coil?
(b) the magnet is settled inside the coil?
(c) moving the magnet away from the coil?



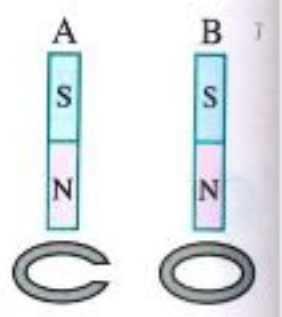
7 In the opposite figure, when the value of the resistance taken from the rheostat increases gradually, **what** will be the direction of the induced current in the coil abcd?
Explain your answer.



8 A metallic ring of aluminum was placed around the shaft of a strong electromagnet's core. When the circuit of the electromagnet was closed, the ring jumped up, **explain.**



9 In the opposite figure:
Two similar magnets A, B are falling freely from the same height through two copper rings, one is opened and the other is closed, **which** of the two magnets reaches the ground first?
Explain your answer.



10 A circular coil of radius 10 cm that has number of turns N, where the resistance of each turn is 1 Ω, is positioned perpendicular to a magnetic flux of density 0.1 T, so if this flux has vanished through 0.01 s, **calculate** the average induced current intensity through the coil.

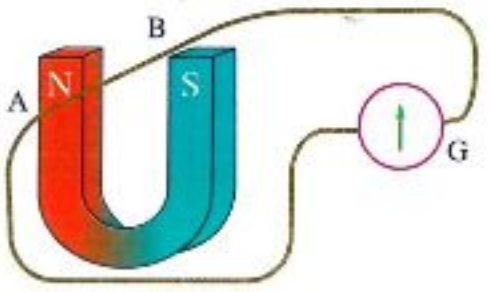
11 A ring of radius 22 cm is placed perpendicular to a uniform magnetic field of flux density 0.05 T, then if the ring is rotated 80° through a time interval of 0.25 s about an axis in its plane, **calculate** the average induced emf in the ring.

12 A metal ring of resistance R is penetrated by a magnetic flux ϕ_m, if the flux gets vanished through a time interval t, **prove that** the quantity of electric charge that flows through a cross-section of the ring wire is calculated by the relation; $Q = \frac{\phi_m}{R}$

13 A copper sheet is vibrating as a pendulum.
Explain why its vibration gets damped when it vibrates between the poles of a strong magnet as in the opposite figure.

https://t.me/to_explain1

The emf induced in a straight wire



14 In the opposite figure:
The wire AB moves with a uniform speed downwards between the poles of the magnet:

(a) **What does happen to** the pointer of the sensitive galvanometer?

(b) **What is the change that happen to** the pointer of the galvanometer when the wire AB moves with a uniform speed upwards?

(c) **How** can the wire AB move through the magnetic field without affecting the pointer of the galvanometer?

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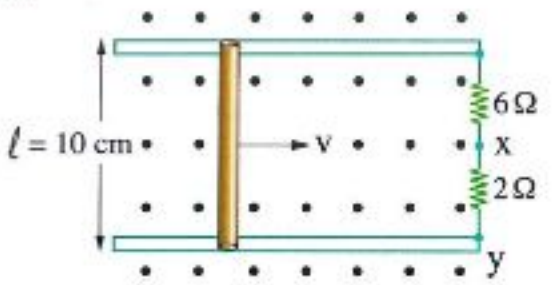
15 The opposite figure illustrates a cylindrical rod of length 10 cm that has a negligible resistance. The rod is moving with a uniform velocity of 4 m/s on two parallel metal rails of negligible resistance perpendicular to a uniform magnetic field of flux density 1 T. **Calculate** the potential difference between the two points x, y during the motion of the rod.



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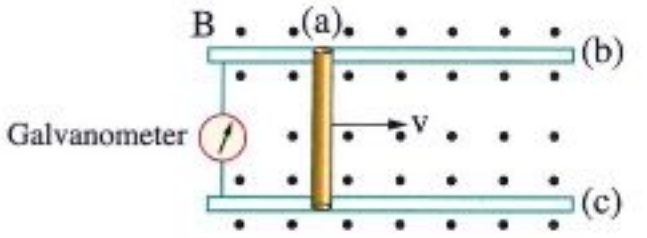
16 A metal rod (a) is moving perpendicular to a uniform magnetic field B with a uniform velocity (v) on two metal rails (b), (c) where the resistance of each of them is (R). **Explain what happens to** the reading of the galvanometer during the motion of rod (a) in the direction shown in the opposite figure.



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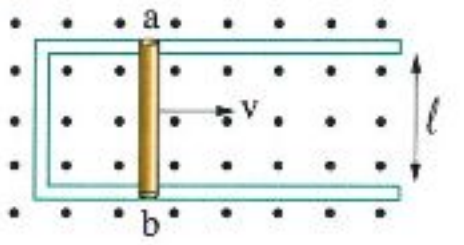
17 The opposite figure shows a rod (ab) of length ℓ and resistance R being dragged with a uniform velocity v perpendicular to a uniform magnetic field of flux density B, **prove that** the magnitude of the required force to drag the rod ab and keep it moving with the same uniform velocity v is given by relation; $F = \frac{B^2 \ell^2 v}{R}$



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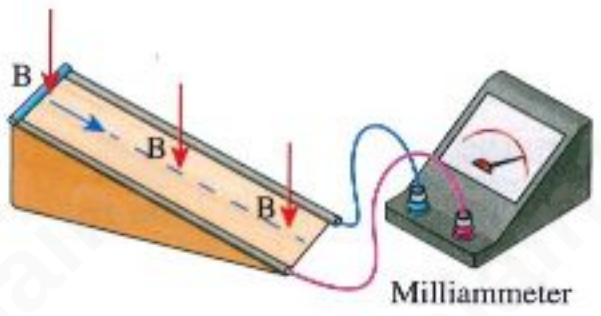
18 A metal cylindrical rod of resistance R slides freely down an inclined plane through a vertical magnetic field (B) touching two smooth metal rails of negligible resistance that are connected to a milliammeter as shown in the opposite figure, **explain why** the milliammeter reading doesn't remain constant while the rod is sliding.



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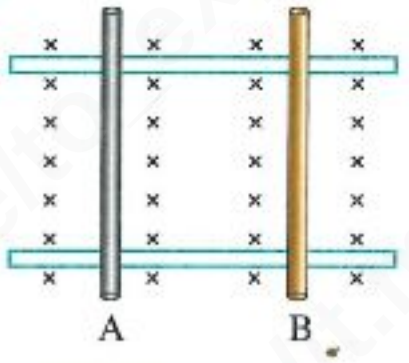
19 In the opposite figure:
The two metal rods (A) and (B) can slide on two parallel rails perpendicular to a uniform magnetic field. If the magnetic field started to decrease gradually, **then describe with explanation** how the two rods will move.



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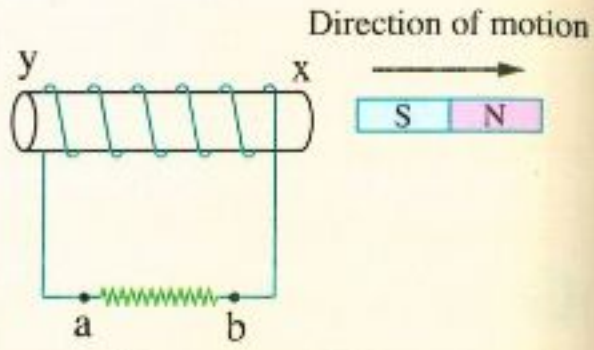
Questions of the Previous Years Exams ? on Lesson 1

Faraday's law and Lenz's rule

1 In the opposite figure, as the magnet moves in the shown direction, which of the following choices becomes correct? *(Exp. May 21)*



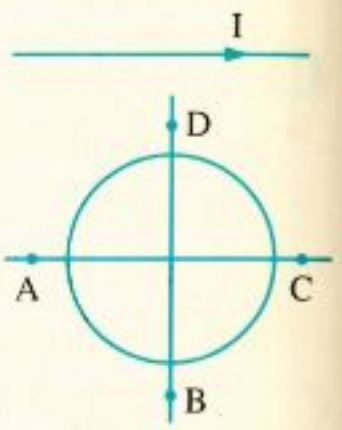
(a) End (y) of the coil acts as a north pole and point (a) has a negative potential.

(b) End (x) of the coil acts as a north pole and point (b) has a positive potential.

(c) End (x) of the coil acts as a south pole and point (a) has a positive potential.

(d) End (y) of the coil acts as a south pole and point (b) has a negative potential.

2 A metallic ring is placed in the same plane with a straight wire that carries an electric current I as shown in the figure. If the ring is moved and consequently a current is induced through it in the clockwise direction, the direction in which the ring has been moved is towards point ..... . *(Exp. May 21)*

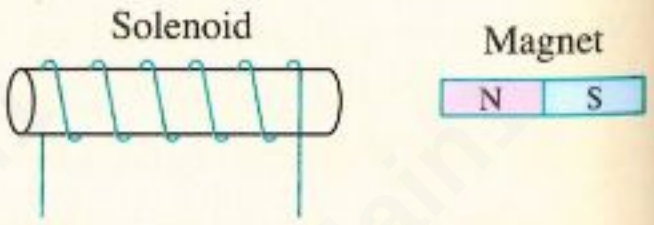


(a) A (b) B (c) C (d) D

3 A magnetic flux whose density is changing by a constant rate is acting normally to a circular coil so that an induced electromotive force (E) is produced in the coil. If the number of turns of the coil gets increased to its double and its area gets decreased to its half while the rate of change of the magnetic flux density remains the same, the induced electromotive force in the coil will be ..... . *(Exp. June 21)*

(a) E (b) 4 E (c) $\frac{1}{2}$ E (d) $\frac{1}{4}$ E

4 A student conducts the following steps by using the tools shown in the figure. *(Exp. June 21)*



Step (I): moving the magnet towards the stationary solenoid while the solenoid is kept settled.

Step (II): moving both the solenoid and the magnet with the same velocity and in the same direction.

Step (III): moving both the solenoid and the magnet with the same speed but in two opposite directions.

Which of the above steps does not produce an induced electromotive force in the coil?

(a) Step (I) only. (b) Step (II) only. (c) Step (III) only. (d) All steps.

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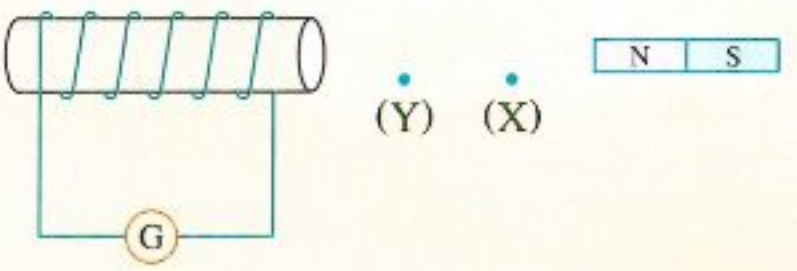
5 The figure illustrates an experiment so that when the magnet is moved towards the coil with velocity v from point (X) to point (Y), the pointer of galvanometer gets deflected with 2 divisions from zero to the right of its scale.



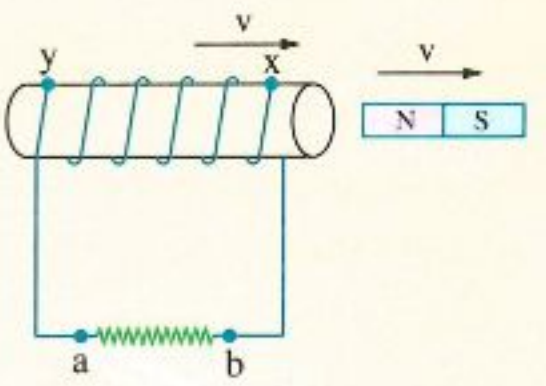
If the experiment is repeated such that the south pole of the magnet is facing the coil and is moving towards the coil with velocity 2 v from point (X) to point (Y), so the pointer of galvanometer deflects with ..... .

(Exp. June 21)

(a) 4 divisions to the left
(b) 4 divisions to the right
(c) 2 divisions to the left
(d) 2 divisions to the right

6 A magnet is moving as shown in the figure, if the coil is moved with the same velocity and in the same direction as the magnet, so ..... .

(1st session 21)



(a) the potential of point (a) is greater than the potential of point (b)
(b) the potential of point (x) is less than the potential of point (y)
(c) the potential of point (x) is greater than the potential of point (y)
(d) the potential of point (a) equals the potential of point (b)

7 Two circular coils (1), (2) of cross-sectional areas A_1, A_2 respectively, having the same number of turns are placed in a magnetic field perpendicular to their plane. When the magnetic flux density is changed through them in the same rate, it is noticed that the average induced emf in coil (1) equals double its value in coil (2), so ..... .

(1st session 21)

(a) $A_1 = 2\,A_2$ (b) $A_1 = 4\,A_2$ (c) $A_1 = \frac{1}{2}\,A_2$ (d) $A_1 = \frac{1}{4}\,A_2$

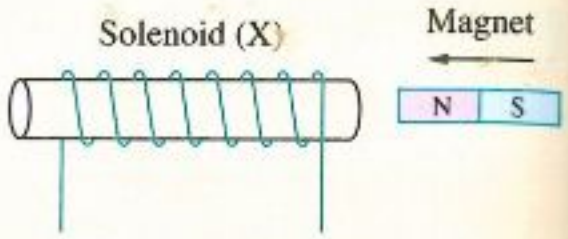
8 Two coils (x), (y) where cross-section of (x) is double that of (y), are placed in a magnetic field of flux density B where plane of each coil is perpendicular to the direction of the flux lines. When reversing the direction of the magnetic field acting on the coils through a time interval of 2 ms, the ratio between $\frac{\text{The average induced emf in coil x}}{\text{The average induced emf in coil y}} = \frac{3}{1}$, so the ratio between $\frac{\text{Number of turns of coil x}}{\text{Number of turns of coil y}}$ = ...

(1st session 21)

(a) $\frac{3}{4}$ (b) $\frac{2}{3}$ (c) $\frac{3}{2}$ (d) $\frac{4}{3}$

https://t.me/to_explain1

9 A student conducted Faraday's experiment to generate an induced electromotive force in a coil. He conducted the following steps to increase the average induced electromotive force in the coil (x):



(I) replacing the coil (x) by another greater in cross-sectional area.

(II) replacing the coil (x) by another higher in number of turns.

(III) increasing the time of magnet motion.

Which of the above steps lead to achieve the purpose of the student? *(2nd session 21)*

(a) (I) and (III). (b) (I) and (II). (c) (II) and (III). (d) (I), (II) and (III).

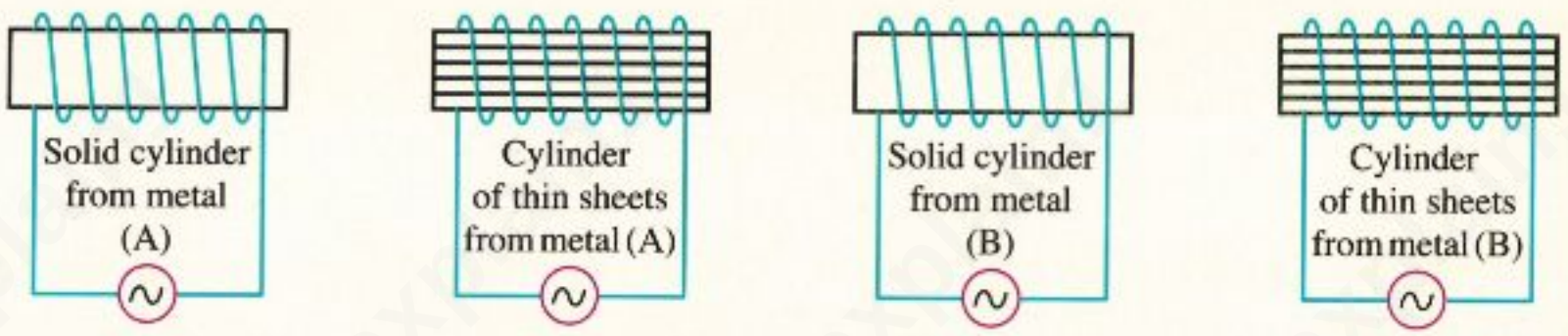
10 When the magnetic flux interacting with a circular coil changes, an induced electromotive force (E) is produced in the coil. If the number of turns of the coil is increased four times with the same area and the rate of change of the magnetic flux interacting with the coil is decreased to its half, then the induced electromotive force will equal ..... . *(2nd session 21)*

(a) 2 E (b) 4 E (c) $\frac{1}{2}$ E (d) $\frac{1}{4}$ E

11 Two coils (X) and (Y), the area of coil (X) is double that coil (Y) while the number of turns of (X) is $\frac{1}{3}$ that of coil (Y). When the two coils are placed inside a magnetic field where the coils' planes are perpendicular to the flux lines direction and the flux density that affects the two coils changes by the same rate, then the ratio of $\frac{\text{The average induced e.m.f in coil (X)}}{\text{The average induced e.m.f in coil (Y)}}$ = ... *(1st session 22)*

(a) $\frac{1}{6}$ (b) $\frac{3}{4}$ (c) $\frac{2}{3}$ (d) $\frac{2}{5}$

12 The figure shows 4 similar AC circuits, if you know that the resistivity of metal (A) is greater than the resistivity of metal (B). *(1st session 22)*



Circuit (1) Circuit (2) Circuit (3) Circuit (4)

In which electric circuit, the metal cylinder has the greatest generated eddy current?

(a) Circuit (3) (b) Circuit (1) (c) Circuit (2) (d) Circuit (4)

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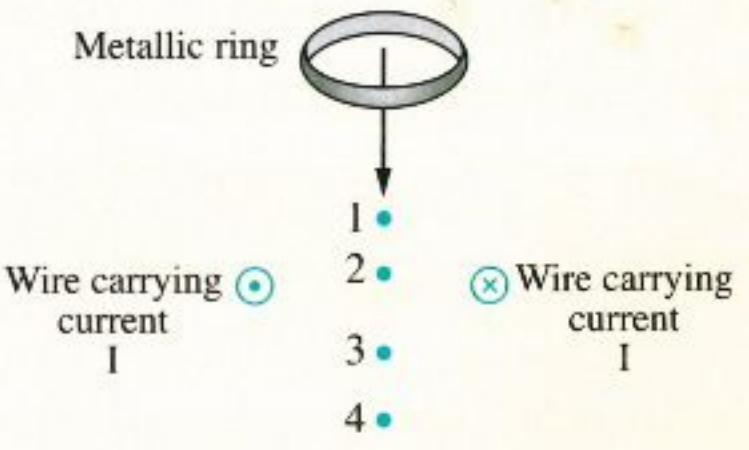
13 The figure shows two straight current-carrying wires placed perpendicular to the page.



If a metallic ring moves in the plane of the page downwards to cut the resulted magnetic field due to the currents in the two wires such that the plane of the ring remains perpendicular to the page. At which points (1, 2, 3, 4) an induced electric current is generated in the ring and produces a magnetic field opposite to the original magnetic field at the mid-point between the two wires? *(1st session 22)*

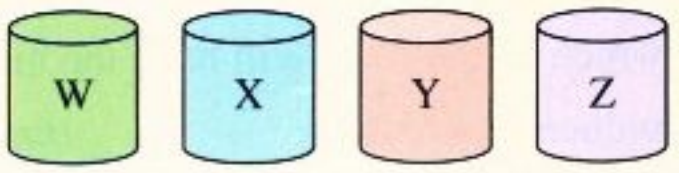
(a) 1, 3 (b) 2, 3 (c) 1, 2 (d) 1, 4

14 Two circular coils (1) and (2) have number of turns (N_1) and (N_2) respectively. If they have the same area and are placed in a magnetic flux perpendicular to their plane. When the magnetic flux density linked with the two coils changes with the same rate, it is noticed that the average induced electromotive force in coil (2) equals quarter that induced in coil (1). So, ... *(2nd session 22)*

(a) $N_1 = \frac{1}{4} N_2$ (b) $N_1 = 8 N_2$

(c) $N_1 = 4 N_2$ (d) $N_1 = \frac{1}{8} N_2$

15 The figure shows four metallic cylinders of the same dimensions but of different metals.



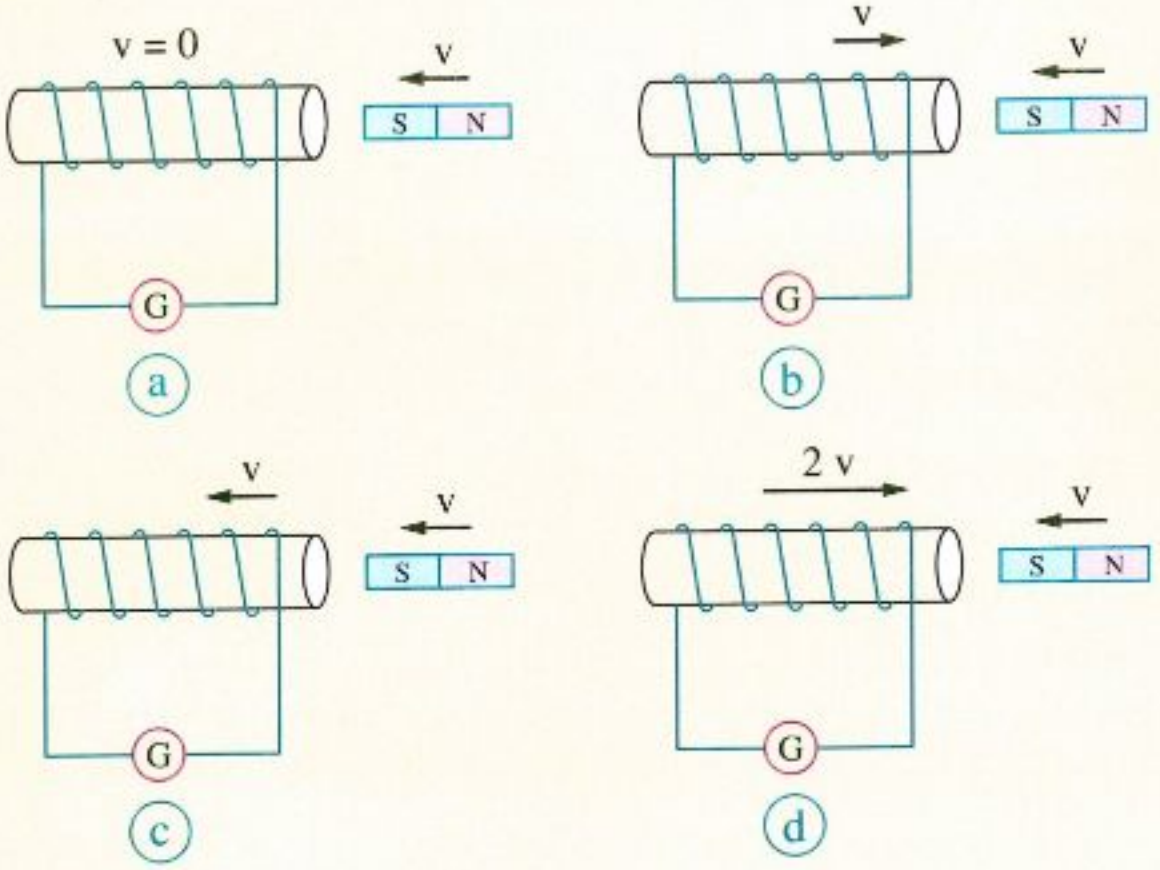
The table illustrates the values of the electrical conductivity for these metals. When the cylinders are exposed to the same variable magnetic flux resulting from an alternating current source, and by neglecting the differences in the magnetic permeability of these metals, then in which cylinder the amount of heat energy generated due to the eddy currents will be the least? *(2nd session 22)*

Metal	Electrical conductivity
W	$5.96 \times 10^7\ \Omega^{-1}.m^{-1}$
X	$3.5 \times 10^7\ \Omega^{-1}.m^{-1}$
Y	$2.98 \times 10^7\ \Omega^{-1}.m^{-1}$
Z	$0.217 \times 10^7\ \Omega^{-1}.m^{-1}$

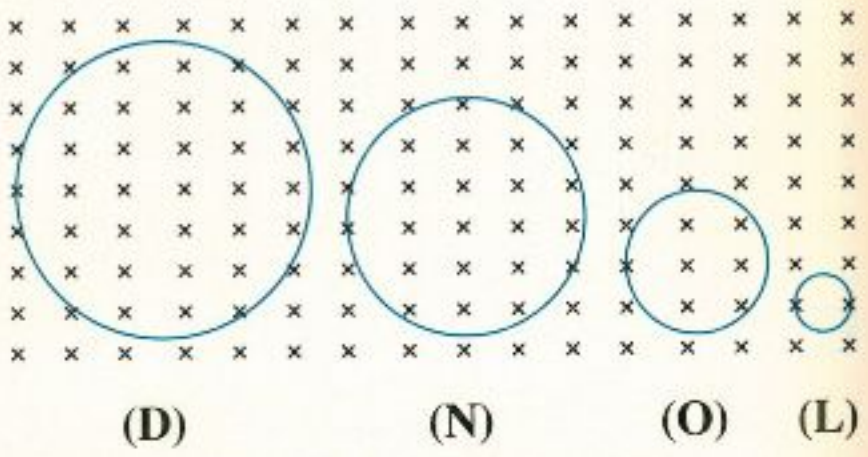
(a) W (b) X (c) Y (d) Z

https://t.me/to_explain1

16 A magnet, a solenoid and a galvanometer are used to verify Faraday's law for electromagnetic induction. If the experiment is repeated four times such as the magnet and the solenoid were moved with the speeds shown in the four figures. So, the pointer of the galvanometer has the greatest deflection in the experiment ..... . *(2nd session 22)*

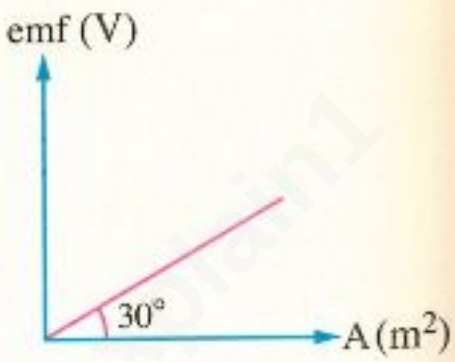


17 Four rings of different radii are made of a copper wire of uniform cross-section. All rings lie in the plane of the page and are exposed to a uniform magnetic field as in the figure. If the magnetic field vanished, which of the rings will have the highest induced current? *(Exp. 23)*



(a) D (b) L (c) O (d) N

18 A group of coils of different areas, the number of turns of each coil is 100 turns, are placed in the same plane and get exposed to a variable magnetic flux for the same time. The opposite graph represents the relation between the average induced electromotive force (emf) in each coil and the area (A) of the coil, so the rate of change in the magnetic flux density is ..... . *(Exp. 23)*

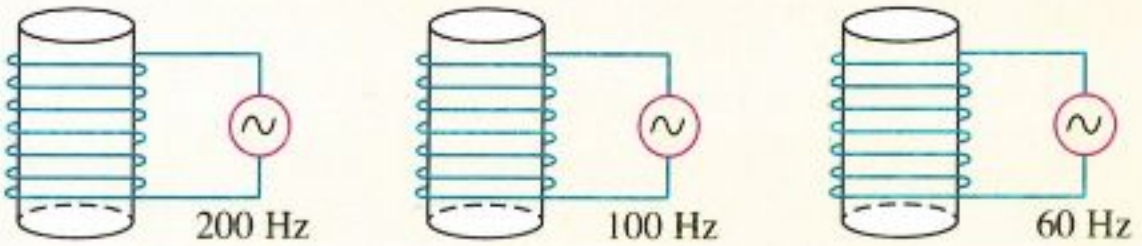


(a) 5.77×10^{-4} T/s (b) 5.77×10^{-2} T/s

(c) 0.577 T/s (d) 5.77×10^{-3} T/s

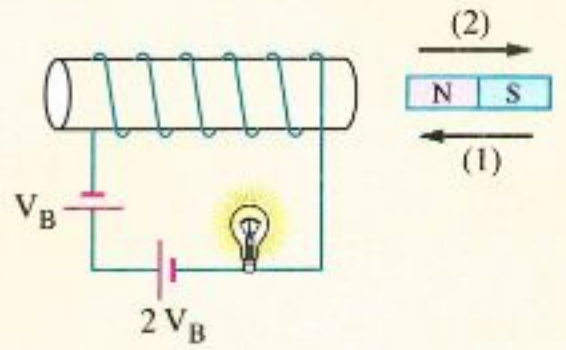
https://t.me/to_explain1

19 The figure shows three identical metallic blocks inside three identical coils, if an alternating current with the same voltage (but with different frequencies) passes through the three coils for the same time, then the temperature of the three blocks increased, which of the following choices is correct concerning the temperature (T) of the three blocks? *(Exp. 23)*



(a) $T_1 > T_2 > T_3$ (b) $T_2 > T_1 > T_3$ (c) $T_2 > T_3 > T_1$ (d) $T_3 > T_1 > T_2$

20 At the moment of moving the magnet in either of the two directions (1) and (2) with the same speed, e.m.f of 0.5 V_B is induced in the coil. Which of the following choices is correct at the moment of moving the magnet? *(1st session 23)*



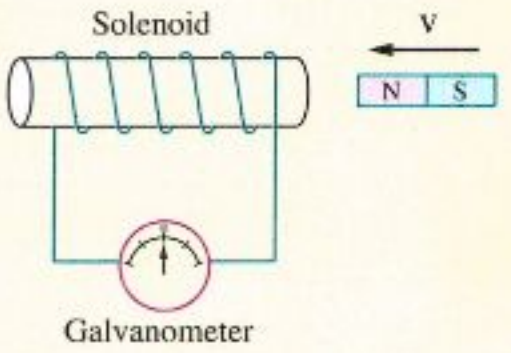
(a) The brightness of the lamp vanishes momentarily on moving the magnet in the direction (2).

(b) The brightness of the lamp increases on moving the magnet in the direction (2).

(c) The brightness of the lamp remains constant on moving the magnet in both directions (1) or (2).

(d) The brightness of the lamp increases on moving the magnet in the direction (1).

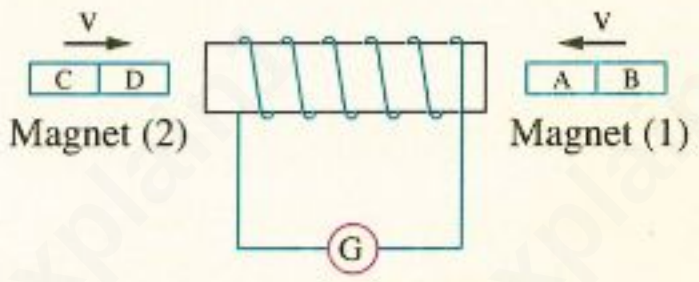
21 The figure illustrates a magnet moving with velocity (v) to the left towards a solenoid connected to a galvanometer. Despite this no current is induced in the coil, because the solenoid moves ..... . *(1st session 23)*



(a) with velocity (v) to the left (b) with velocity (2 v) to the left

(c) with velocity (v) to the right (d) with velocity (2 v) to the right

22 Two identical magnets (1), (2) were placed at the same distance from a solenoid as shown in the figure. On moving each of the magnets with the same speed simultaneously towards the two terminals of the solenoid and along its axis, it is noticed that the pointer of the galvanometer doesn't deflect. This is due to ..... . *(2nd session 23)*



(a) pole (A) is north and pole (D) is north (b) pole (A) is north while pole (D) is south

(c) pole (A) is south while pole (D) is north (d) pole (B) is south and pole (D) is south

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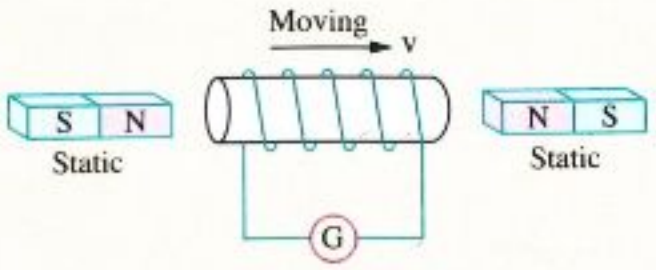
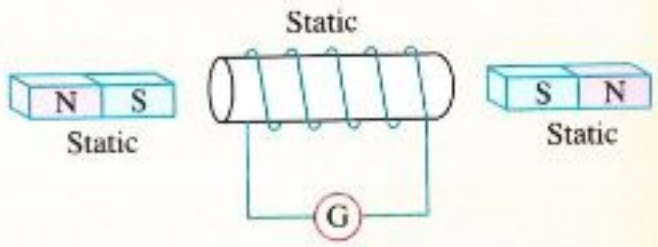
23 Each figure of the following shows a solenoid which is connected to a galvanometer where two magnets are placed such that each is close to one of its two ends. If the solenoids are similar and the magnets are similar and at the same distances from the solenoid.

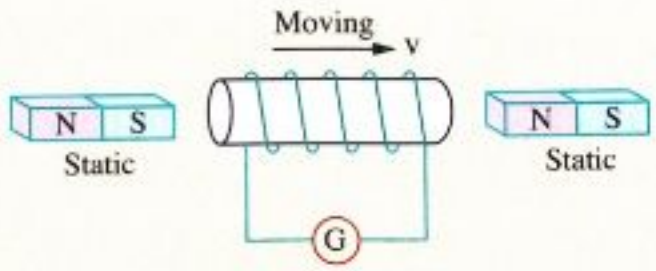
(1)



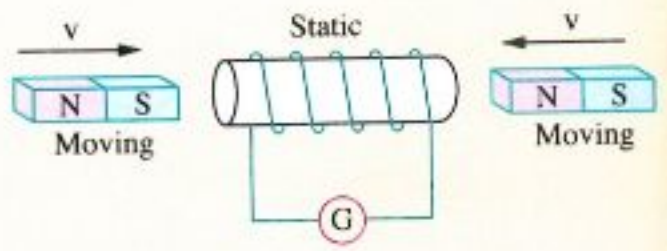
(2)



(3)



(4)



What is the correct order for the magnitude of the induced emf in each solenoid according to its state of motion which is shown in each figure? *(1st session 24)*

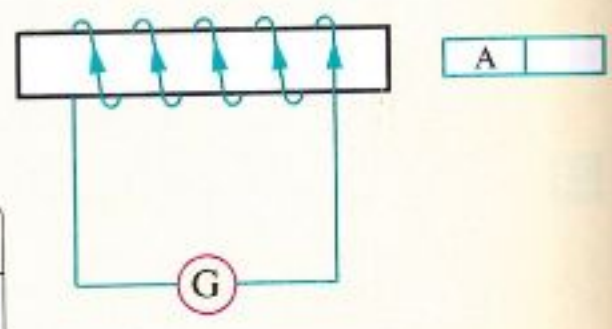
(a) $(emf)_2 = (emf)_4 > (emf)_1 = (emf)_3$

(b) $(emf)_1 = (emf)_4 > (emf)_2 = (emf)_3$

(c) $(emf)_4 = (emf)_2 > (emf)_1 > (emf)_3$

(d) $(emf)_1 = (emf)_3 > (emf)_2 = (emf)_4$

24 The following table shows multiple probabilities for getting induced electric current in the solenoid by moving the shown magnet in the figure:

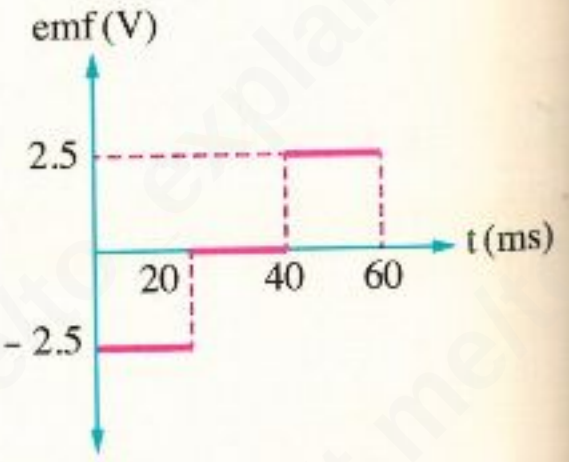


Probability	Pole A	The magnet movement
1	South	Approaches the solenoid
2	South	Gets away from the solenoid
3	North	Approaches the solenoid
3	North	Gets away from the solenoid

Which two probabilities lead to generating electric current in the shown direction in the figure? *(1st session 24)*

(a) 1, 2 (b) 1, 4 (c) 3, 4 (d) 2, 3

25 The opposite graph represents the relation between the induced emf in a square metal frame that enters a region of magnetic field of flux density 0.2 T with a uniform velocity till it gets out of it and the time (t), so the area of the metal frame equals ..... . *(1st session 24)*



(a) 0.5 cm^2 (b) 0.5 m^2

(c) 0.25 cm^2 (d) 0.25 m^2

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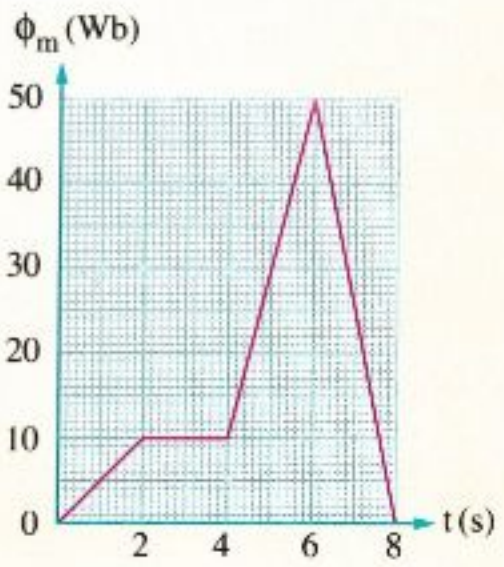
26 A circular coil with 60 turns and a face area of 36 cm^2 is penetrated by a perpendicular magnetic flux of density 10^{-6} T. The average induced electromotive force in the coil during its rotation for half a cycle from the vertical position in a time of 400 ms equals ..... .

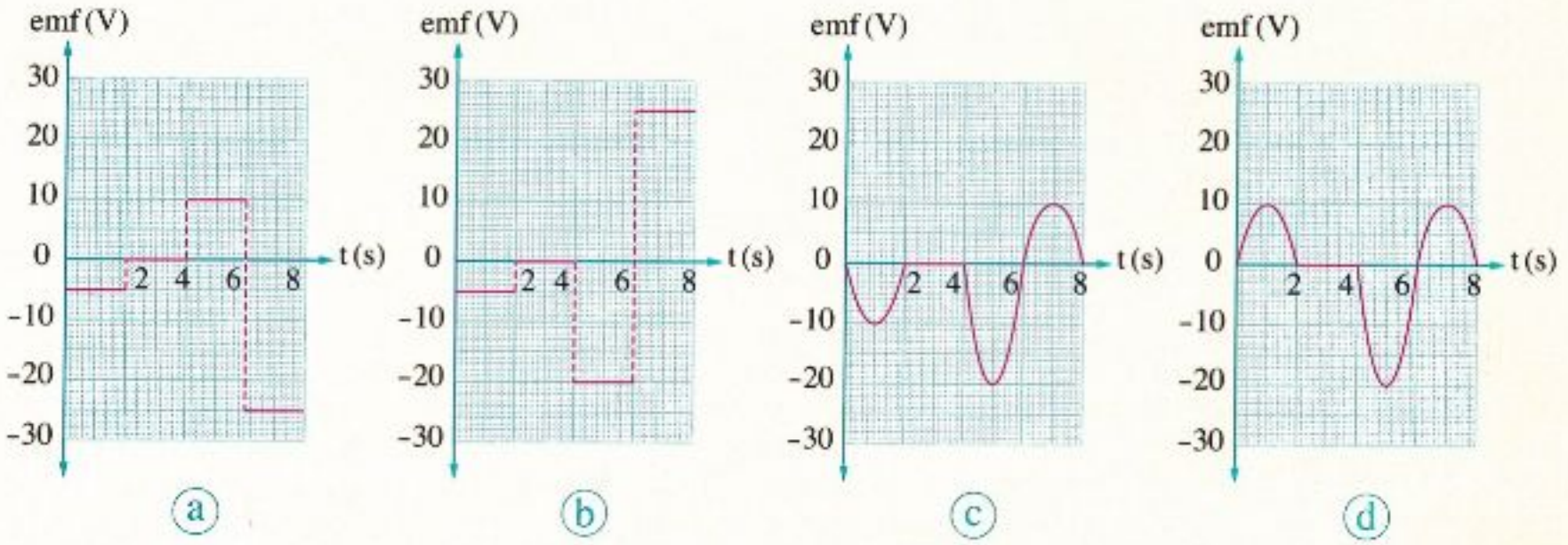
(1st session 24)

(a) 1.08 nV (b) 0.54 μV (c) 1.08 μV (d) 0.54 nV

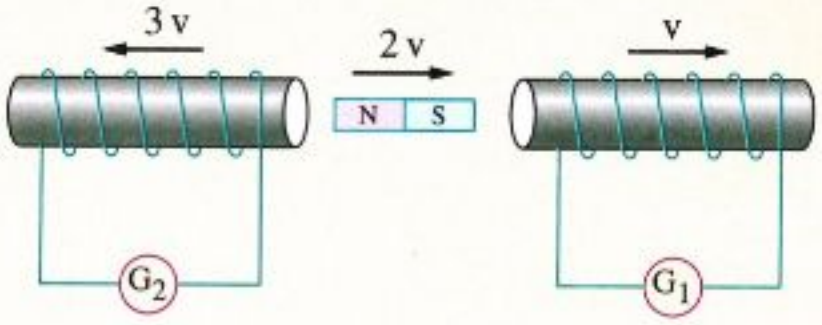
27 The opposite graph shows the change in the magnetic flux that penetrates a circular coil consisting of a single turn. Which of the following graphs represents the relationship between the induced electromotive force (emf) in the coil and time (t) during the same time interval?

(2nd session 24)





28 Two identical galvanometers connected to two identical coils where a magnet is placed at the mid-distance between the coils. If the magnet and the coils move at the speeds shown in the opposite figure, then ..... .



	The relation between the readings of the galvanometers	The currents
(a)	$G_2 > G_1$	in the same direction
(b)	$G_2 > G_1$	in opposite directions
(c)	$G_1 > G_2$	in opposite directions
(d)	$G_1 > G_2$	in the same direction

(2nd session 24)

https://t.me/to_explain1

29 A magnetic flux penetrates a coil with 10 turns. If the magnetic flux decreases by 0.3 mWb within 0.02 s, then the induced electromotive force in the coil equals ..... .

(a) 0.15 V (b) 15 V (c) 150 V (d) 1.5 V *(2nd session 24)*

30 A circular coil with 200 turns and a face area of 5 cm^2 rotates inside a magnetic field of density 6×10^{-4} T around a fixed axis perpendicular to the flux direction. This motion generates an average induced electromotive force of 0.3 mV over a time interval of 400 ms. Which of the following options will produce the given electromotive force? *(2nd session 24)*

(a) The coil rotates $\frac{1}{2}$ cycle from the perpendicular position to the magnetic flux.

(b) The coil rotates $\frac{1}{4}$ cycle from the perpendicular position to the magnetic flux.

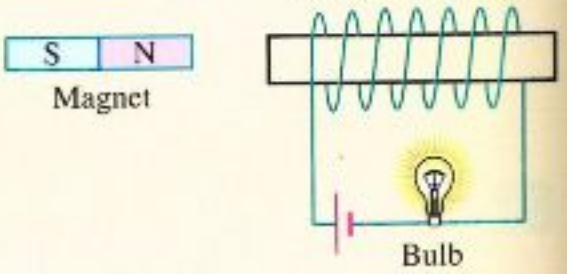
(c) The coil rotates $\frac{1}{2}$ cycle from the parallel position to the magnetic flux.

(d) The coil rotates $\frac{3}{4}$ cycle from the parallel position to the magnetic flux.

31 Two circular coils are placed perpendicular to a magnetic field that its density is changing uniformly where area of the first coil is double that of the other, and number of turns of the first coil is twice that of the other, so the ratio between the generated emf in the first coil and that generated in the second equals ..... . *(Exp. 25)*

(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{1}{4}$ (d) $\frac{4}{1}$

32 In the opposite figure, if the induced emf in case of being generated is less than that of the battery, what happens to the luminosity of the electric bulb during approaching the magnet towards the coil? *(Exp. 25)*



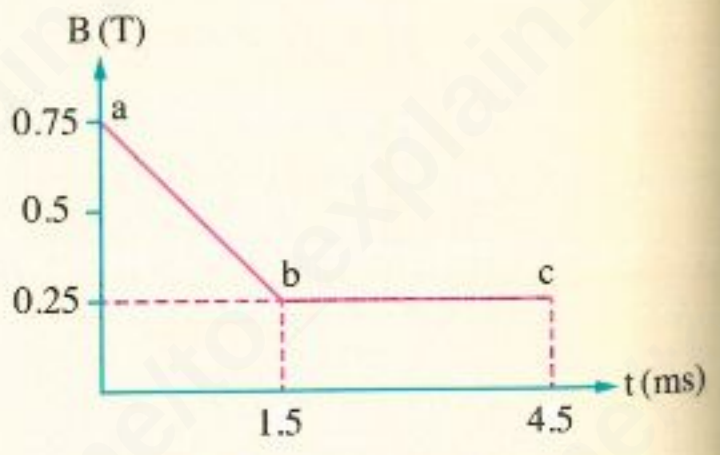
(a) The luminosity of the bulb increases.

(b) The luminosity of the bulb decreases.

(c) The luminosity of the bulb does not change.

(d) The luminosity of the bulb vanishes.

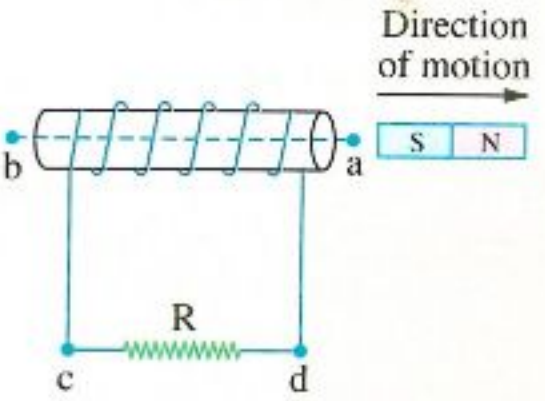
33 The opposite graph represents the relation between the magnetic flux density (B) inside which a coil of 200 turns that each of area 30 cm^2 is placed and the time (t). if the direction of the magnetic flux is parallel to the coil axis, so the average induced emf in the coil during the interval (bc) equals ..... . *(Exp. 25)*



(a) 0 (b) 25 V (c) 35 V (d) 50 V

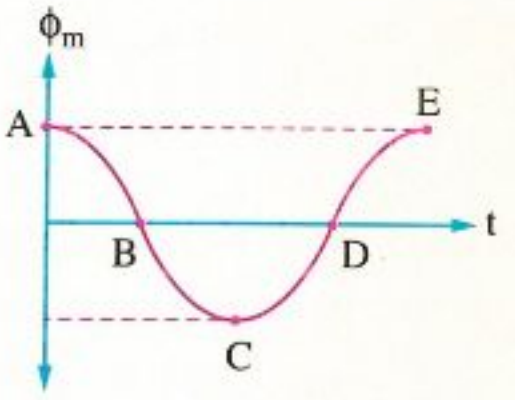
https://t.me/to_explain1

34 In the opposite figure, when moving the magnet away from the solenoid, *(Exp. 25)*



	Direction of the induced magnetic flux in the solenoid is:	Direction of the current passing in the resistor (R) is:
(a)	b ⟶ a	c ⟶ d
(b)	a ⟶ b	d ⟶ c
(c)	b ⟶ a	d ⟶ c
(d)	a ⟶ b	c ⟶ d

35 The opposite figure represents the change in the magnetic flux which cuts the coil through a certain time interval, so the induced emf in the coil becomes maximum at the points ..... . *(Exp. 25)*

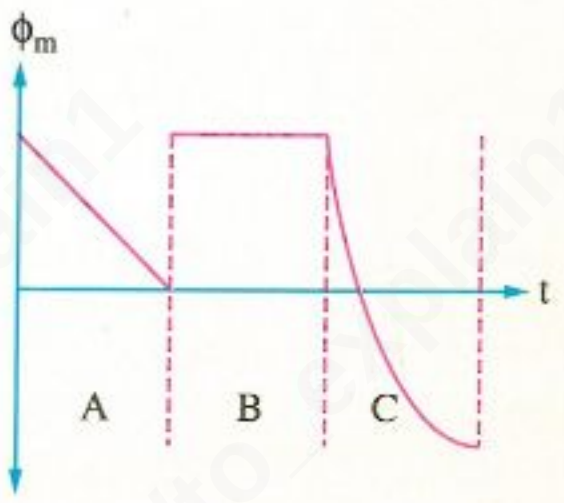


(a) A, E
(b) C, D
(c) D, B
(d) A, E, C

36 Which of the following actions does not lead to generating an induced emf in a coil placed perpendicular to a magnetic flux? *(Exp. 25)*

(a) Changing the coil area which is exposed to the magnetic flux.
(b) Keeping the coil static inside a variable magnetic flux.
(c) Keeping the coil static inside a uniform magnetic flux.
(d) Changing the angle between the coil and the magnetic flux.

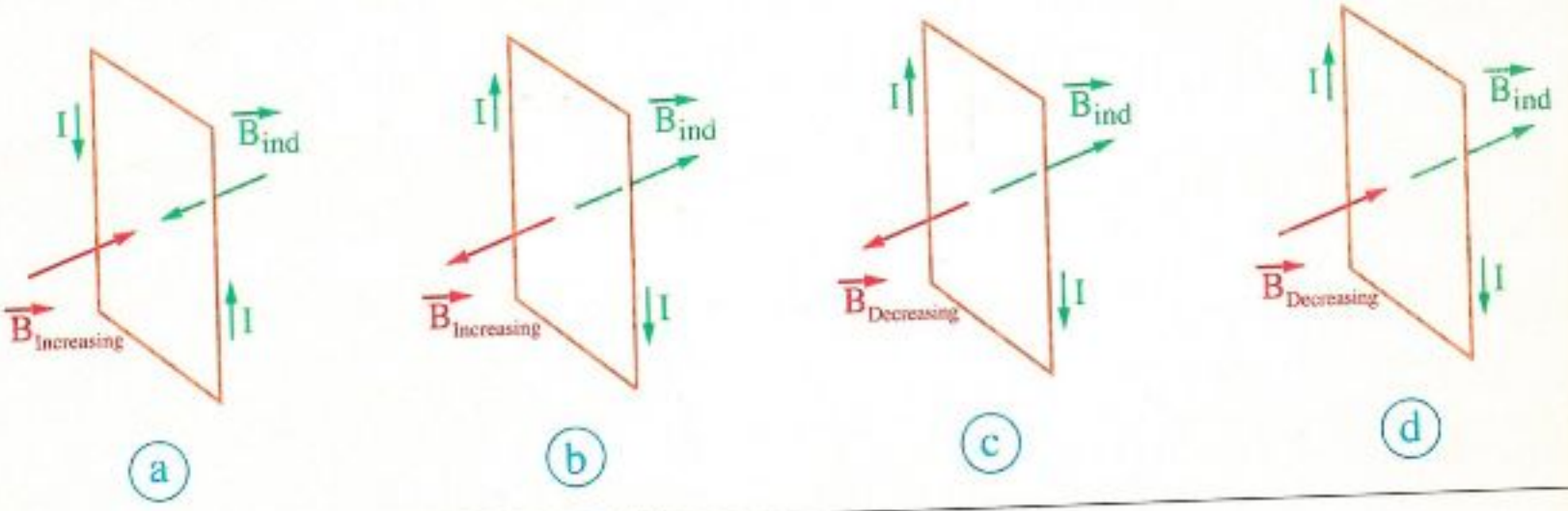
37 A variable magnetic flux is penetrating a metal ring where the opposite graph represents the relation between the magnitude of the magnetic flux and time, so the time interval in which a regularly decreasing electric current passing in the ring is the interval ..... . *(Exp. 25)*



(a) A
(b) B
(c) C
(d) A, B

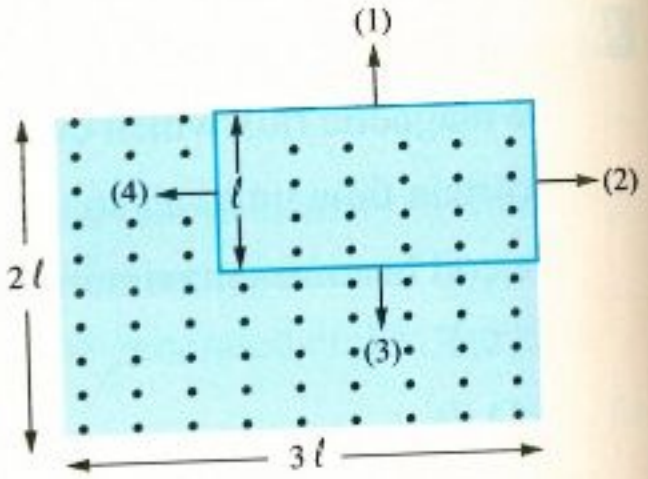
https://t.me/to_explain1

38 The following figures show generating an induced current (I) in a coil due to increasing or decreasing the density of the magnetic flux which is acting on the coil. Which of the figure based on Lenz's rule is incorrect? *(Exp. 25)*



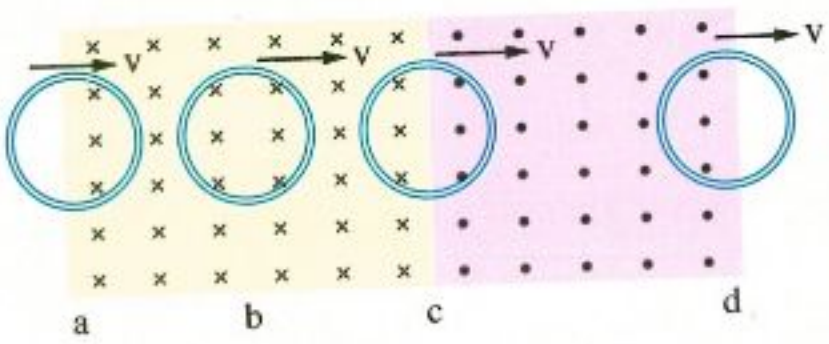
(a) (b) (c) (d)

39 A metal frame of width ℓ and length 2ℓ is placed perpendicular to a uniform magnetic field limited to the shaded area as shown in the figure. If the frame moves a distance ℓ over a time t, in the direction that generates the maximum average electromotive force (emf), then that direction is ..... . *(Exp. 25)*



(a) direction 1 (b) direction 2
(c) direction 3 (d) direction 4

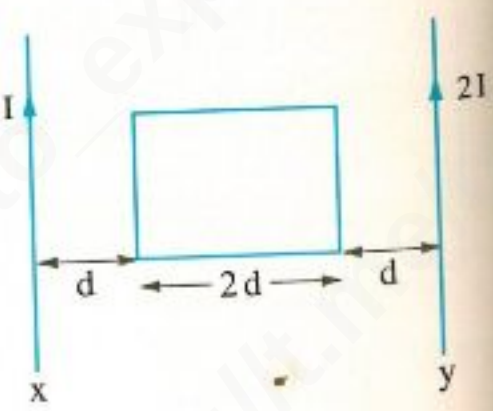
40 A metal ring moves with a uniform velocity in the shown direction.



So, an induced electric current passes in the ring in clockwise direction at the moment it passes the position ..... . *(Exp. 25)*

(a) a (b) b (c) c (d) d

41 In the shown figure a metal frame and two long parallel wires (x), (y) are all in the same plane and carrying electric current. So, direction of the induced current which is passing in the metal frame if within a time t: *(Exp. 25)*



https://t.me/to_explain1

	The current of wire (x) vanished	The current of wire (y) vanished
(a)	In the clockwise direction	In the clockwise direction
(b)	In the counter-clockwise direction	In the counter-clockwise direction
(c)	In the clockwise direction	In the counter-clockwise direction
(d)	In the counter-clockwise direction	In the clockwise direction

42 In figure (1) when the magnet approaches the solenoid, the galvanometer pointer deflects in a certain direction by an angle (θ) and in figure (2) the experiment is repeated using two magnets identical to the one in figure (1), which of the following choices is correct? *(Exp. 25)*

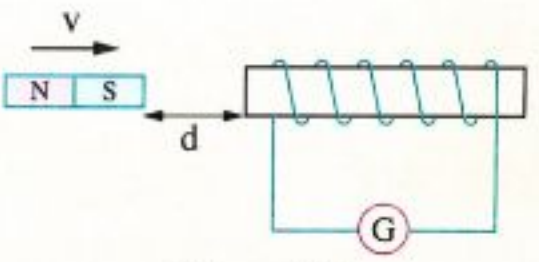


Figure (1)

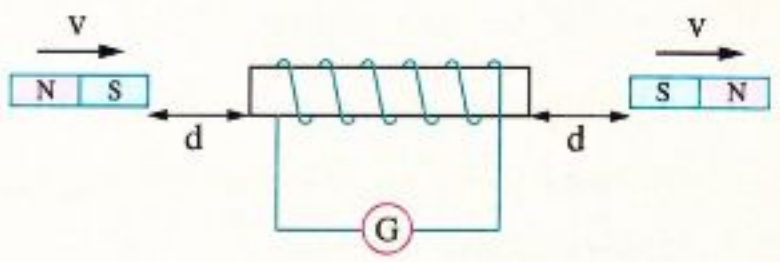


Figure (2)

(a) The pointer deflects with an angle 2θ in the opposite direction.

(b) The pointer deflects with an angle 2θ in the same direction.

(c) The pointer does not deflect.

(d) the pointer deflects with an angle θ in the same direction.

43 In figure (1) a solenoid of aluminum is moved towards a strong magnet , so induced electromotive force of value (emf) is generated at its ends, if the aluminum solenoid is replaced with another made of copper having the same number of turns and cross-sectional area, then the experiment is repeated in the same velocity as shown in figure (2), then the value of the induced emf in the copper coil is ..... . *(Exp. 25)*

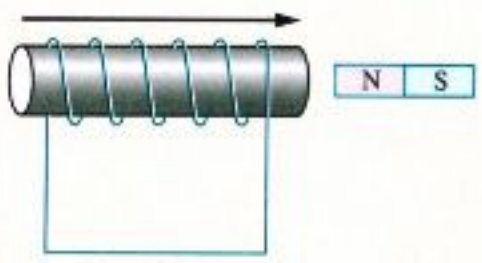


Figure (1)

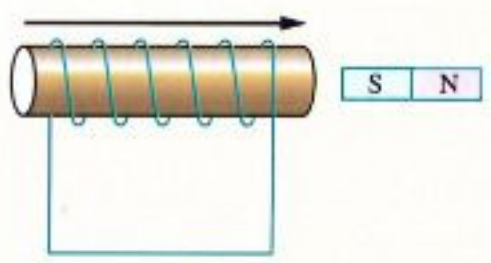


Figure (2)

(a) greater than emf

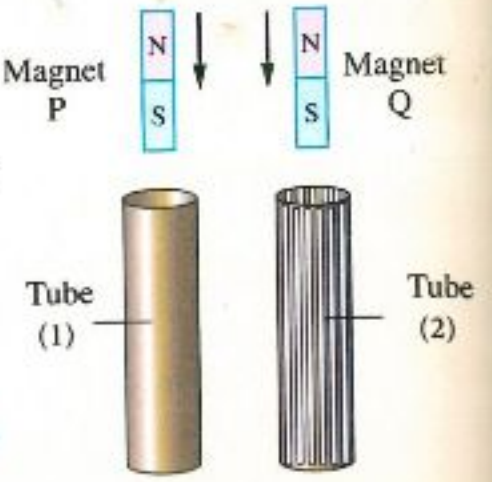
(b) less than emf

(c) equals emf

(d) equals zero

https://t.me/to_explain1

44 Two identical magnets are suspended vertically above two tubes (1), (2) respectively. The tubes are made of copper where tube (2) is divided into insulated longitudinal sheets as in the opposite figure. when the magnets are dropped at the same moment to pass through the tubes without touching them, two induced currents I_1, I_2 are generated respectively. Which of the magnets gets out completely from the tube first? And why? *(Exp. 25)*

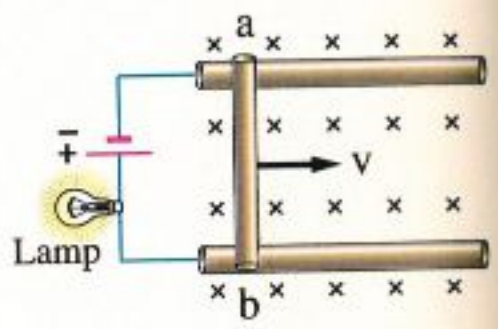


(a) Q, the reason $I_1 > I_2$
(b) Q, the reason $I_1 < I_2$
(c) P, the reason $I_1 > I_2$
(d) P, the reason $I_1 < I_2$

45 Which of the following action does not decrease the eddy currents in the metal core inside a coil carrying an electric current? *(Exp. 25)*

(a) Making the metal core in the form of lamina insulated from each other.
(b) Making the metal core from a material of high conductivity.
(c) Using a current of low frequency.
(d) Making the metal core from a material of high resistivity.

46 In the opposite figure, during the motion of the rod (ab) to the right as shown, the brightness of the lamp ..... . *(Exp. May 21)*
(Where the ohmic resistance of the rod and the two rails is negligible)



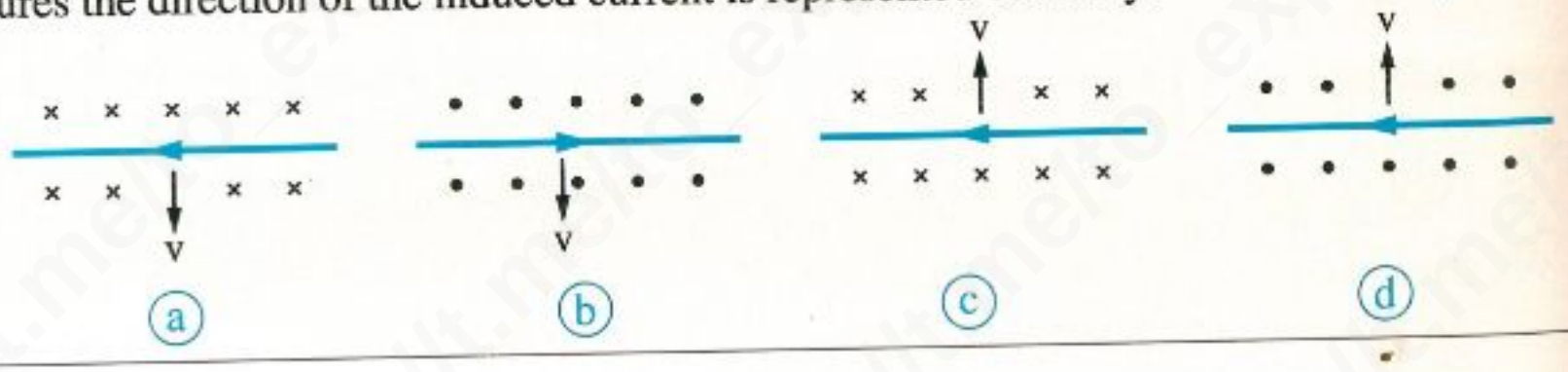
(a) vanishes (b) increases (c) doesn't change (d) decreases

The generated emf in a straight wire

47 When a straight wire of unit length moves perpendicular to a magnetic field of flux density 0.4 T, an induced emf of 0.2 V gets generated between its terminals, so the velocity of the wire equals ..... . *(Exp. June 21)*

(a) 0.5 m/s (b) 1 m/s (c) 1.5 m/s (d) 2 m/s

48 The following figures represent four straight wires. Each one is connected in a closed electric circuit while moving at velocity v in a uniform magnetic field. In which of these figures the direction of the induced current is represented correctly? *(Exp. June 21)*



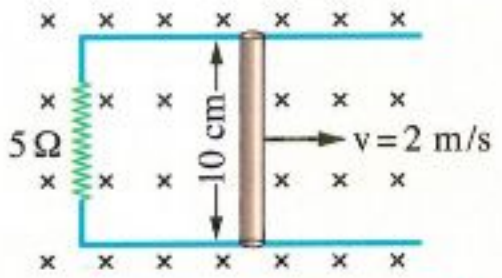
https://t.me/to_explain1

49 In the figure, a straight wire (AB) is placed in a uniform magnetic field that is perpendicular out of the page. To produce an induced emf such that the potential of point (A) becomes greater than the potential of point (B), the direction of motion of wire (AB) should be ..... .

(1st session 21)

(a) downwards of the page
(b) upwards of the page
(c) to the right of the page
(d) to the left of the page

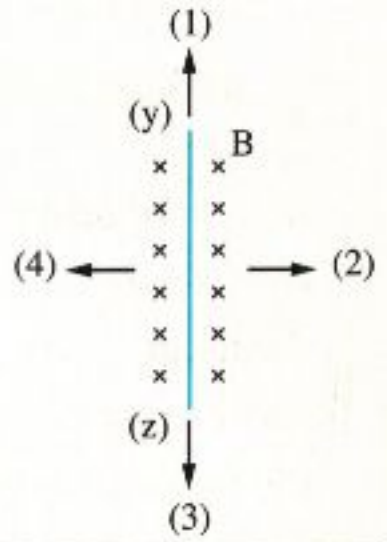
50 The figure represents a conductor moving perpendicular to a magnetic field of flux density 0.2 T, using the data on the figure, the passing current intensity in the resistor equals ..... .



(Where the ohmic resistance of each of the wire and the frame is negligible) *(1st session 21)*

(a) 4 mA
(b) 6 mA
(c) 8 mA
(d) 2 mA

51 The figure represents a straight wire (yz) that is moving in a uniform magnetic field (B) while being connected in a closed circuit, hence an induced current is produced in the direction from (z) to (y). To which direction (1), (2), (3) or (4) the wire (yz) has to be moved ? *(2nd session 21)*

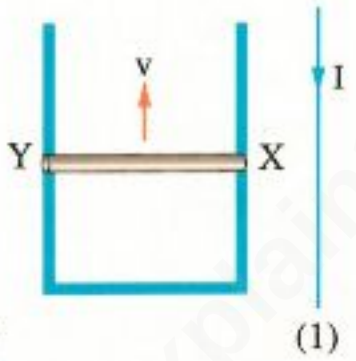


(a) (1)
(b) (2)
(c) (3)
(d) (4)

52 A straight wire of length 20 cm moves at velocity 0.5 m/s in a direction that makes angle (θ) with the direction of a magnetic field of flux density 0.4 T, so an induced emf of 20 mV gets generated between its terminals, hence the angle (θ) equals ..... . *(2nd session 21)*

(a) 60°
(b) 30°
(c) 45°
(d) 90°

53 The figure shows a straight current-carrying wire (1) through which a current of intensity (I) passes. When a wire (XY) is moved upwards with velocity (v) in the magnetic field of the electric current in wire (1), an induced electric current is generated in it from (X to Y).

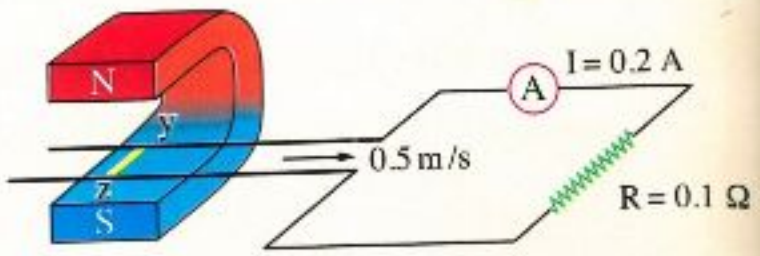


To decrease the intensity of the induced electric current to half its value, we must ..... . *(1st session 22)*

(a) increase the velocity of wire (XY) to its double
(b) decrease the electric current intensity in wire (1) to its quarter
(c) increase the velocity of wire (XY) to its four times
(d) decrease the electric current intensity in wire (1) to its half

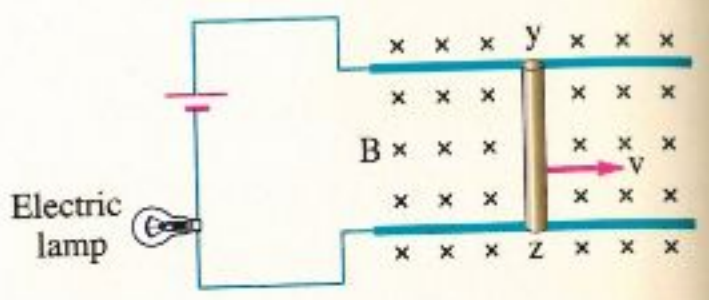
https://t.me/to_explain1

54 The figure shows a metallic wire (yz) sliding on two metallic bars with velocity 0.5 m/s perpendicular to the direction of a magnetic field of flux density 2 T. If the reading of the ammeter is 0.2 A, so the length of the moving wire zy in the magnetic field equals ..... .



(a) 0.04 m (b) 0.02 m (c) 0.01 m (d) 0.03 m *(1st session 22)*

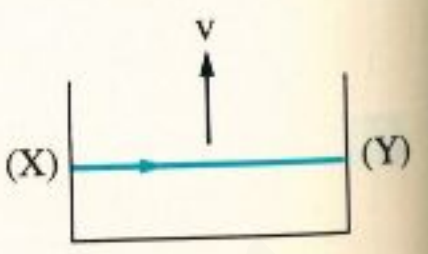
55 At moving the straight metallic wire (zy) toward right normal to the direction of a magnetic field (B) that is directed perpendicular into the page as shown in the figure where the induced emf in the wire is less than that of the battery.

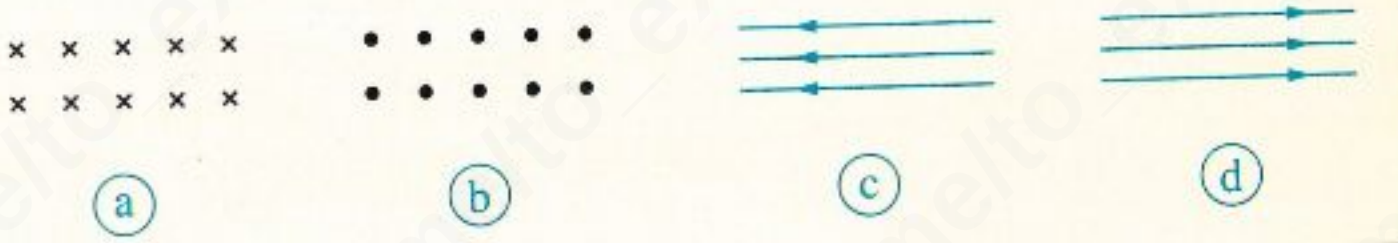


Which of the following choices correctly tells about: *(1st session 22)*

	The illumination of the electric bulb?	The relation between the electric potential of points Z and Y?
(a)	increases	the potential of point z is more than that of point y
(b)	increases	the potential of point z is less than that of point y
(c)	decreases	the potential of point z is less than that of point y
(d)	decreases	the potential of point z is more than that of point y

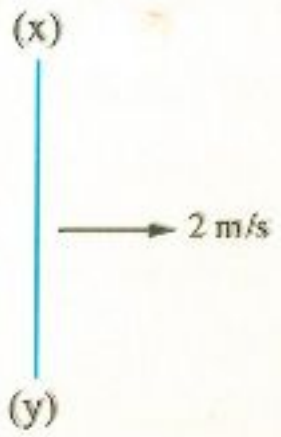
56 The figure represents a part of closed circuit that contains a straight wire (XY) that is placed in the same plane of the paper and moving upward with velocity v producing an induced current that passes from (X) to (Y). Which of the following figures represents the direction of magnetic flux acting on the wire according to the plane of the paper? *(2nd session 22)*





https://t.me/to_explain1

57 The figure shows a part of closed circuit that contains a straight wire (xy) of length 20 cm moving at velocity of 2 m/s perpendicular to the direction of a uniform magnetic flux, that produces an induced electromotive force of 0.02 V between the two terminals of the wire where the electric potential of point (x) is more than that of point (y). Then, the magnitude and the direction of the magnetic flux density are ..... .



(2nd session 22)

(a) 0.05 T, perpendicular into the page
(b) 0.5 T, perpendicular into the page
(c) 0.05 T, perpendicular out of the page
(d) 0.5 T, perpendicular out of the page

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58 A wire of length 0.2 m is moved with velocity 2 m/s in a direction that makes an angle 30° with magnetic flux lines of density 0.4 T, so the instantaneous induced electromotive force is ..... .

(Exp. 23)

(a) 0.16 V (b) 0.32 V (c) 0.08 V (d) 0.24 V

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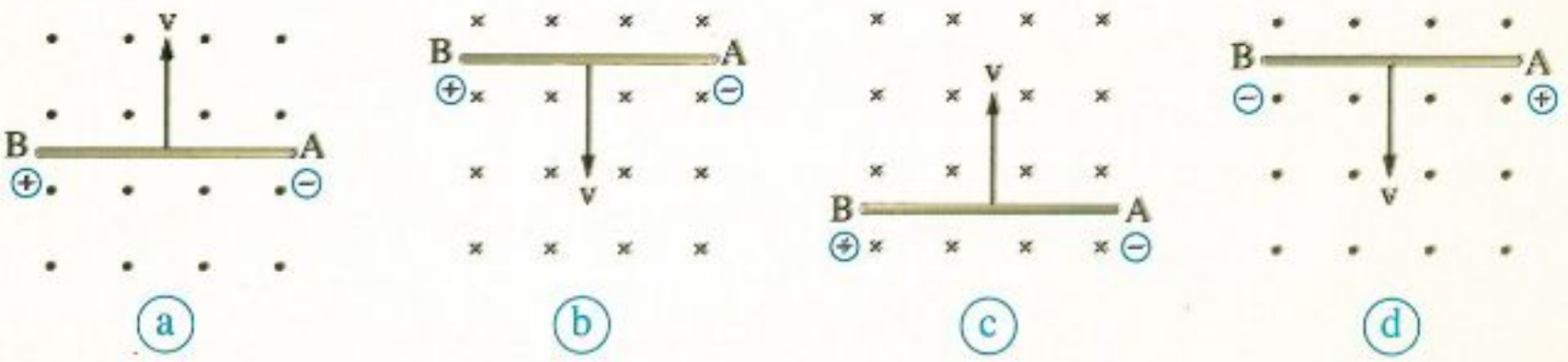
59 A copper wire AB of length (ℓ) is placed in the same plane of the page and then it is moved perpendicular to a uniform magnetic field, which of the following figures correctly represents the polarity of the wire terminals?

(Exp. 23)



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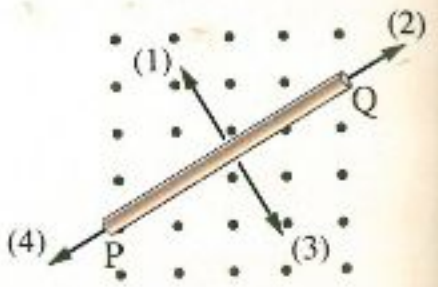
60 A copper wire of length ℓ is connected to a galvanometer. If the wire is moved with velocity v perpendicular to a magnetic field of flux density B, the pointer of the galvanometer deflects momentarily with an angle θ and when the velocity of the wire is increased to 2 v and the flux density is increased to 2 B, then the pointer of the galvanometer will deflect momentarily with an angle equals to ..... .

(Exp. 23)

(a) 2 θ (b) 4 θ (c) 6 θ (d) θ

https://t.me/to_explain1

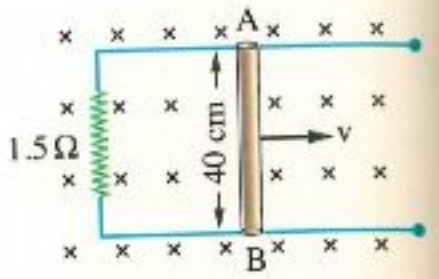
61 The opposite figure represents a uniform magnetic field acting on wire (PQ) that is placed in the same plane of the page and embedded in a closed circuit. If the direction of the induced current is from (Q) to (P), so the direction of motion of the wire is towards ..... . *(1st session 23)*



(a) (1) (b) (3) (c) (2) (d) (4)

62 The figure represents a wire (AB) that has a resistance of (0.5 Ω) moving perpendicular to a magnetic flux of density (0.2 T). In order to obtain an induced current of 0.1 A at the moment of the wire motion, the wire must move with a velocity equal to ..... .

(Neglect the resistance of the connecting wires) *(1st session 23)*



(a) 1.5 m/s (b) 1.875 m/s (c) 2.5 m/s (d) 0.625 m/s

63 A straight wire of length (ℓ) moves with velocity (v) inclined to a magnetic field of flux density (B) with an angle (30°) to the direction of the field, so an induced electromotive force is generated in it. To increase the electromotive force generated in it to the double ..... . *(2nd session 23)*

(a) the length of the wire must increase to ($4\,\ell$)

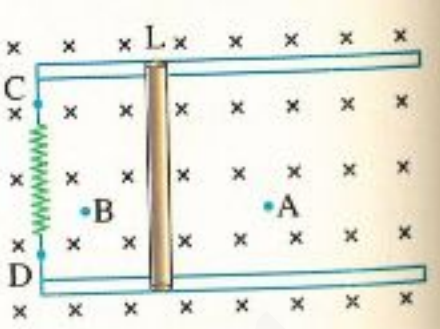
(b) the wire must move with velocity (3 v)

(c) the wire must move in a magnetic field of flux density = $\left(\frac{1}{2}B\right)$

(d) the wire must move perpendicular to the magnetic field

64 In the figure, the wire (L) is able to move in the same plane of the page through a magnetic field perpendicular into the page.

Which of the following choices is correct? *(2nd session 23)*



(a) If the wire is moved towards point "A", the potential of the point "C" will be greater than that of "D".

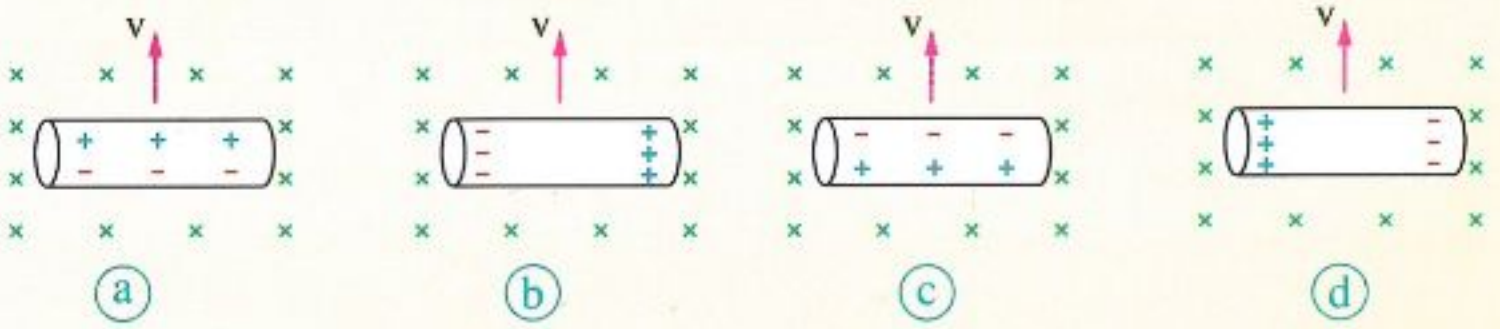
(b) If the wire is moved towards point "A", the potential of the point "C" will be less than that of "D".

(c) If the wire is moved towards point "B", the potential of the point "C" will be greater than that of "D".

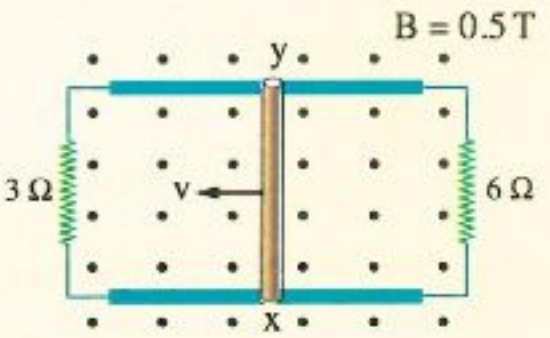
(d) If the wire is moved towards point "B", the potential of the point "C" will be equal to that of "D".

https://t.me/to_explain1

65 A metallic wire moves with constant velocity (v) upwards in the plane of the page and is affected by a magnetic field perpendicular into the plane of the page. Which figure illustrates the drift of the electric charges inside the wire during its motion? *(2nd session 23)*

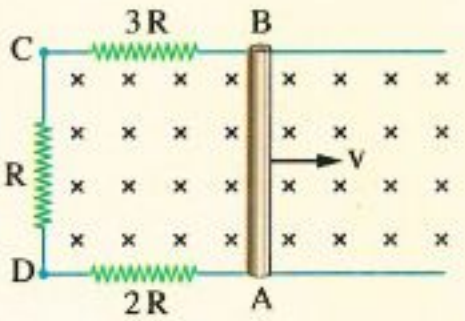


66 A metallic straight wire (yx) of length 0.2 m whose electric resistance is 1 Ω moves at velocity of 3 m/s perpendicular to the direction of magnetic field of flux density 0.5 T on two rails of negligible resistance that are connected with two resistors 6 Ω, 3 Ω as shown in the figure. Then, the potential difference across the resistor (3 Ω) during moving the wire equals ..... . *(2nd session 23)*



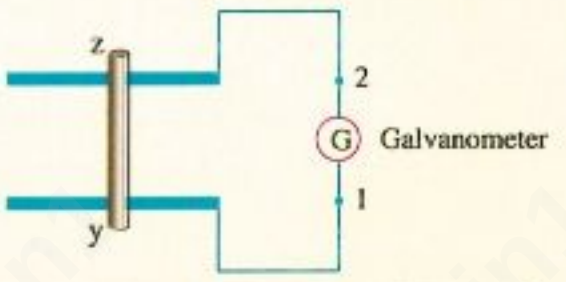
(a) 0.2 V (b) 0.3 V (c) 0.1 V (d) 0.4 V

67 The opposite figure shows a conductor AB which is moved rightwards perpendicular to a uniform magnetic flux, so during the motion of the conductor (AB) which of the following statements is correct? *(1st session 24)*



(a) Potential (C) equals (D).
(b) Potential (A) equals (B).
(c) Potential (C) less than (D).
(d) Potential (C) greater than (D).

68 The opposite figure shows a movable wire yz that is affected by a uniform magnetic flux, so which of the following directions allows the flow of the current from point 1 to point 2? *(1st session 24)*



	Direction of the wire's motion	Direction of the magnetic flux
(a)	Leftwards	Perpendicular to the plane of the page outwards
(b)	Rightwards	Perpendicular to the plane of the page outwards
(c)	Rightwards	In the plane of the page leftwards
(d)	Leftwards	In the plane of the page rightwards

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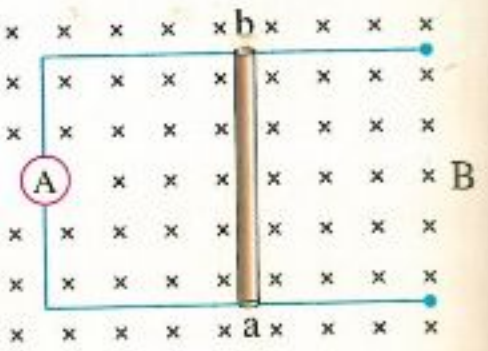
69 The opposite figure represents a metal wire (ab) which moves perpendicular to a uniform magnetic field of flux density (B) generating in the wire induced electric current such that potential of point (a) is greater than that of point (b), so direction of motion of the wire is ..... . *(2nd session 24)*



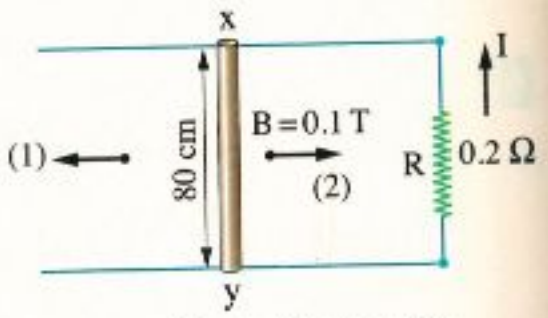
(a) to the left of the page
(b) to the right of the page
(c) upwards of the page
(d) downwards of the page

70 Three straight wires A, B, C of lengths ℓ, 1.5 ℓ, 2 ℓ respectively are moving with velocities v, 2 v, 4 v respectively, perpendicularly to a uniform magnetic flux of density (B) and its direction is into the page as in the following figures, so ..... . *(2nd session 24)*

Which of the following choices is correct?

(a) $emf_{(C)} > emf_{(B)}$ (b) $emf_{(A)} > emf_{(C)}$ (c) $emf_{(B)} > emf_{(A)}$ (d) $emf_{(C)} > emf_{(A)}$

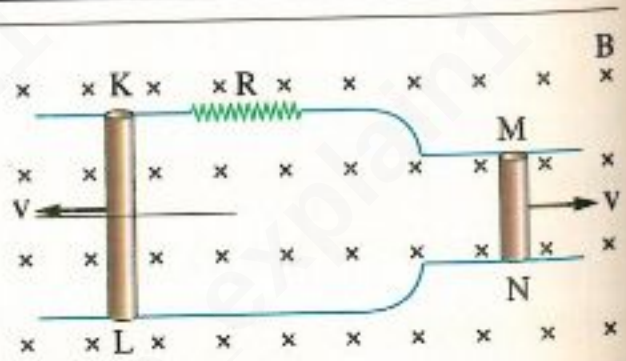
71 Depending on the data in the opposite figure and by ignoring the resistance of each of the conductor xy and the metal rails, on which the conductor xy is sliding, the two conditions for generating induced current of 2 A in the resistor R in the shown direction are ..... .



(Supposing that the whole figure is completely immersed in the magnetic field and its direction is into the page) *(Exp. 25)*

	Direction of motion of the conductor	The uniform speed of the conductor
(a)	Direction 1	5 m/s
(b)	Direction 2	10 m/s
(c)	Direction 1	10 m/s
(d)	Direction 2	5 m/s

72 Two copper conductors KL, MN having the same cross-section and negligible resistance, length of MN is ℓ and that of KL is 2ℓ. The conductors are moving on a metal frame of negligible resistance with a velocity v in the direction shown in the opposite figure, so intensity of the induced current which passes in the resistor R equals ..... . *(Exp. 25)*



(a) $\frac{3\,B\ell v}{R}$ (b) $\frac{B\ell v}{R}$ (c) $\frac{2\,B\ell v}{R}$ (d) $\frac{4\,B\ell v}{R}$

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Chapter 3

Questions on Lesson Two

- Mutual Induction between Two Coils.
- Self Induction of the Coil.

Interactive test

The questions signed by ✱ are answered in detail. ● Understand ○ Apply Higher Order Thinking Skills

Important guidelines

⇒ The mutual induction between two coils:

- To determine the induced emf generated in the secondary coil by mutual induction $(emf)_2$:

$$(emf)_2 = -M\frac{\Delta I_1}{\Delta t} = -N_2\frac{\Delta(\phi_m)_2}{\Delta t}$$

(Where: ΔI_1 is the change in the electric current intensity passing in the primary coil, Δt is the time of that change)

- To determine the coefficient of mutual induction between two coils (M):

$$M = \frac{\mu N_1 N_2 A}{\ell} \qquad M = \frac{(emf)_2}{\Delta I_1/\Delta t}$$

- If the time (Δt) is not given: $M\Delta I_1 = N_2\,\Delta(\phi_m)_2$

⇒ The self induction of a coil:

- To determine the emf generated in the solenoid by self induction:

$$emf = -L\frac{\Delta I}{\Delta t} = -N\frac{\Delta(\phi_m)}{\Delta t}$$

(Where: $\frac{\Delta I}{\Delta t}$ is the rate of change in the electric current intensity passing in the coil)

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- To determine the coefficient of self induction for a solenoid (L):

$$L = \frac{\mu A N^2}{\ell} \qquad L = \frac{emf}{\Delta I/\Delta t}$$

- If the time (Δt) is not given:

$$L\Delta I = N\Delta\phi_m$$

- To compare between the coefficients of self induction for two solenoid coils in the same medium:

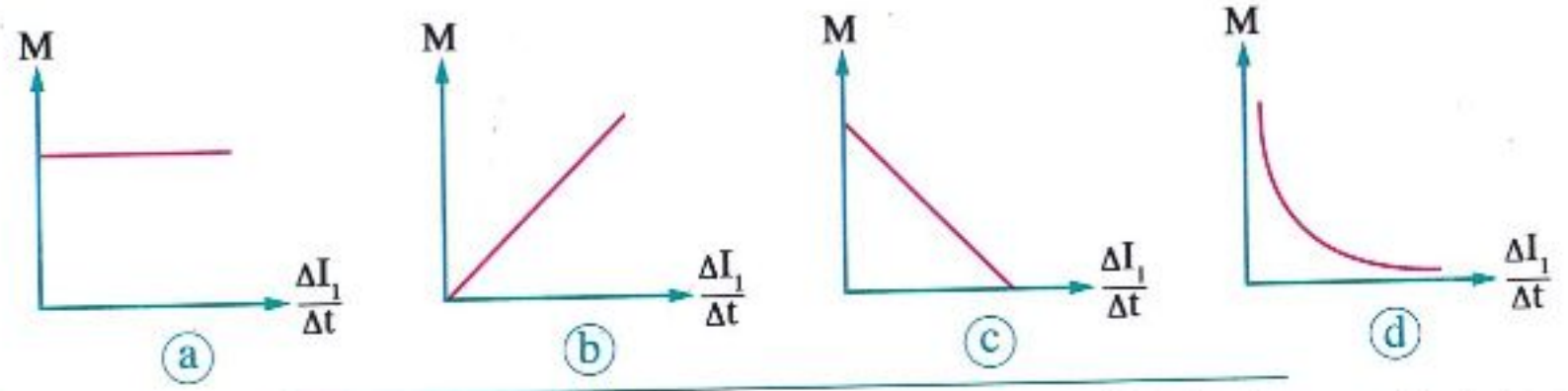
$$\frac{L_1}{L_2} = \frac{A_1 N_1^2 \ell_2}{A_2 N_2^2 \ell_1} = \frac{r_1^2 N_1^2 \ell_2}{r_2^2 N_2^2 \ell_1}$$

First Multiple choice questions

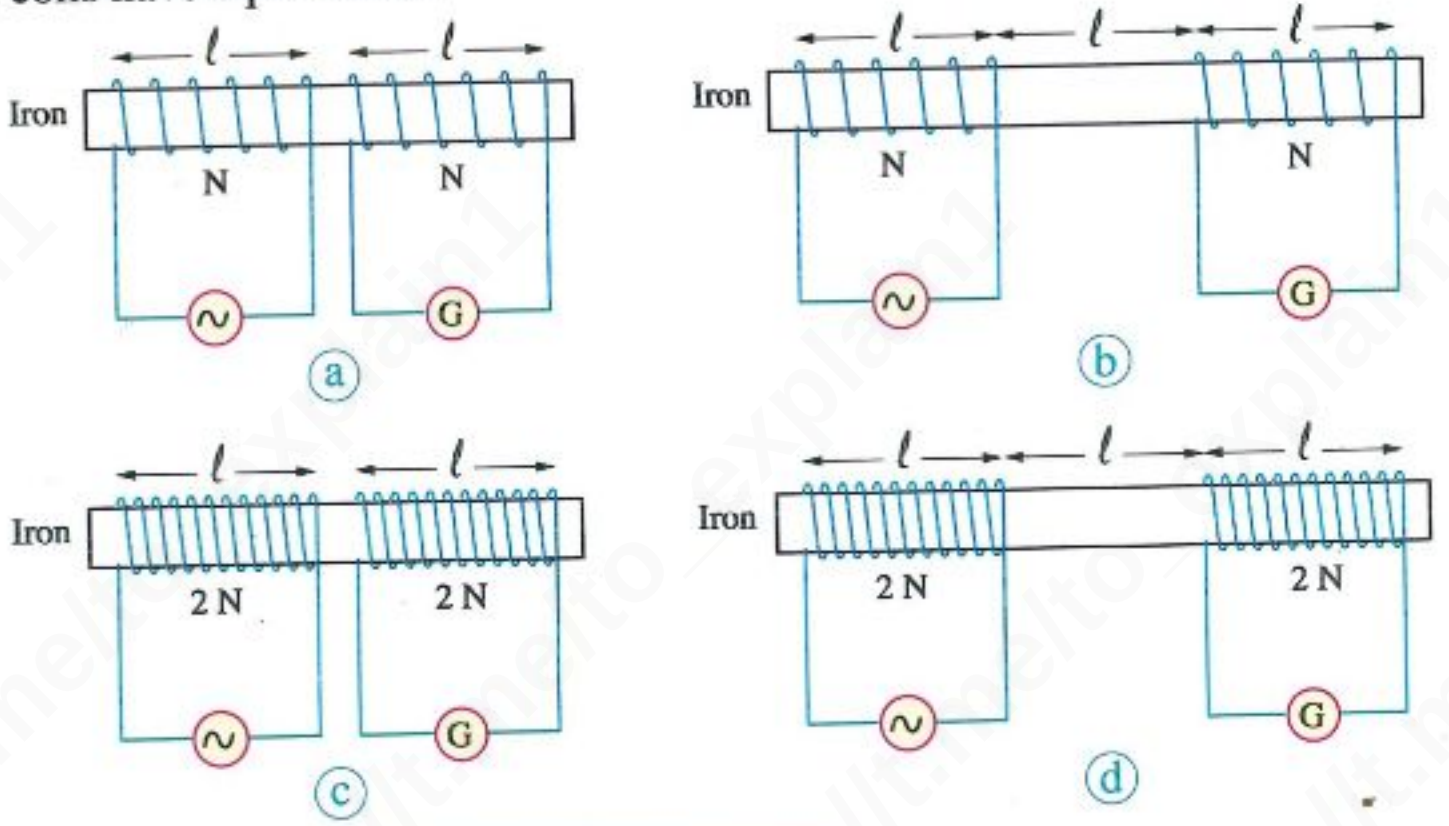
Using the following constant if it is needed: $\mu_{air} = 4\pi \times 10^{-7}$ Wb/A.m

The mutual induction between two coils

1. Which of the following graphs represents the relation between the mutual induction coefficient (M) between two coils and the time rate of change in the intensity of the electric current which is passing in the primary coil $\left(\frac{\Delta I_1}{\Delta t}\right)$?



2. Which of the following pairs of coils has the greatest mutual induction coefficient, given that all coils have equal areas?



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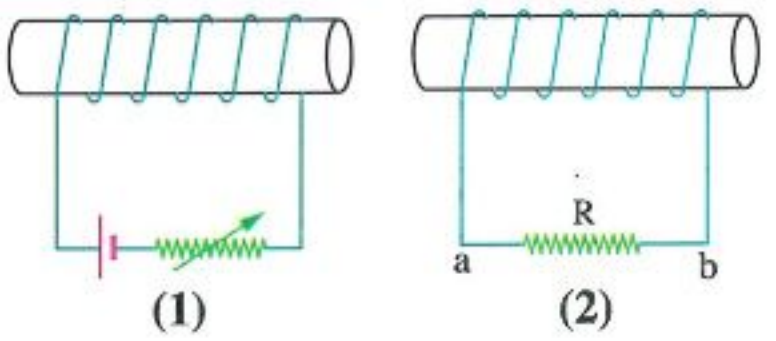
3 A primary coil was connected to a DC source while being placed inside a secondary coil, so when opening the circuit of the primary coil, the generated current in the circuit of the secondary coil will be ..... .

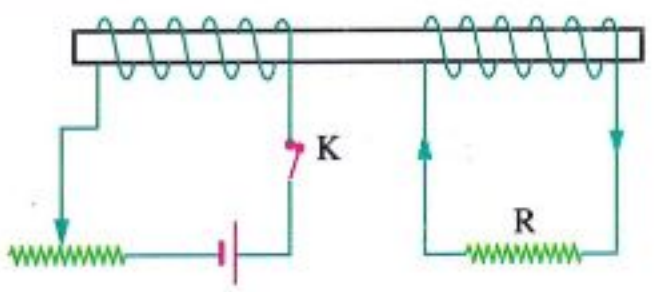
(a) forward induced instantaneous current
(b) back induced instantaneous current
(c) alternating current
(d) direct current

4 In the opposite figure, an induced electric current will be generated in circuit (2) and passes from point a to point b through resistor R when ..... .



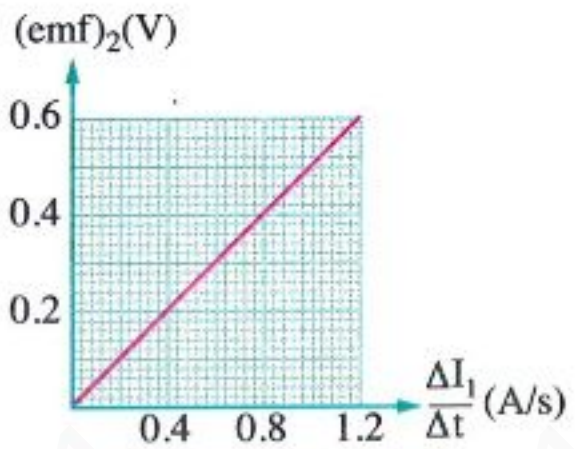
(a) moving the two circuits together at the same speed to the right side
(b) moving one of the circuits towards the other
(c) increasing the variable resistance in circuit (1)
(d) removing the iron core from one of the two circuits

5 An induced electric current will be generated in the secondary coil in a direction as shown in the opposite circuit, at ..... .



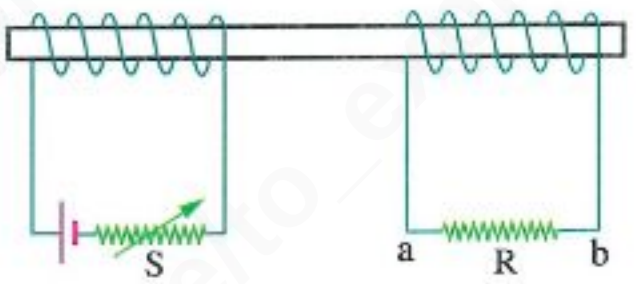
(a) opening switch K
(b) decreasing the variable resistance
(c) increasing the variable resistance
(d) moving the two coils away from each other

6 In an experiment for studying the mutual induction between two coils (1, 2), the relation between the magnitude of the induced emf $(emf)_2$ in coil (2) and the rate of change of the current $\left(\frac{\Delta I_1}{\Delta t}\right)$ in coil (1) was as shown in the opposite graph, so the mutual inductance between the two coils is ..... .



(a) 0.1 H
(b) 0.2 H
(c) 0.4 H
(d) 0.5 H

7 In the opposite figure, during increasing the variable resistor (S), the potential of point (a) becomes ..... that of point (b).



(a) greater than
(b) less than
(c) equal to
(d) we can't determine the answer unless by knowing the value of resistance R

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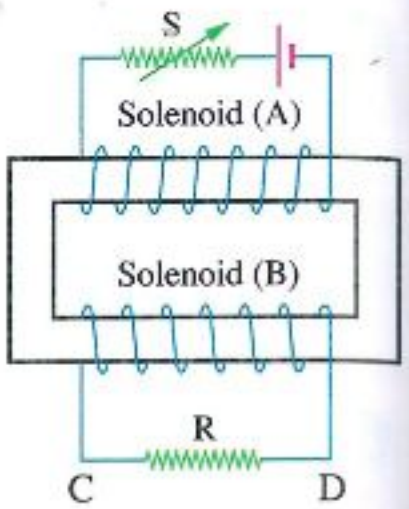
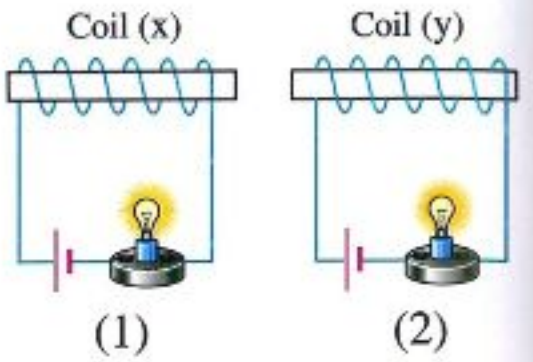
8 Two adjacent solenoids (A), (B) where solenoid (A) is connected to an electric circuit and solenoid (B) is connected to a resistor (R) as in the opposite figure. When value of the variable resistor (S) is decreased in the circuit of solenoid (A), the electric potential at point (C) becomes ..... .



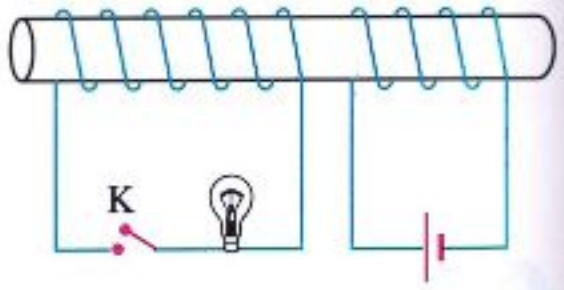
(a) greater than the electric potential at point (D)
(b) less than the electric potential at point (D)
(c) equals the electric potential at point (D)
(d) indeterminable.

9 Two coaxial solenoids each carries electric current I and connected to two bulbs (1), (2) as in the opposite figure, when moving the solenoid (x) with a uniform velocity away from solenoid (y), the luminosity of ..... .



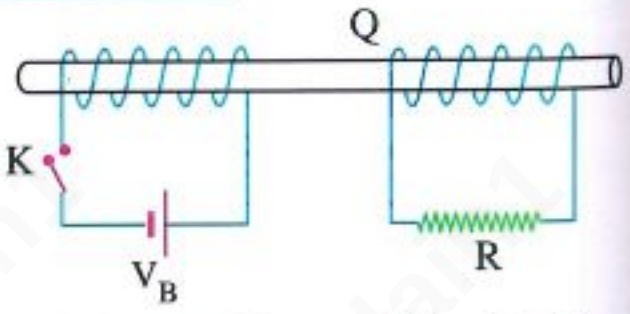
	Bulb (1)	Bulb (2)
(a)	increases	increases
(b)	decreases	increases
(c)	increases	decreases
(d)	decreases	decreases

10 An isolated primary and secondary solenoids are coiled around an iron cylinder; the primary solenoid is connected to a battery while the secondary is connected to an electric bulb and a switch (K) as in the opposite figure. When switch (K) is closed the bulb ..... .



(a) illuminates momentarily then gets off (b) illuminates and doesn't get off
(c) illuminates and its luminosity decreases gradually till it gets off
(d) does not illuminate at all

11 In the opposite figure, at the moment of closing circuit (1), then in circuit (2) ..... .



	The terminal Q	The direction of the current
(a)	south	in the same current direction as circuit (1)
(b)	north	in the same current direction as circuit (1)
(c)	south	in opposite direction to the current of circuit (1)
(d)	north	in opposite direction to the current of circuit (1)

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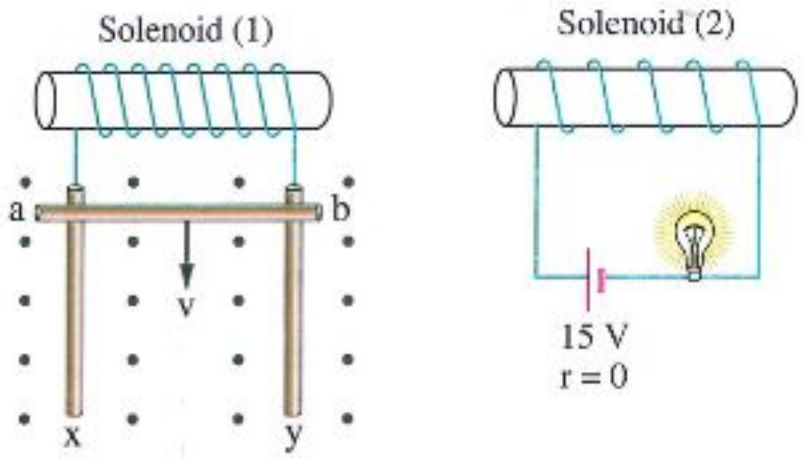
12 In the opposite figure, two adjacent solenoids (1), (2), where solenoid (1) is connected to two metal rails (x), (y) having the same resistance R. A metal rod moves while touching them with a uniform velocity (v) perpendicular to a uniform magnetic field, so if the magnitude of the induced emf in the rod (ab) equals 10 V, the luminosity of the bulb which is connected to solenoid (2) during the movement of the rod ..... .



(a) increases (b) decreases
(c) doesn't change (d) the answer is indeterminable

13 ❋ The mutual inductance between two coils is 0.1 H. If the intensity of current has dropped in the primary from 4 A to zero within 0.01 s, the induced emf across the secondary coil is equal to ..... .

(a) 20 V (b) 40 V (c) 60 V (d) 80 V

14 ❋ A primary solenoid is 10 cm long, consists of 200 turns and carries an electric current of 4 A, it has a soft iron core of permeability 0.002 Wb/A.m, on which a secondary coil of diameter 3.5 cm is wound with 10^5 turns if the current is cut off from the primary coil within 0.01 s, then:

(i) The generated emf in the secondary coil equals ..... .

(a) 1.54×10^5 V (b) 4.32×10^5 V (c) 6.21×10^6 V (d) 8.8×10^6 V

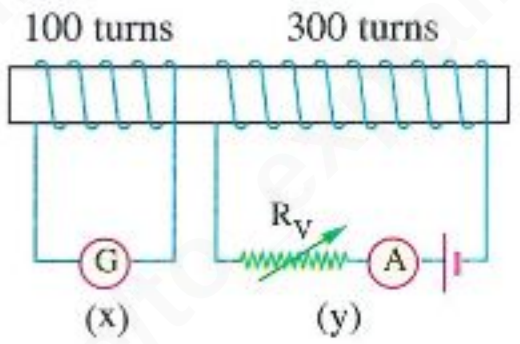
(ii) The mutual induction coefficient between the two coils is ..... .

(a) 130 H (b) 193 H (c) 385 H (d) 522 H

15 ❋ Two coils X and Y are adjacent. The number of turns of Y is 2000 turns, if a current of intensity 7 A flows in coil X and produced a magnetic flux of 2.5×10^{-4} Wb through coil Y, then the mutual induction coefficient between the two coils equals ..... .

(a) 0.01 H (b) 0.03 H (c) 0.05 H (d) 0.07 H

16 ❋ The opposite figure represents two adjacent solenoids, the mutual inductance between them is 0.01 H. If the current intensity in coil y has changed by a value of ΔI, the magnetic flux that cuts coil x changes by a value of 2×10^{-3} Wb through the same time interval, then the value of the change in the current intensity (ΔI) in the coil y is ..... .



(a) 2 A (b) 5 A (c) 10 A (d) 20 A

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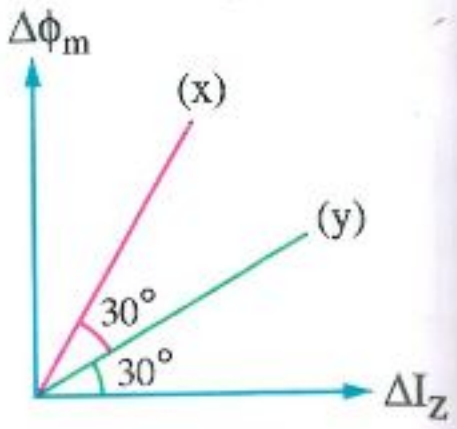
17 Two secondary solenoids (x), (y) of number of turns N, 2 N respectively, each is placed individually besides a primary solenoid (z) such that they have common axis every time. The opposite graph represents the relation between the change in the magnetic flux ($\Delta\phi_m$) and the change in the current (ΔI_z) passing in the primary solenoid, so the ratio between the mutual induction coefficient in each case $\left(\frac{M_{xz}}{M_{yz}}\right)$ equals ..... .

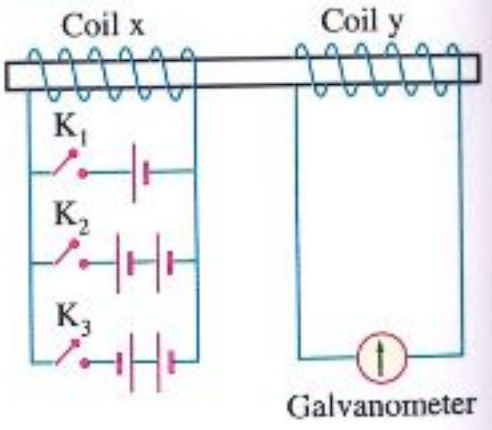


(a) $\frac{1}{2}$ (b) $\frac{2}{3}$ (c) $\frac{3}{2}$ (d) 3

18 An electric current of intensity 10 A passes through one of two adjacent coils between which the mutual inductance is 0.3 H, when this current vanishes to zero, an induced emf of 60 V is generated in the other coil, then the decay time of the current in the first coil is equal to ..... .

(a) 0.005 s (b) 0.05 s (c) 0.04 s (d) 0.4 s

19 The opposite figure shows two similar coils x, y, each of resistance R. Coil x is connected through switches K_1, K_2 and K_3 to similar electric cells of negligible internal resistances. At the moment of closing switch K_1, the pointer of the galvanometer which is connected to coil y gets deflected by an angle θ, then the deflection angle of the galvanometer pointer at the moment of ..... .



	Closing switch K_2 only	Closing switch K_3 only
(a)	greater than (θ)	zero
(b)	greater than (θ)	greater than (θ)
(c)	equals (θ)	zero
(d)	less than (θ)	less than (θ)

20 Three adjacent solenoids (x), (y), (z) of negligible resistances having the same common axis, same length and their numbers of turns are N, 2 N, 3 N respectively. Each of the solenoids (x), (z) is connected to a resistor (R) and a galvanometer which its zero is in the middle of its scale and a resistor (R). The solenoid (y) is connected to a variable resistor (S) and a battery as shown in the following figure;

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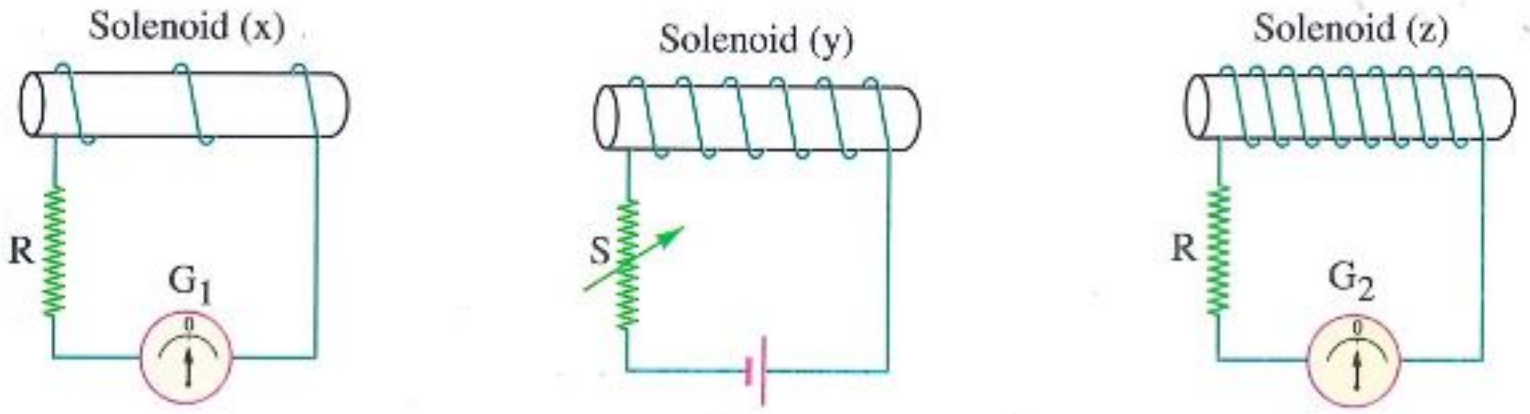


When the resistance of the variable resistor (S) is reduced, the pointer of the galvanometer (G_1) is deflected by an angle (θ) to the right side of the zero scale, so the galvanometer's pointer (G_2) deflects by an angle ..... .

(a) equals (θ) to the right side of the zero scale

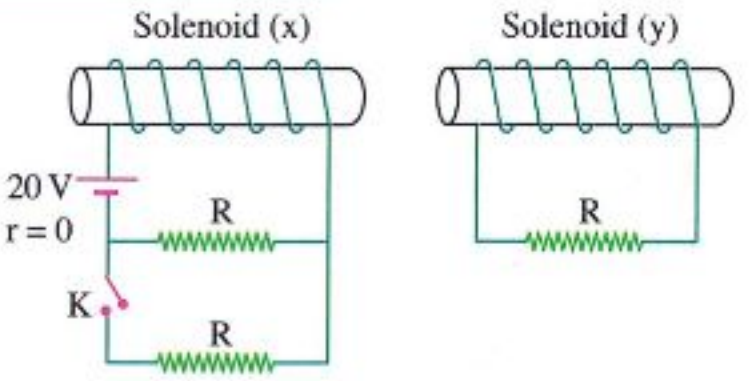
(b) equals (θ) to the left side of the zero scale

(c) greater than (θ) to the right side of the zero scale

(d) greater than (θ) to the left side of the zero scale

---

21 ✱ In the opposite figure the solenoids (x), (y) are of negligible resistances and the mutual induction coefficient between them is 0.01 H. Solenoid (x) carries a DC current of constant intensity. When closing the switch (K), the value of the current changes till becomes constant through an interval of 0.25 s and during that interval the average induced emf in the solenoid (y) becomes 0.04 V, so value of the resistor (R) equals ..... .



(a) 10 Ω (b) 20 Ω (c) 40 Ω (d) 60 Ω

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22 Figure (1) represents two adjacent solenoids P, Q and figure (2) represents graphically the relation between the current intensity (I) in coil P and the time (t),

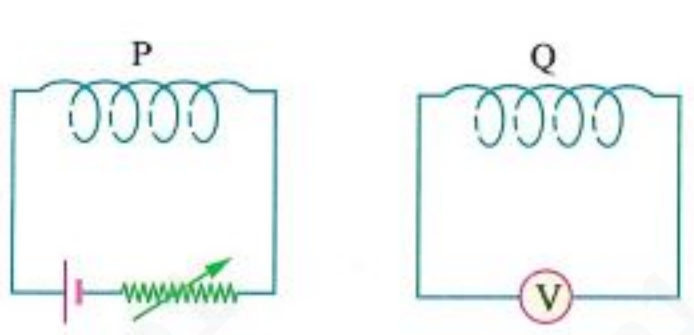


Figure (1)

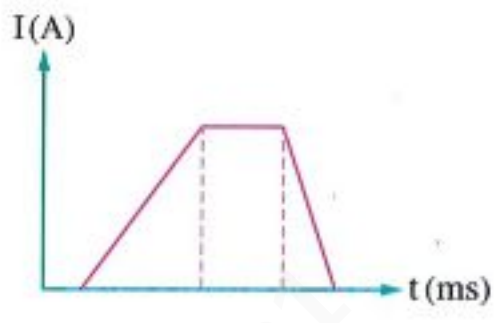
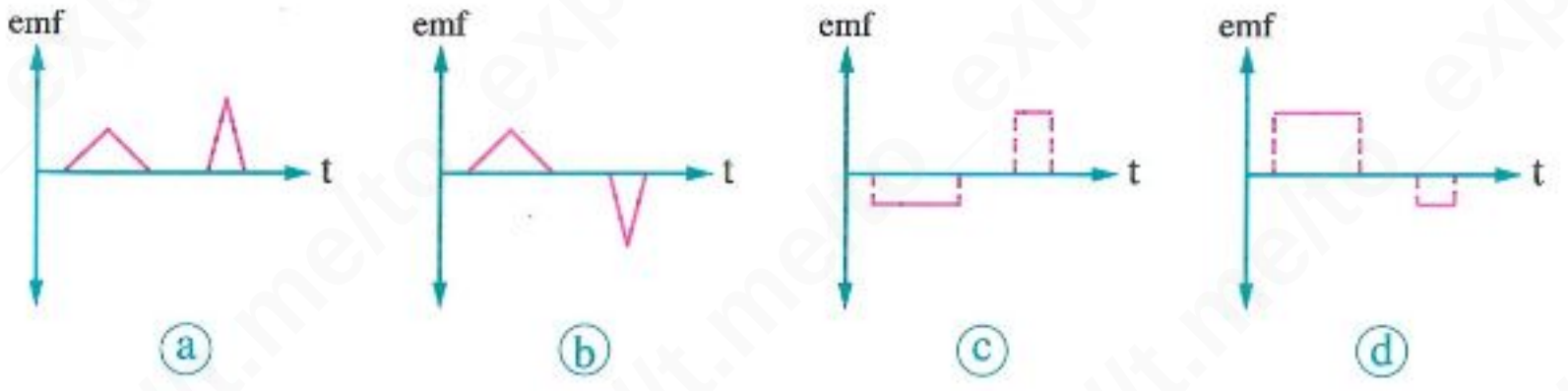


Figure (2)

then the graph that represents the induced emf in coil Q versus time is ..... .



(a) (b) (c) (d)

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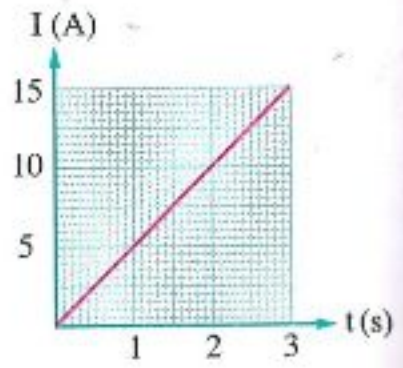
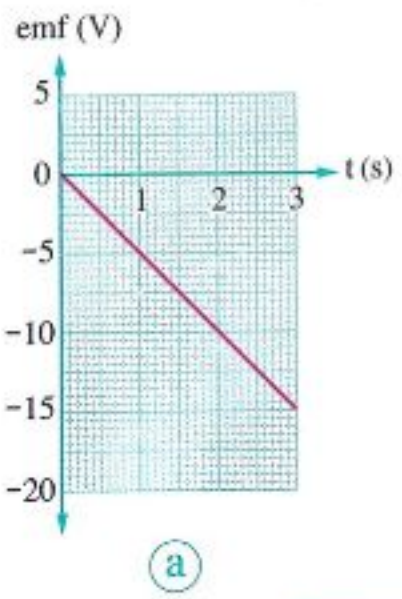
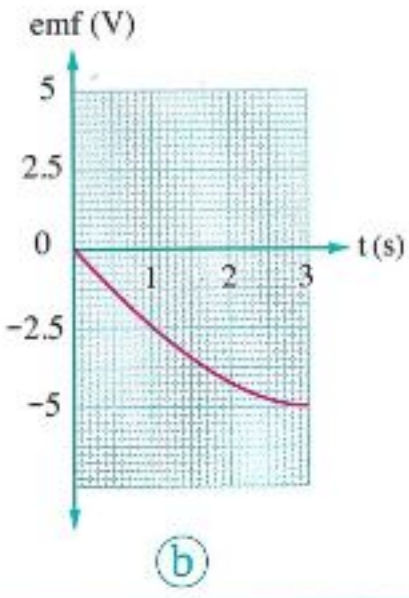
23 The mutual induction coefficient between two adjacent coils is 1 H, if the passing current through one of the coils changes with time as in the opposite graph, then the graph that represents the relation between the induced emf generated in the second coil and the time is ..... .

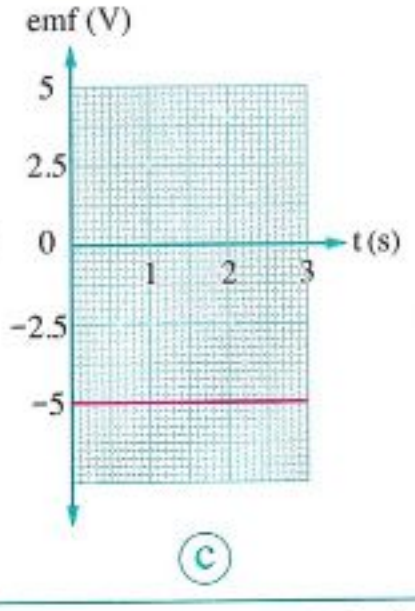




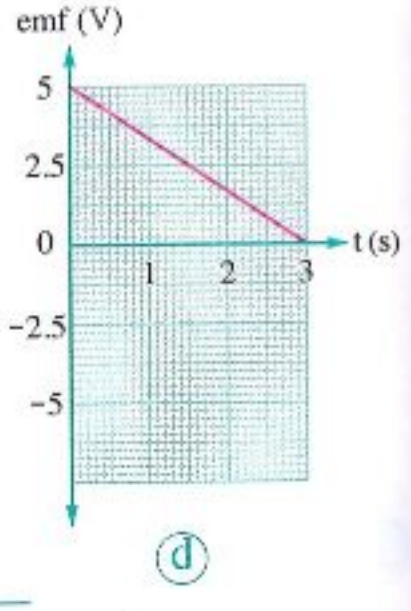
(a)



(b)

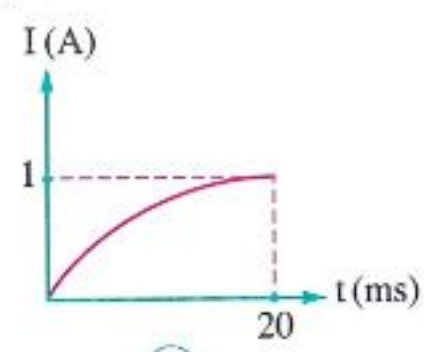


(c)

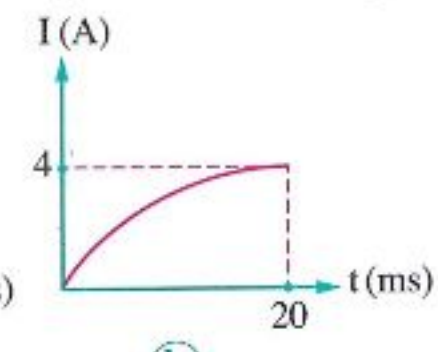


(d)

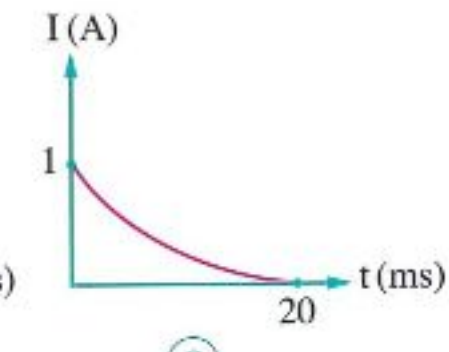
24 Two solenoids primary and secondary solenoid having mutual inductance between them of 10 mH. Which of the following graphs represents the change of the current of the primary solenoid (I) with time (t), so an average back induced emf of 2 V gets generated in the secondary solenoid through 20 ms?



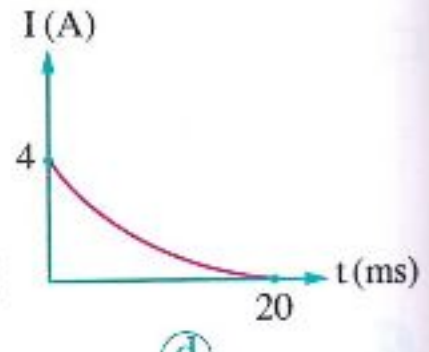
(a)



(b)

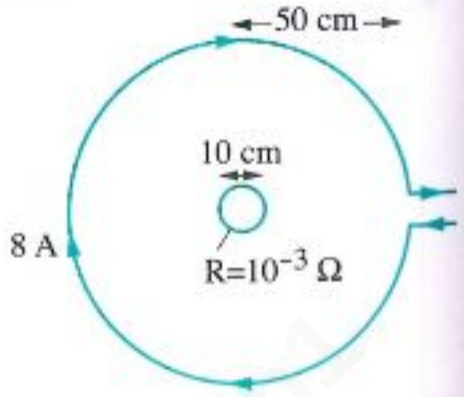


(c)



(d)

25 The opposite figure shows a one turn small circular loop of radius 5 cm and resistance 10^{-3} Ω placed at the center of a one turn big loop of radius 50 cm. A variable current that changes uniformly from 0 to 8 A within 10^{-6} s passes through the big loop. Then the induced electric current passing in the small loop within the same period of time equals ..... .



(a) 49 A (b) 57 A (c) 66 A (d) 79 A

26 ✱ Coil (y) of resistance 50 Ω, area 5 cm^2 that consists of 10 turns is placed in the same plane and at the center of a coil (x) of radius 11 cm that consists of 7 turns and carries an electric current of intensity I. During the rotation of coil x about an axis in its plane for 180° an electric charge of 20 nC has passed in coil y, so the current intensity I passing in coil x equals ..... .

(a) 2.5 A (b) 5 A (c) 7.5 A (d) 10 A

https://t.me/to_explain1

27 ✳ A circular coil of diameter 2 cm that consists of 100 tightly adjacent turns is placed inside a long solenoid of diameter 5 cm that consists of 2100 turns/m such that both coils have the same axis. If the electric current intensity in the solenoid is decreased with a constant rate from 1.5 A to zero through an interval of 0.05 s, then increased to 1.5 A in the opposite direction at the same rate through an interval of 0.05 s, so the average emf induced in the circular coil equals ..... .

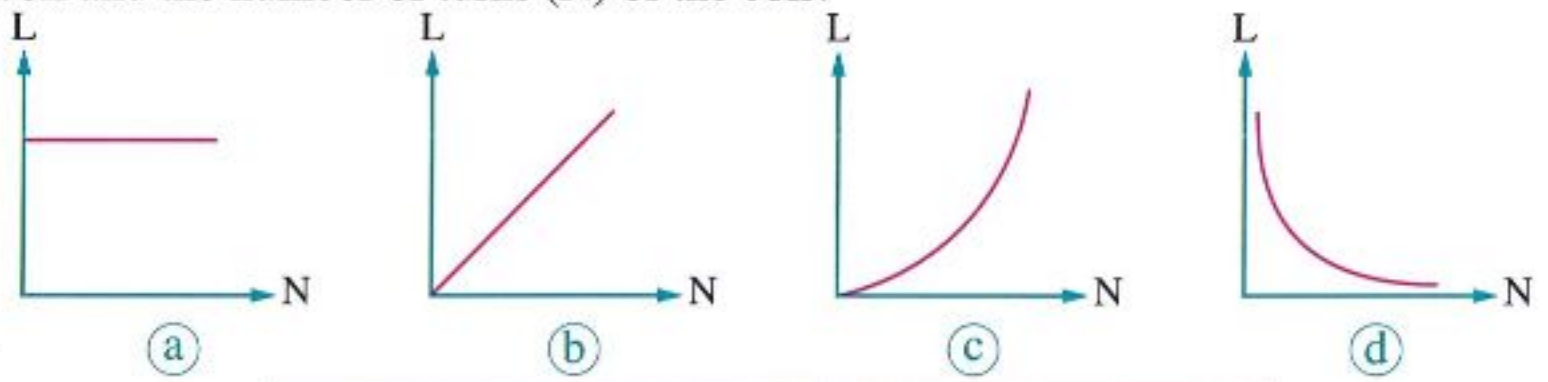
(a) 2.49×10^{-3} V (b) 4.32×10^{-3} V (c) 6.34×10^{-3} V (d) 7.12×10^{-3} V

Self induction of the coil

28 The self inductance of a coil is measured in a unit called henry which is equivalent to ..... .

(a) volt.s (b) ohm.s (c) ohm/s (d) volt.s.ampere

29 Which of the following graphs represents the relation between the self inductance (L) of a coil and the number of turns (N) of the coil?



(a) (b) (c) (d)

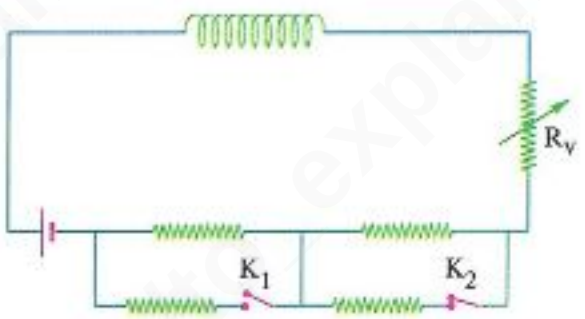
30 After a while of the flow of a direct electric current in an inductor, its intensity becomes constant due to ..... .

(a) generation of forward currents (b) generation of eddy currents
(c) vanishing of self induction (d) presence of back currents

31 The slow rate of growth of the current in a solenoid coil at the moment of closing its circuit is due to the ..... .

(a) generation of forward induced current
(b) generation of back induced emf
(c) loss of energy of the electric charges in the coil
(d) increase of the ohmic resistance in the circuit

32 In the opposite electric circuit, which of the following actions, each individually causes the generation of forward induced emf in the solenoid?



(a) Closing switch (K_1).
(b) Opening switch (K_2).
(c) Decreasing the value of the resistor (R_v).
(d) Inserting an iron rod in the solenoid.