Exam 1 April

1) Element (X) is from 1st transition series and followed by element (Z) in the series, Z is the most difficult to be oxidized from Z^{2+} to Z^{3+}. The element (X) is ---- (Ch 1)

a) Fe b) Mn c) Cu d) Zn

2) Which of the following transition elements has lowest third ionization potential? (Ch 1)

a) Ni b) Cr c) Mn d) Co

3) The process that take place in the extraction of iron from iron ore follows the following sequence ---- (Ch 1)

a) roasting – crushing – reduction
b) crushing – oxidation - roasting
c) sintering – reduction - steel production
d) crushing - sintering - reduction

4) Which of the following are the correct f steps to convert iron (II) sulphate to iron? (Ch 1)

a) Oxidation - reduction - thermal decomposition
b) Thermal decomposition - oxidation - reduction
c) Reduction - oxidation - thermal decomposition
d) Thermal decomposition – reduction

5) Which of the following is the product from passing water vapor on red-hot iron and then adding a concentrated acid to the resulting substance? (Ch 1)

a) Iron (II) salts and water
b) Iron (III) salts and water
c) Iron (II) salts and Iron (III) salts only
d) Iron (II), Iron (III) salts and water

6) In front of you a section of the periodic table with four consecutive elements [A, B, C, and D], which of the following is correct? (Ch 1)

a) Element C has a higher density than D
b) Maximum oxidation number of (B) lower than that of (A)
c) Element D has a higher ionization potential than C
d) Element A has a lower atomic radius than B

7) Which of the following salts forms a mixture of gases in adding hot concentrated sulphuric acid? (Ch 2)

a) Lead (II) nitrate b) Zinc carbonate c) Copper (II) sulphate d) Sodium acetate

8) Adding silver nitrate solution to (X) salt solution, white precipitate is formed. Adding sodium carbonate solution to (X) salt solution, white precipitate is formed.
-So, the salt (X) is ----- (Ch 2)

a) NaCl b) $Pb(NO_3)_2$ c) $CaCl_2$ d) K_2SO_4

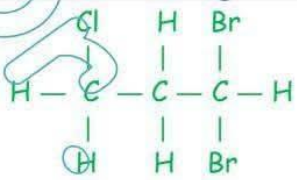
9) If the following experiments are carried out on a salt solution ----
1- Adding $BaCl_2$ solution does not produce any precipitate
2- Adding NaOH solution produces a reddish-brown precipitate
3- Addition of $AgNO_3$ solution produces a white colored precipitate
-Which salt is most likely present in the solution? (Ch 2)

a) $FeCl_3$ b) Na_2CO_3 c) $FeCl_2$ d) $CuSO_4$

9) Which analytical group can be precipitated by acidic Hydrogen sulphide ? (Ch 2)

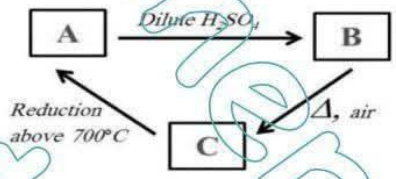
a) The third analytical group
b) The second analytical group
c) The fifth analytical group
d) The first analytical group

10) What is the IUPAC name of the following formula of a halogenated alkane ? (Ch 5)



a) 3,3-Bromo-1-Chloropropane
b) 1,1-Dibromo-3-chloropropane
c) 1,1-Bromo-3-chloropropane
d) 3,3-Dibromo-1-chloropropane

11) Study the following diagram, then Find out A, B and C (Ch 1)



a) A: Fe , B: $FeSO_4$, C: Fe_2O_3
b) A: Fe , B: $Fe_2(SO_4)_3$, C: Fe_2O_3
c) A: $FeCl_3$, B: $FeSO_4$, C: Fe_2O_3
d) A: Fe_2O_3, B: FeSO4, C: Fe

12) Dilute hydrochloric acid could be used to distinguish between ---- (Ch 2)

a) Na_2CO_3 and $NaHCO_3$
b) Na_2SO_4 and NaCl
c) Na_2SO_3 and NaCl
d) Na_3PO_4 and NaI

13) During the reversible reaction, Which of the following represents the graph relating concentration and time ? (Ch 3)

a) The concentration of reactant decreases until it completely consumed.
b) The concentration of product increases and concentration of reactant decreases until they reach a constant concentration.
c) The concentration of both reactants & products increase until they reach equilibrium.
d) There is no change in the concentration of both reactants & products since the beginning of the reaction.

14) How many hours for a current of 5 Ampere strength is needed to precipitate 6.35 g of Copper from Copper sulphate solution, the cathode reaction is:

$Cu^{+2}_{(aq)} + 2e^- \rightarrow Cu_{(s)}$ (Cu=63.5g). (Ch 4)

a) 0.5 h
b) 1.07 h
c) 1.5 h
d) 2.3 h

15) The standard electrode potential, E, is measured under standard conditions. Which of the following is not a standard condition when measuring these values? (Ch 4)

a) Temperature of 298 K (25 C)
b) Concentration of solution is 1 M
c) KNO_3 solution in the salt bridge
d) Measuring against standard hydrogen electrode

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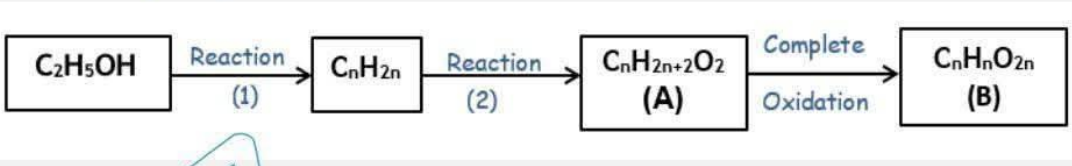
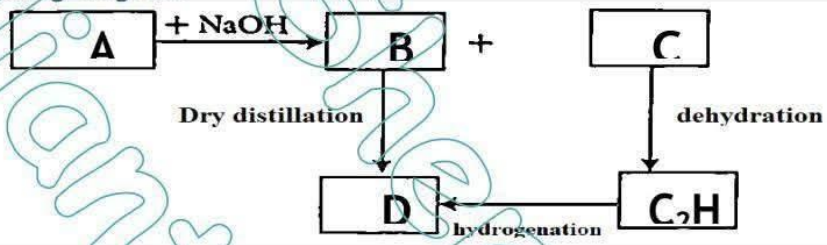
44) Study the following diagram:



-Which of the following is the correct answer ?

	Reaction(1)	Compound (A)	Compound (B)
A	Dehydration	Acid	Dicarboxylic acid
B	Catalytic hydration	Acid	Dihydroxy alcohol
C	Dehydration	Glycol	Dicarboxylic acid
D	Catalytic hydration	Glycol	Dihydroxy alcohol

45) Study the following diagram (Ch 5)



-Which of these compounds?

a) Reacts with metals forming alkoxide:

b) Gives by ammonolysis, organic acid amid

c) Hydrocarbon that reacts by substation

d) The acid of salt (B)

46) Choose from the following compounds: (Ch 1)

Cu_2Cl_2, $ScCl_3$, $FeCl_3$, $ZnCl_2$

a) Compound has paramagnetic properties: ----------

b) A compound of a non-transition element: ----------

c) A compound of transition element whose cation's oxidation state matches its group number: ----------

d)A compound of transition element has one oxidation state: ----------

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10) 1L of (0.4M) iron II sulphate solution was added to 1L of (0.6 M) sodium hydroxide solution. the mass of the formed precipitate is:
($FeSO_4$ = 154 g/mol), (NaOH = 40 g/mol) , ($Fe(OH)_2$ = 90 g/mol) (Ch 2)

a) 27 g b) 54 g c) 70.1 g d) 120.2 g

11) Which of the following pairs can be used to detect the ions of calcium chloride salt in its solution by using solutions of? (Ch 2)

a) Silver nitrate - sodium hydroxide
b) Barium chloride - sodium nitrate
c) Barium sulphate - ammonium hydroxide
d) Silver nitrate - sodium sulphate

12) Three samples of solution X , the following experiments done to each

1- Adding dil. HCl to solution	No reaction
2- Adding diluted sulphuric acid	No reaction
3- Adding excess NaOH and filtration	No ppt. is found

So the solution may contain cation ---- (Ch 2)

a) Ag^+ b) Pb^{2+} c) Fe^{2+} d) Al^{3+}

13) A solution containing (1 g) of impure sodium hydroxide, 40 ml of 0.1 M hydrochloric acid was needed to titrate it, what is the percentage of impurities in the sample? (Ch 2)

a) 16% b) 32 % c) 64 % d) 84 %

14) Which one of the following reactions is irreversible? (Ch 3)

a) $2NO_{(g)} + O_{2(g)} = 2NO_{2(g)}$ (Closed vessel)
b) $CH_3COOH_{(l)} + C_2H_5OH_{(l)} = CH_3COOC_2H_{5(aq)} + H_2O_{(l)}$
c) $HCl_{(aq)} + NaOH_{(aq)} = NaCl_{(aq)} + H_2O_{(l)}$
d) $N_{2(g)} + 3H_{2(g)} = 2NH_{3(g)}$ (Closed vessel)

15) In the following equilibrium reaction: $2NO_{2(g)} \rightleftharpoons N_2O_{4(g)}$ (Kp = 20)
-The value of Kp for decomposition of 92 gm of N_2O_4 equals ---- (Ch 3)

a) 40 b) 25×10^{-3} c) 5×10^{-2} d) 0.22

16) At equilibrium A+ B ⇌ 2C, the equilibrium constant Kc = 0.04, which of the following are the final concentrations of A , B, and C at equilibrium? (Ch 3)

	[A] (M)	[B] (M)	[C] (M)
a)	0.89	0.02	0.33
b)	0.5	0.89	0.02
c)	0.89	0.89	0.18
d)	0.48	0.48	0.52

28) Two compounds X and Y have the following formulas ----
-small piece of sodium is added to the compound (X) , and hydrochloric acid is added to the compound (Y)
-Which of the following is correct? (Ch 5)

Compound	Formula
Aliphatic X	$C_nH_{2n+2}O$
Aromatic Y	C_nH_nO

a) No reaction occurs for X, and an aromatic halogen compound forms for Y.
b) Sodium alkoxide forms for X, and an aromatic halogen compound forms for Y.
c) No reaction occurs for both X and Y.
d) Sodium alkoxide forms for X, and no reaction occurs for Y.

29) Three organic compounds A, B and C with the same molar mass are arranged by their boiling point as follows: A < B < C. Compounds (A) and (C) are isomers.
Which of the following is correct? (Ch 5)

Option	C	B	A
A	Methyl ethanoate	Ethanoic acid	1-propanol
B	Ethanoic acid	1-propanol	Methyl Methanoate
C	Ethanoic acid	1-propanol	Methyl ethanoate
D	1-propanol	Ethanoic acid	Methyl ethanoate

30) According to the following equations:

$$Al^{3+}_{(aq)} + 3e^- \rightarrow Al(s) \text{ , } E^\circ = -0.76 \text{ V}$$

$$Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn(s) \text{ , } E^\circ = -0.76 \text{ V}$$

- The emf for the equation: $2Al_{(s)}^0 + 3Zn^{2+}_{(aq)} \rightarrow 2Al^{3+}_{(aq)} + 3Zn_{(s)}$ is ----- (Ch 4)

a) +2.43 V b) +0.91 V c) -2.43 V d) -0.91 V

31) From the opposite table, all the following are correct, except: (Ch 4)

Half-reaction	Reduction potential (E^0)
$A^+ + e^- \rightarrow A^0$	+0.8 V
$B^{2+} + 2e^- \rightarrow B^0$	-0.26 V
$C^+ + e^- \rightarrow C^0$	-2.711 V

a) A+ is the best oxidizing agent.
b) C is the best reducing agent.
c) B oxidizes in the presence of A.
d) A precedes B in the electrochemical series.

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9) Which of the following solutions can be used to distinguish between AgI and Ag_3PO_4 ? (Ch 2)

a) Sodium chloride solution.
b) Ammonia solution.
c) Silver nitrate solution.
d) Dilute hydrochloric acid.

10) Diluted hydrochloric acid can be used to detect the ions of the salts ----- (Ch 2)

a) $FeSO_4$ b) $HgSO_4$ c) Na_2S d) Ag_2S

11) Which of the following ions could be separated from their salt solution by using barium chloride solutions? (Ch 2)

a) Ag^+/SO_4^{2-} b) Na^+/Ag^+ c) Cu^{2+}/PO_4^{3-} d) K^+/Al^{3+}

12) A volume of water is added to a 0.8 M solution, resulting in 400 mL of a 0.2 M solution. The volume of water added is ----- (Ch 2)

a) 100 mL b) 200 mL c) 300 mL d) 400 mL

13) Which of the following is the number of moles of water crystallization in washing soda ($Na_2CO_3 \cdot XH_2O$) if its molar mass equals 286 ?(Na=23, C=12, O=16, H=1.) (Ch 2)

a) 6 b) 8 c) 10 d) 12

14) In the following reaction:

$$Mg_{(s)} + H_2SO_{4(aq)} \xrightarrow{dil} MgSO_{4(aq)} + H_{2(g)}$$

The amount of hydrogen gas in a unit of time increases by ---- (Ch 3)

a) increasing the pressure
b) increasing the container volume
c) increasing sulfuric acid concentration
d) decreasing the temperature

15) In the following equilibrium reaction: $A_{2(g)} + 3B_{2(g)} \rightleftharpoons 2AB_{3(g)}$, $\Delta H < 0$
Which of the following factors increases the rate of the reverse reaction? (Ch 3)

a) Lowering pressure and cooling.
b) Lowering pressure and heating.
c) Using a catalyst and cooling.
d) Using a catalyst and reducing container volume.

16) Which of the following equations represents the following relationship ? (Ch 3)

$$Kc = \frac{1}{[Y_2]^3}$$

a) $2X_{(g)} + 3Y_{2(s)} \rightarrow 2XY_{3(l)}$.
b) $2X_{(s)} + 3Y_{2(g)} \rightarrow 2XY_{3(s)}$.
c) $2X_{(s)} + 3Y_{2(s)} \rightarrow 2XY_{3(s)}$.
d) $2X_{(g)} + 3Y_{2(l)} \rightarrow 2XY_{3(l)}$.

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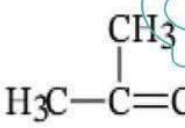
33) Which of the following consecutive combinations will lead to obtaining cyclohexane from normal hexane? (Ch 5)

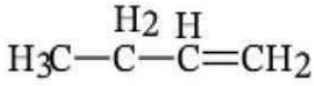
a) Catalytic reforming followed by oxidation.
b) Polymerization followed by reduction.
c) Polymerization followed by oxidation.
d) Catalytic reforming followed by reduction.

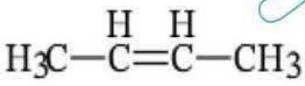
34) Which two compounds would react to give the following compound? (Ch 5)

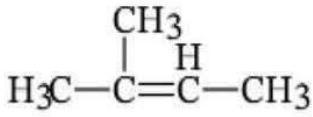
a) Benzene and Sulfur dioxide.
b) Benzene and Sulfuric acid.
c) Toluene and Sulfuric acid.
d) Toluene and Hydrogen sulfide.

35) Which of the following alkenes is a possible product upon the dehydration of one mole of 1-butanol? (Ch 5)

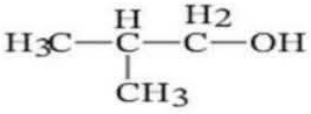
a) 

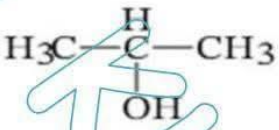


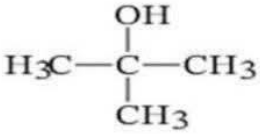
c) 

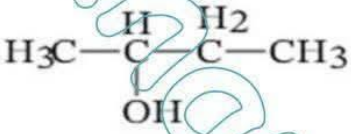
d) 

36) Alkaline hydrolysis of tertiary butyl iodide, gives ----- (Ch 5)

A 

C 



D 

37) Which of the compounds has the lowest boiling point? (Ch 5)

a) 1,3 – propan - diol ($C_3H_8O_2$)
b) 1 - propanol (C_3H_8O)
c) ethyl methanoate ($C_3H_6O_2$)
d) propanoic acid ($C_3H_6O_2$)

38) An ester (A) with molecular formula $CH_3COOC_6H_5$, What are the ammonolysis products of an ester (B) which considered isomer of (A)? (Ch 5)

a) Acetamide , Benzoic acid
b) Acetamide, Phenol
c) Benzamide , Ethanol
d) Benzamide , Methanol

39) Which of the following reagents could be used to differentiate between aspirin and marookh oil? (Ch 5)

a) Sodium carbonate
b) Sodium hydroxide solution
c) Sodium bromate
d) Ethyl alchol solution

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19) Dissolving 18.5 g of Calcium hydroxide in 0.5 L Nitric acid (2 molar) , so the resulting solution will be [$Ca(OH)_2$ = 74 g/mol] (Ch 2)

a) neutral b) acidic c) alkaline d) amphoteric

20) An hydrated metal salt has the chemical formula $XBr_2.6H_2O$.When a 4.578 g sample of the salt is heated, the sample decreases in mass by 1.515 g. Which of the following is the identity of metal X. [Br = 80, H = 1, O = 16] (Ch 2)

a) Mn [M=55 g/mol] b) V [M=51 g/mol]

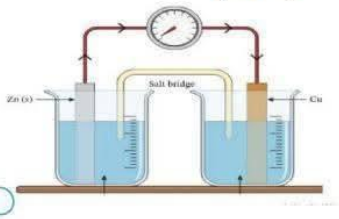
c) Cu [M=63.5 g/mol] d) Co [M=58.35 g/mol]

21) Calculate the volume of evolved chlorine when passing 19300 Coulombs in a solution of copper II chloride between two platinum electrodes. (Ch 2)

a) 11.2L b) 22.4 L c) 2.24 L d) 1.12 L

22) Consider the figure below:
What may cause the electric current to stop flowing? (Ch 4)

a) The full consumption of the Cu^{2+} ions
b) Removing the salt bridge
c) The full consumption of the Cu electrode
d) Both (a) and (b) are correct.



23) If you know that, the standard reduction potentials of (Ni =- 0.23 V), (Fe =- 0.41V), (Cu=+0.34 V), (Al =- 1.67 V) (Ch 4)

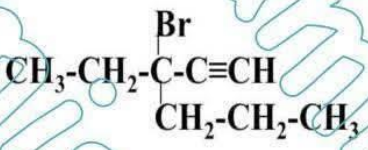
a) copper oxidized aluminum and doesn't oxidize iron
b) nickel reduced iron and doesn't reduce copper
c) aluminum oxidized iron and doesn't oxidize copper
d) iron oxidized aluminum and reduced nickel

24) You have oxidation potentials of some elements, which of them is the best reducing agents ? (Ch 4)

a) 3 Volts b) 2.3 Volts c) zero Volt d) - 2.8 Volts

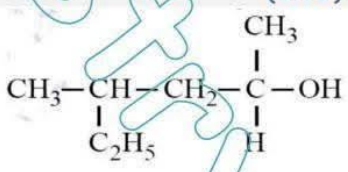
25) The IUPAC name of the following compound is :----- (Ch 5)

a) 3- bromo hexene
b) 4 - bromo hexene
c) 3 – bromo - 3 - propyl hex-4-ene
d) 3 – bromo – 3 - ethyl hexyne



26) The IUPAC name of the following ---- (Ch 5)

a) 3 - methyl hexan – 5 - ol
b) 4 - methyl hexan - 1 - ol
c) 4 - ethyl pentan – 2 - ol
d) 4 - methyl- 2 - hexanol



27) Which of the following pairs represent isomers? (Ch 5)

a) Propanol and Propanal b) Pentane and 2,2 - dimethyl butane
c) Propanone and dimethyl ether d) Butanoic acid and 2-methyl propanoate

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40) A, B and C are three organic compounds:
* Compound (A) reacts with HCl, but does not react with NaOH
* Both (B) and (C) react with NaOH and do not react with HCl.
* Only compound (B) gives effervescence on reacting with NaHCO3
Identify the organic families that A, B and C belong to, (Ch 5)

(a)	(A) Phenol	(B) Alcohol	(C) Acid
(b)	(A) Alcohol	(B) Phenol	(C) Acid
	(A) Alcohol	(B) Acid	(C) Phenol
(d)	(A) Phenol	(B) Acid	(C) Phenol

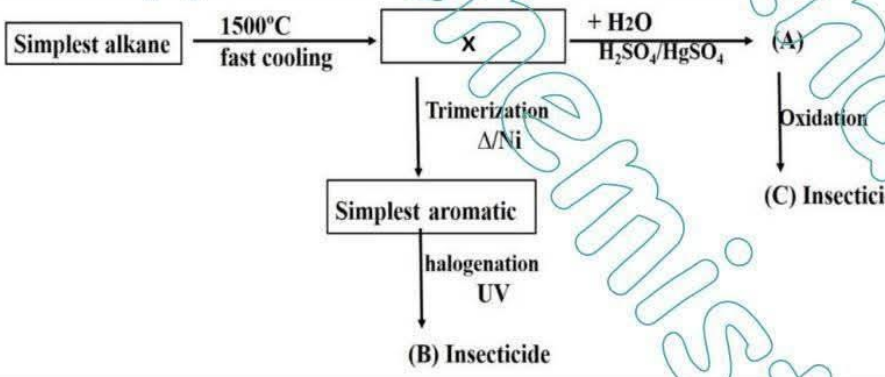
41) Heating Ethyl alcohol with concentrated Sulphuric acid in different conditions, give three different products, Which of these products respond to the polymerization by addition? (Ch 5)
a) Di ethyl ether b) Acetone c) Ethylene d) Ethyl hydrogen sulphate

42) Calculate the volume of water that should be added to 1L of 0.05 M Hcl acid in order for its pH value to become 2 . (Ch 5)
a) 1L b) 4 L c) 5 L d) 9L

43) The compounds which can be similar in physical and chemical character ----- (Ch 5)
a) $C_{20}H_{42}$ and $C_{18}H_{38}$ b) C_8H_{18} and $C_{18}H_{38}$ c) C_3H_6 and $C_{15}H_{32}$ d) C_6H_{12} and C_6H_6

44) (A) and (B) are two Aliphatic compounds, compound (A) produced from acidic hydrolysis of aspirin while compound (B) used in condensation reaction to prepare dacron fibers ---- (Ch 5)
a) acetic acid, terphthalic acid b) salicylic acid, terphthalic acid
c) acetic acid, ethylene glycol d) salicylic acid, ethylene glycol

45) Essay: Study the following figure: (Ch 5)



-What are the names of compounds (B) and (C)
Gamixane – Acetic acid.
-What is the name of compound produced from reduction of (A)
Ethyl alcohol
-Write the polymer obtained from adding 1 mole of HCl to Compound X.
P.V.C.

46) What is the similarity and difference between copper and zinc ions in CuCl and $ZnSO_4$ respectively. (Ch 1)

CuCl	Cu^+	|	$ZnSO_4$	Zn^{2+}
$[_{18}Ar], 4S^0, 3d^{10}$		|	$[_{18}Ar], 4S^0, 3d^{10}$	

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Exam 2 February

1) Which one of the following pairs paramagnetic? (Ch 1)

a) $_{30}Zn^{+2}$ and $_{26}Fe^{+2}$
b) $_{21}Sc^{+3}$ and $_{26}Fe^{+2}$
c) $_{30}Zn^{+2}$ and $_{24}Cr^{+2}$
d) $_{26}Fe^{+2}$ and $_{24}Cr^{+2}$

2) The number of main transition elements in first and second series are ----- (Ch 1)

a) 20 elements. b) 32 elements c) 18 elements d) 16 elements

3) The ions which have the electronic configuration $[_{18}Ar]$, $3d^4$ are ---- (Ch 1)

a) $_{25}Mn^{+2}$ and $_{27}Co^{+2}$
b) $_{26}Fe^{+3}$ and $_{24}Cr^{+3}$
c) $_{24}Cr^{+2}$ and $_{25}Mn^{+3}$
d) $_{26}Fe^{+2}$ and $_{27}Co^{+3}$

4) The atomic radii of d-block elements from chromium to copper are relatively constant, Which of the following causes this phenomenon? (Ch 1)

a) Electrons filling the 3d orbital.
b) Increasing nuclear charge.
c) Greater repulsion between 3d electrons.
d) Answers (b) and (c) are correct.

5) All the following from the properties of titanium except ---- (Ch 1)

a) can form different oxides as TiO, Ti_2O_3 and TiO_2
b) rigid and strong metal with low density
c) does not cause any poisoning effect so body when implanted
d) its melting point lower than aluminum

6) During Haber-method to prepare Ammonia: $N_{2(g)} + 3H_{2(g)} = 2NH_{3(g)}$. Which of the following conditions are suitable to increase amount ammonia ? (Ch 3)

a) Increasing pressure and adding zinc powder.
b) Decreasing pressure and adding iron powder.
c) Increasing pressure and adding iron powder.
d) Decreasing pressure and adding zinc powder.

7) Which of the following processes does not aim to improve the physical and mechanical properties of iron ore? (Ch 1)

a) Sintering process.
b) Roasting process.
c) Crushing process.
d) Concentrating process.

8) Which of the following alloys its elements are chemically combined? (Ch 1)

a) Alloys used in heating coils and electric furnaces.
b) Alloys used in real way tracks.
c) Cementite.
d) Bauxite.

9) Oxygen converter is charged with ----- (Ch 1)

a) hematite b) carbon dioxide c) molten iron d) iron III oxide

10) Reactions of iron with acids depend on ----- (Ch 1 & 2)

a) type of acid and its amount
b) amount of acid and its concentration
c) type of acid and its concentration
d) basicity of acid and its amount

2) The rate of formation of ammonia gas prepared from its two elements increases with increasing pressure.

Because: The reaction is: $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$
This is a reversible gaseous reaction where 4 moles of reactants (1 N_2 + 3 H_2) produce 2 moles of product (NH_3).
According to Le Chatelier's Principle, increasing pressure favors the side with fewer gas molecules — in this case, the product side.
Higher pressure also increases the frequency of collisions between N_2 and H_2 molecules, thus increasing the rate of effective collisions and speeding up the formation of ammonia.
Increasing pressure shifts the equilibrium toward ammonia and increases the rate by enhancing molecular collisions.

B) Give reasons for the following:

3) A high excise tax is imposed on pure ethanol with a concentration of (96%).

Because: Ethanol (96%) is highly concentrated and can be used as an alcoholic beverage or in the illegal production of spirits, due to its intoxicating effects.
Governments impose high excise taxes on such substances to:
Limit misuse or illegal distribution for recreational drinking.
Control consumption due to its potential health risks.
Generate revenue, as ethanol is also used industrially and commercially in solvents, fuels, and disinfectants.
The high tax discourages abuse for non-industrial purposes and helps regulate its distribution and consumption.

C) Write one use of the following:

1) Aluminum alloys with manganese :

Used in the manufacture of beverage cans.

2) Water gas.

Used as a fuel in industrial processes and for synthesizing other chemicals like methanol.
Example use: It serves as a reducing agent in the extraction of metals from their ores, such as in the reduction of iron oxide in blast furnaces.

3) $LiPF_6$

(Lithium hexa-fluoro-phosphate) is used as an electrolyte salt in lithium-ion batteries.
Reason: It provides high ionic conductivity and stability in organic solvents, making it essential for efficient energy storage in rechargeable batteries used in smartphones, laptops, and electric vehicles.

Q4: (A) Choose the correct answer from the answers given for each of the following statements:

1) The law of mass action can be applied to a solution of ----

a) NaOH b) NH_4OH c) H_2SO_4 d) H_3PO_4

2) When NH_4OH solution is added to the product of the reaction of iron with chlorine, a precipitate is formed ----

a) greenish-white b) white c) blue d) reddish-brown

3) The number of binary alcohols in its molecular formula $C_6H_{14}O$ is equal to -----

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

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C) 300 ml of HCl solution was added to a silver nitrate solution.
When the precipitate was filtered and dried, its mass was found to be 5.74 g.
This is equivalent to 6 ml of potassium hydroxide solution and 40 ml of the same acid solution.
Knowing that: [Ag = 108, Cl = 35.5, H = 1]
From the above information, choose the correct answer for each of the following statements:

1) The mass of hydrochloric acid is equal to ----

a) 2.92 g	b) 0.73 g	c) 1.46 g	d) 2.12 g

2) The concentration of hydrochloric acid is equal to ----

a) 0.04 M	b) 1 M	c) 0.4 M	d) 0.8 M

3) The concentration of potassium hydroxide is equal to -----

a) 2.5 M	b) 0.5 M	c) 0.75 M	d) 1 M

Q 3: Put the appropriate scientific term from between the brackets after each of the following statements: (Polytetrafluoroethylene - Methyl orange - Methyl salicylate - Homologous series - Hydroxide number - Roasting processes - Mercury cell - pH - Molecular similarity - Bromothymol blue - Concentration processes - Fuel cell)

1) A small, sealed galvanic cell using potassium hydroxide as the electrolyte.

[Fuel cell]

2) Processes carried out to increase the percentage of iron by separating impurities from raw materials.

[Concentration processes]

3) Indicator turns light green in neutral medium.

[Bromothymol blue]

4) Negative logarithm (to base 10) of hydrogen ion concentration.

[pH]

5) A group of compounds that are united by a general molecular law and share common chemical properties.

[Homologous series]

6) An organic compound used as a topical ointment to relieve rheumatic pain.

[Methyl salicylate]

B) Give reasons for the following:
1) Phenol reacts with halogen acids.

because: Phenol contains a hydroxyl group (–OH) directly attached to an aromatic ring. The oxygen atom in this group has lone pairs of electrons, making it partially negatively charged and nucleophilic in nature.
Phenol reacts with halogen acids due to the nucleophilic nature of the –OH group and the activation of the benzene ring toward electrophilic substitution.

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3rd Secondary Azhar Exam 2025

Q1 (A) Choose the correct answer from the answers given for each of the following statements:

1) There is ----- gas in coal mines.

a) ethane b) methane c) propane d) ethene

2) To neutralize 20.5 ml of 0.1 M NaOH solution, 25 ml of .... dibasic acid solution is required.

a) 0.041 M b) 0.081 M c) 0.121 M d) 0.164 M

3) Fehling's solution is used to detect glucose from the color -----

a) orange to blue b) red to blue
c) blue to orange d) orange to green

4) In the opposite reaction: $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ + Energy
The formation of sulfur trioxide increases when ----

a) increasing the temperature b) reducing oxygen
c) decreasing the temperature d) adding a catalyst

5) Positive ions in the electrolytic solution ----

a) move toward the cathode
b) their charge is neutralized by gaining electrons
c) are reduced at the cathode
d) all of the above

6) The compound resulting from the reaction of a dibasic organic acid with an antifreeze in car radiators is -----

a) Aspirin b) Dacron c) Moisturizing oil d) Methyl benzoate

B) Explain with balanced chemical equations how to obtain:

1) Iron II sulfide from iron III hydroxide.

Step 1: Reduce $Fe(OH)_3$ to Fe^{2+}: $2Fe(OH)_3 + H_2 \rightarrow 2Fe(OH)_2 + H_2O$
Step 2: React $Fe(OH)_2$ (or Fe^{2+} solution) with a sulfide source $Fe(OH)_2 + H_2S \rightarrow FeS + 2H_2O$

2) Dihydroxy alcohol from suitable alkyl halide.

Step 1: Choose a suitable alkyl halide
Use a dihalide such as 1,2-dibromoethane ($Br–CH_2–CH_2–Br$).
Step 2: React with aqueous KOH (hydrolysis)
$BrCH_2CH_2Br + 2KOH_{(aq)} \xrightarrow{\Delta} HOCH_2CH_2OH + 2KBr$

C) When an electric charge of 58233°C is passed through an aqueous solution of element X chloride, 11.23% of it precipitates. Calculate the atomic mass of element X, knowing that the cathode reaction is $X^{3+} + 3e^- \rightarrow X$

We are given: Charge (Q) = 58233 C
Precipitated mass = 11.23% of total (but not total mass — it's a percent, so we'll treat this symbolically first)
Cathode reaction: $X^{3+} + 3e^- \rightarrow X$
We are to calculate the atomic mass (molar mass) of element X.
Step 1: Use Faraday's Law

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17) Which of the following choices is correct during the discharge of a lead-acid accumulator? (Ch 4)

a) The concentration of the electrolyte increases, and a lead (II) cation is formed at the anode.
b) The concentration of the electrolyte increases, and a lead (IV) cation is formed at the cathode.
c) The concentration of the electrolyte decreases, and a lead (IV) cation is formed at the anode.
d) The concentration of the electrolyte decreases, and a lead (II) cation is formed at the anode.

18) The following table represents the reduction potentials of the elements X,Y,Z ----
If the elements X and Y are coated with Z separately, which of the following represents the correct protection method? (Ch 4)

Element	X	Y	Z
Reduction potential	+1.1	-2.5	-1.5

a) Cathodic protection for X and anodic protection for Y.
b) Anodic protection for X and cathodic protection for Y.
c) Anodic protection for X and Anodic protection for Y.
d) Cathodic protection for X and Cathodic protection for Y.

19) A current of 2 A is passed for 10 minutes through the molten oxide of a metal.
What is the volume of oxygen gas produced? (Ch 4)

a) 0.1392 L b) 0.0696 L c) 0.0031 L d) 0.0995 L

20-In the following reactions: $CH_3(CH_2)_5COONa \xrightarrow{NaOH\ /\ CaO\ +\ heat} X + A$
1- Catalytic reforming of X→Y
2- Halogenation of Y in direct sunlight → Z (Ch 5)
Which of the following describes the number of compounds resulting from the above reactions?

Option	Aliphatic Organic Compound	Aromatic Organic Compound	Inorganic Compound
A	2	0	2
B	2	1	1
C	1	1	2
D	1	2	1

21) The most acidic compound produced from ---- (Ch 5)
a) reduction of phenol
b) oxidation of ethylene in alkaline medium
c) complete oxidation of methanol
d) Alkaline hydrolysis of alkyl halides

22) Which of the following steps is correct to obtain para-chloro toluene from calcium carbide? (Ch 5)

a) Substitution halogenation → Alkylation → Triple polymerization → Water addition.
b) Water addition → Triple polymerization → Alkylation → Substitution halogenation.
c) Alkylation → Substitution halogenation → Water addition → Triple polymerization.
d) Water addition → Alkylation → Triple polymerization → Substitution halogenation.

24) Considered the following equilibrium system

$$Br_{2(aq)} + H_2O_{(l)} \rightarrow Br^-_{(aq)} + 2H^+_{(aq)} + OBr^-_{(aq)}$$

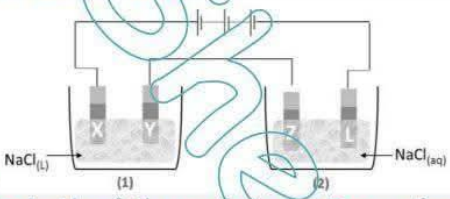
The aqueous Bromine is characterized by a yellowish-brown colour but the Br^- and OBr^- are colorless, Thus it is expected that the colour of Bromine will be fade upon the addition of ----

a) H_2SO_4 b) KOBr c) $AgNO_3$ d) KBr

25) Which indicator is not used to differentiate between distilled water and acetic acid solution ?

a) Litmus b) Phenol Phethalein
c) Methyl orange d) Bromothymol blue

26) In the opposite diagram:
Cell (1) contains molten sodium chloride
Cell (2) contains aqueous solution of sodium chloride



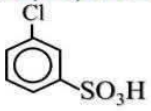
An electrolysis process is made for both of them, the substances formed at the electrodes (X, Y, Z, and L) are ----

	X	Y	Z	L
a	Cl_2	Na	Cl_2	H_2
b	H_2	Cl_2	Na	Cl_2
c	Cl_2	Na	Na	Cl_2
b	Cl_2	Na	Na	O_2

27) Which of the following occurs upon the addition of 3 moles of bromine dissolved in CCl_4 to one mole of 2-Butene?

a) The intensity of red color of Bromine decreased
b) The red color of Bromine water discharged.
c) The red color changed into green.
d) The intensity of red color remains unchanged.

28) Which of the following choices suitable to prepare the following compound?



a) Chlorination of benzene then Sulphonation b) Sulphonation of Chlorobenzene
c) Chlorination of benzene sulphonic acid d) No suitable answer

29) Calculate the Pressure of Nitrogen for the following equilibrium:

$$N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)} \quad [Kp=25x10^{-5}]$$

Giving: pressure of Hydrogen and Ammonia are 6.8 and 0.4 atm.

a) 10 atm b) 20 atm c) 30 atm d) 40 atm

30) Which of the following pairs used to detect Lead acetate .....

a) S^{2-} and PO_4^{-3} b) Fe^{2+} and SO_4^{-2} c) S^{2-} and SO_4^{-2} d) NO_2^{1-} and Cl^{-1}

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17) The ionization constants (Ka) of four acids are provided in the table below.
- Arrange the in ascending order according to pH (Ch 3)

Acid	Ka	Ca
(P)	3.2×10^{-4}	0.01
(Q)	2.5×10^{-6}	0.2
(R)	9.8×10^{-2}	0.02
(S)	5.6×10^{-5}	0.4

a) (Q) < (P) < (S) < (R)
b) (P) < (Q) < (R) < (S).
c) (R) < (S) < (P) < (Q).
d) (Q) < (S) < (P) <(R).

18) If the solubility product (Ksp) of the salt AB_3 is 2.7×10^{-11}, what is the concentration of $[B^-]$ in the solution? (Ch 3)

a) 3×10^{-4} M b) 27×10^{-3} M c) 1×10^{-3} M d) 3×10^{-3} M

19) For the following saturated solution :

$$BaSO_{4(s)} \rightleftharpoons Ba^{2+}_{(aq)} + SO_4{}^{2-}_{(aq)}$$

Which of the following salts solutions does not change the equilibrium state? (Ch 3)

a) $K_2SO_{4(aq)}$ b) $NaCl_{(aq)}$ c) $Ba(NO_3)_{2(aq)}$ d) $H_2SO_{4(aq)}$

20) In the reaction A + B ⇌ C + D, the values of the equilibrium constant (Kc) at two different temperatures were:
- Kc = 50 at 27 °C Kc = 10 at 120 °C
Which of the following statements is correct? (Ch 3)

a) The reaction shifts forward as temperature increases.
b) The reaction shifts backward as pressure increases.
c) The reaction is not affected by temperature changes.
d) This reaction is exothermic.

21) If degree of ionization of $NH_4OH = 1.8 \times 10^{-5}$, the number of ionized moles in 500 ml of 0.2 M equals: (Ch 2 & 3)

a) 1.8×10^{-5} b) 3.6×10^{-5} c) 3.6×10^{-4} d) 1.8×10^{-6}

22) The following reaction occurs in a electrochemical cell:

$$X_{(s)} + 2Y^+_{(aq)} \rightarrow X^{2+}_{(aq)} + 2Y_{(s)}$$

If: $X^{2+}_{(aq)} \rightarrow X_{(s)}$, $E^\circ = -0.56$ V , $Y^+_{(aq)} \rightarrow Y_{(s)}$, $E^\circ = +0.23$ V
So the cell is: (Ch 4)

a) galvanic and e.m.f.= 0.23 volt b) galvanic and e.m.f.= 0.79 volt
c) electrolytic and e.m.f.= - 0.23 volt d) electrolytic and e.m.f.= - 0.79 volt

23) The half-reaction that occurs at the anode during electrolysis of molten sodium bromide is: (Ch 4)

a) $2Br^- \rightarrow Br_2 + 2e^-$ b) $Br_2 + 2e^- \rightarrow 2Br^-$
c) $Na^+ + e^- \rightarrow Na$ d) $Na \rightarrow Na^+ + e^-$

B) Compare each of the following with chemical equations.

1- Dry distillation of sodium acetate	Dry distillation of sodium benzoate
2- Cathode reaction in a fuel cell	Cathode reaction in a lead-acid battery
3- Reaction of benzene with chlorine by addition	Reaction of benzene with chlorine by substitution

Feature	Sodium Acetate	Sodium Benzoate
Reactant	CH_3COONa	C_6H_5COONa
Type of hydrocarbon formed	Alkane	Aromatic hydrocarbon
Main product	Methane (CH_4)	Benzene (C_6H_6)
By-product	Sodium carbonate (Na_2CO_3)	Sodium carbonate (Na_2CO_3)
Chemical equation	$CH_3COONa + NaOH \rightarrow CH_4 + Na_2CO_3$	$C_6H_5COONa + NaOH \rightarrow C_6H_6 + Na_2CO_3$

Feature	Fuel Cell	Lead-Acid Battery (Discharging)
Electrode	Cathode	Cathode
Reactant	$O_2 + H_2O$	$PbO_2 + H^+ + SO_4^{2-}$
Electrons gained (reduction)	Yes (O_2 gains e^-)	Yes (PbO_2 gains e^-)
Product	OH^-	$PbSO_4 + H_2O$
Cathode Reaction	$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$	$PbO_2 + 4H^+ + SO_4^{2-} + 2e^- \rightarrow PbSO_4 + 2H_2O$

Feature	Addition Reaction	Substitution Reaction
Type	Addition (non-aromatic product)	Electrophilic aromatic substitution
Condition	UV light or heat	Anhydrous $AlCl_3$ (Lewis acid catalyst)
Aromaticity	Lost (ring becomes saturated)	Retained
Product	Benzene hexachloride ($C_6H_6Cl_6$)	Chlorobenzene (C_6H_5Cl)
Equation	$C_6H_6 + 3Cl_2 \rightarrow C_6H_6Cl_6$ (hv)	$C_6H_6 + Cl_2 \rightarrow C_6H_5Cl + HCl$ ($AlCl_3$)

C) Put a mark (<, >, or =) in the spaces below:

1) Boiling point of glycerol < Boiling point of sorbitol.

2) Ionization potential V^{5+} > ionization potential V^{4+} (V = 23)

3) When equilibrium occurs between the rate of evaporation and the rate of condensation, the number of water molecules that evaporate = the number of vapor molecules that condense.

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4) If the solubility product of silver sulfate salt Ag_2SO_4 at a certain temperature is 1.1×10-5, then its solubility in water is ------

a) 1.410^{-2} mol/L b) 5.5×10^{-3} mol/L c) 2.3×10^{-3} mol/L d) 2.2×10^{-2} mol/L

5) The molecular formula for catechol is ------

a) $C_6H_6O_3$ b) $C_6H_6O_2$ c) C_6H_6O d) $C_6H_6O_4$

6) Bakelite polymer is formed as a result of the condensation polymerization process resulting from the reaction of phenol with -----

a) CH_3CHO b) $(CH_3)_2CO$ c) HCHO d) CH_2CHO

B) Choose from columns (B) and (C) what suits (A)

(A)	(b)	(c)
1- Isopyrene alcohol is oxidized by 2- The scientist Estwald studied the quantitative relationship between 3- In the electrolytic cell of bauxite	A- The rate of the chemical reaction and the concentration of the reactants B- Atmospheric air gives C- Platinum electrodes work D- The degree of ionization and the degree of dilution E- Carbon electrodes work D- Potassium dichromate acidified with concentrated sulfuric acid gives	I- Pronaldehyde II- Inversely, III- Cathode and reacts with the evolved oxygen. IV- Bubanone V- Directly, VI- Anode and reacts with the evolved oxygen.

(A) Statement	(B) Match	(C) Match
1. Isoprene alcohol is oxidized by	D – Potassium dichromate acidified with H_2SO_4	I – Pronaldehyde
2. Ostwald studied the quantitative relationship	A – Rate of reaction and concentration of reactants	V – Directly
3. In the electrolytic cell of bauxite	E – Carbon electrodes work	VI – Anode and reacts with oxygen

28) Which of the following equations describes the substitution reaction of an alkane? (Ch 5)

a) Alkane + Halogen → di halo alkane

b) Alkane + Oxygen → Carbon dioxide + water

c) Alkane + Halogen → Haloalkane + Hydrogen halide

d) Alkane + Hydrogen halide → Haloalkane + water

29) Which of the following reagents used to detect the double bond of alkenes? (Ch 5)

a) Hydrogen peroxide

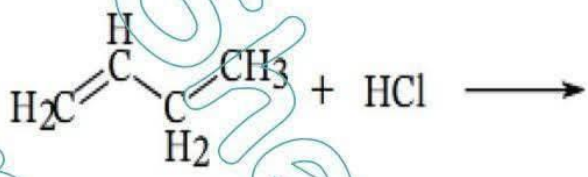
b) Combustion in air

c) Bromine water

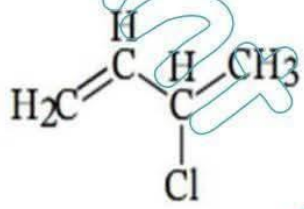
d) Hydrolysis in acidified water

30) Consider the reaction of but – 1 - ene with HCl: (Ch 5)

What is the major product?



A



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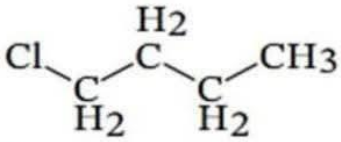

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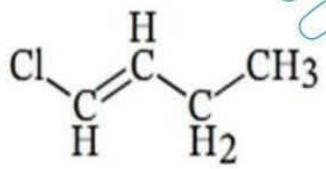

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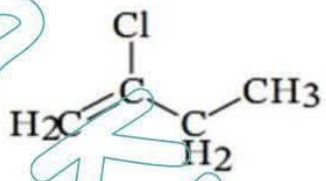
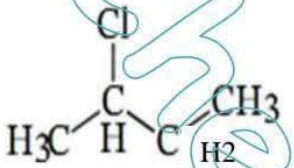




31) Which of the following is correct in, burning ethyne gas in atmospheric air? (Ch 5)

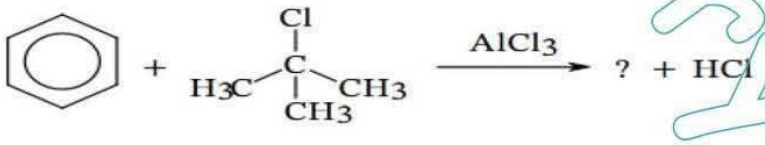
a) Carbon dioxide completely formed.

b) Forming smoky flame.

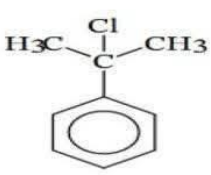
c) Forming highly thermal flame.

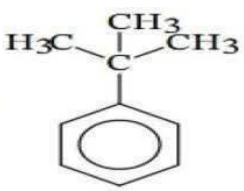
d) Carbon monoxide totally forming carbon dioxide.

32) Which of the following is the correct product for the following reaction? (Ch 5)



A





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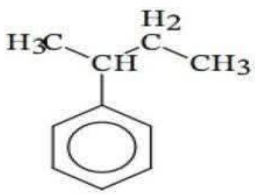

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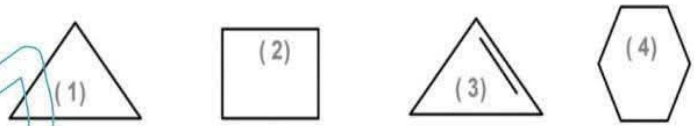
16) These are four cyclic aliphatic hydrocarbons -----



The correct arrange of stability of these compounds: (From less stable to more stable) (Ch 4)

a) (2), (1), (3), (4).
b)(3), (1), (4), (2)
c) (1), (3), (2), (4)
d) (3), (1), (2), (4)

17) Calculate the solubility product (K_{sp}) of $Al(OH)_3$ giving that its degree of solubility equals 10^{-6} mole/liter.

a) 2.7×10^{-23}
b) 5.9×10^{-11}
c) 13.5×10^{-10}
d) 8.5×10^{-8}

18) Which of the following has the largest number of paired electrons.

a) $_{29}Cu^{2+}$
b) $_{23}V^{5+}$
c) $_{29}Cu^{1+}$
d) $_{24}Cr^{2+}$

19) Dry distillation of sodium propanoate forms ---

a) C_3H_8
b) C_2H_6
c) C_4H_{10}
d) C_3H_6

20) Consider the following observation of the qualitative analysis of two samples, A and B of unknown sodium salts.

Test	Sample A	Sample B
Addition of dilute $HCl_{(aq)}$ to salt solid	No gas evolved	No gas evolved
Addition of concentrated $H_2SO_{4(aq)}$ to salt solid	No gas evolved	No gas evolved
Addition of $BaCl_{2(aq)}$ to salt solution	White precipitate insoluble in dilute HCl	White precipitate soluble in dilute HCl

It can be concluded that sample (A) is ----- and sample (B) is -----

a) Na_2S and Na_2SO_3
b) Na_3PO_4 and Na_2SO_4
c) Na_2SO_4 and Na_3PO_4
d) $Na_2S_2O_3$ and Na_2SO_3

21) Organic compound obtained from dropping water on calcium carbide then catalytic hydration of the produced gas ----

a) ethanol
b) ethanal
c) acetaldehyde
d) both (b), (c)

22) Steel, is a solid mixture consisting of carbon atoms get into the holes of an iron atom structure, is an example of -----

a) an intermetallic alloy
b) brass alloy
c) a substitutional alloy
d) an interstitial alloy

23) Which of the following is correct about the solution obtained by mixing 10 ml of 0.2 M KOH with 20 ml of H_3PO_4 0.1 molar?

a) The obtained solution will be acidic and turns methyl orange yellow.
b) The obtained solution will be alkaline and turns methyl orange yellow.
c) The concentration of the obtained solution will be 4 M.
d) The obtained solution will be acidic and turns bromothymol blue yellow.

C) Arrange each of the following in ascending order

1) Cations of the following compounds, according to their magnetic moment:

Ti_2O_3 / $Fe_2(SO_2)_3$ / Cu_2O / Cr_2O_3 (Ti = 22, Cr = 24, Cu = 29, Fe = 26)

Step 2: List Cations with Unpaired Electrons

Compound	Cation	Unpaired Electrons	Magnetic Moment $\mu \approx \sqrt{n(n+2)}$
Cu_2O	Cu^+	0	0 BM
Ti_2O_3	Ti^{3+}	1	$\sqrt{3} \approx 1.73$ BM
Cr_2O_3	Cr^{3+}	3	$\sqrt{15} \approx 3.87$ BM
$Fe_2(SO_4)_3$	Fe^{3+}	5	$\sqrt{35} \approx 5.92$ BM

✓ Final Answer (Ascending Order): $Cu_2O < Ti_2O_3 < Cr_2O_3 < Fe_2(SO_4)_3$

2) The following half-cells are classified according to the strength of the oxidizing agent as a function of their potentials:

Mg / Mg^{2+} (E0 = +2.37 V) Cu^{2+} / Cu (E0 = +0.34 V)

K^+ / K (E0 = -2.92 V) Ni^{2+} / Ni (E0 = 0.23 V)

Half-cell	E° (V)	Oxidizing Agent
K^+/K	-2.92	K^+
Mg^{2+}/Mg	-2.37	Mg^{2+}
Ni^{2+}/Ni	+0.23	Ni^{2+}
Cu^{2+}/Cu	+0.34	Cu^{2+}

Final Answer: $K^+/K < Mg^{2+}/Mg < Ni^{2+}/Ni < Cu^{2+}/Cu$

3) The following compounds, according to the number of π bonds in them:

(terephthalic acid - anthracene - acetamide - oxalic acid)

✓ Final Answer (Ascending Order of π Bonds):

Acetamide (1) < Oxalic acid (2) < Terephthalic acid (5) < Anthracene (9)

Q5: (A) Choose the correct answer from the answers given for each of the following statements:
(3-methyl-1-pentane - tin - chlorophyll - benzodiazepine - Föhler's - magnesium - protein - NO_2^- - SO_2^- - (2-methyl-2-butene) - substitution)

1) To protect ship hulls from corrosion, they are connected to the element magnesium

2) In plants, chlorophyll absorbs light and forms carbohydrates in the presence of water and carbon dioxide.

3) The compound (2-methyl-2-butanol) is prepared by the catalytic hydrolysis of the compound

2-methyl-2-butene

4) Gas SO_2 is prepared by soaking a piece of paper in a solution of potassium dichromate acidified with concentrated sulfuric acid.

5) Consider protein to be organic compounds that are formed within the cells of living organisms by biological forces.

6) Alloys of tin compounds are characterized by being solids composed of metals located in one group of the periodic table

Model 1 May

1) An element of the first transition series, considered as a Para magnetic Element, has the highest density, one of its compounds is used in ---- (Ch 1)

a) detecting malignant tumors.
b) galvanizing metals.
c) sunscreen products.
d) glucose detection.

2) Which of the following processes is easiest process? (Ch 1)

a) $FeCl_3 \rightarrow FeCl_2$
b) $VBr_5 \rightarrow VBr_3$
c) $(MnO_4)^{-} \rightarrow MnO_2$
d) $TiO \rightarrow TiO_2$

3) Which of the following is correct regarding the properties of the following transition elements? $_{21}Sc$, $_{24}Cr$, $_{26}Fe$, $_{28}Ni$ (Ch 1)

a) Ni has the highest atomic mass.
b) Fe has the highest density.
c) Cr has the lowest melting point.
d) Sc is the least reactive.

4) Which of the following processes are used to remove phosphorus from iron ore? (Ch 1)

a) Electrical separation and sintering.
b) Crushing and reduction.
c) Sintering and roasting.
d) Roasting and concentration.

5) An organic compound is converted into reducing agents to be used in the reduction of iron ore in ---- (Ch 1)

a) Midrex furnace.
b) Blast furnace.
c) Open-hearth furnace.
d) Electric furnace.

6) Which of the following is the correct order to obtain iron (III) sulfate from an organic iron salt? (Ch 1)

a) Heating in the absence of air → oxidation in hot air → reaction with dilute sulfuric acid.
b) Heating in air → reduction at 250°C → reaction with concentrated sulfuric acid.
c) Heating in the absence of air → oxidation in hot air → reaction with concentrated sulfuric acid.
d) Reduction at 250°C → reaction with dilute sulfuric acid → oxidation in hot air.

7) When a barium chloride solution is added to solutions of salts (A) and (B), a precipitate forms with salt (A) but not with salt (B). The anions of the salts are, respectively ---- (Ch 2)

a) Anion of salt (A): *sulfate*, anion of salt (B): *carbonate*.
b) Anion of salt (A): *nitrate*, anion of salt (B): *bicarbonate*.
c) Anion of salt (A): *sulfate*, anion of salt (B): *nitrate*.
d) Anion of salt (A): *chloride*, anion of salt (B): *carbonate*.

8) Acids (X) and (Y) are both monoprotic acids. Acid (X) can be used to detect the anion of acid (Y) in its salt. The anions of acids (X) and (Y) are ------ (Ch 2)

a) anion of (X): SO_4^{2-} anion of (Y): Cl^-.
b) anion of (X): Cl^-, anion of (Y): $NO_2^{\ -}$
c) anion of (X): Cl^- , anion of (Y): $NO_3^{\ -}$
d) anion of (X): $NO_3^{\ -}$, anion of (Y): SO^{2-}.

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Exam 1 February

1) The role of coke in a blast furnace is similar to that of natural gas in a Midrex furnace. Which of the following explains this statement? (Ch 1)

a) Both of them are used as catalysts to reduce time consumed in reduction process.
b) Both of them are used to prepare the reducing agent.
c) Both of them are used as a reducing agent.
d) Both of them are used as fuel to operate the furnaces at high temperatures.

2) Calculate the degree of dissociation for a weak mono-protic acid with concentration 0.01 M and pH=5 (Ch 3)

a) 0.05 b) 0.001 c) 0.01 d) 0.005

3) If 3 Faradays are required to deposit 1 mole of metal (X^{+x}). What is the chemical formula of metal oxide? (Ch 4)

a) XO_2 b) XO c) X_2O_3 d) No suitable answer

4) Dilute hydrochloric acid added to a solution containing equal concentrations of Fe^{2+}, Ca^{2+}, Pb^{2+} and Cu^{2+}.Which one of these cations would precipitate? (Ch 2)

a) Cu^{2+} b) Fe^{2+} c) Pb^{2+} d) Ca^{2+}

5) Which of the following considered a tertiary monohydric alcohol? (Ch 5)

a) $H_3C-CH_2-CH_2-CH_2-OH$

b) $H_3C-CH_2-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$

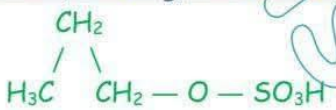
c) $H_3C-\underset{\displaystyle OH}{\underset{|}{CH}}-\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}-CH_3$

d) $H_3C-CH_2-\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}-CH_3$

6) Which of the following happens upon closing the galvanic cell circuit? (Ch 4)

a) Anions move toward the Anode through the porous septum
b) Cations move toward the Anode through the porous septum
c) Electrons move through the external wire from the +ve rode toward the -ve rode
d) Electrons move through the external wire from the cathode toward the anode

7) What is the product of thermal decomposition (cracking) for the following compound? (Ch 5)



a) C_2H_4 b) C_3H_8 c) C_3H_7 d) C_3H_6

8) Study the following table:

Acid	HU	HW	HY	HX
Ionization degree (α)	2.8%	5.9%	13.4%	9.2%

Which acid has the highest conductivity? (Ch 4)

a) HU b) HW c) HY d) HX

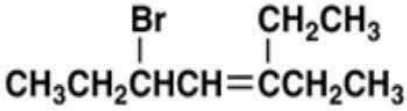
31) Which of the following is the correct IUPAC name of the following compound? (Ch 5)

a) 3-ethyl-5-bromo3-heptene

b) 5-bromo-3-ethyl-3-heptene

c) 3-bromo-5-ethyl-4-heptene

d) 1,1-diethyl-3-bromo-1-pentene



32) Number of isomers that can be oxidized for molecular formula C4H10O is ---- (Ch 5)

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

33) Catalytic dehydration of 2-methyl -1-propanol then Catalytic hydration of the product gives ---- (Ch 5)

a) ketone b) aldehyde c) tertiary alcohol d) primary alcohol

34) A compound (X) with the molecular formula C_3H_8O can be oxidized to another compound Y whose molecular formulae is $C_3H_6O_2$. The compound X may be ----- (Ch 5)

a) $CH_3CH_2OCH_3$ b) CH_3CH_2CHO c) $CH_3CH_2CH_2OH$ d) $CH_3CHOHCH_3$

35) The correct sequence for preparing alkane from an alcohol is ---- (Ch 5)

a) oxidation → hydrolysis→ reduction

b) hydrolysis → neutralization → dry distillation

c) oxidation → hydrolysis → reduction

d) oxidation → neutralization → dry distillation

36) Which of the following has no effect on acidified potassium dichromate? (Ch 5)

a) Ethanol b) Ethanal c) 2- propanol d) Propanone

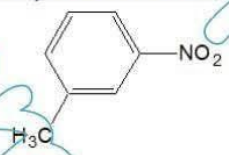
37) To obtain the following compound from benzene, the last process is ----- (Ch 5)

a) nitration

b) polymerization

c) alkylation

d) oxidation



38) Number of sigma bonds in 1,2-dimethyl benzene is ---- (Ch 5)

a) 12 b) 16 c) 18 d) 20

39) Which of the following is the most acidic compounds? (Ch 5)

a) C_6H_5COOH b) CH_3COOH c) CH_3CH_2COOH d) $CH_3(CH_2)_2COOH$

40) Meta-chloro-benzoic acid can be obtained from ethyne by ---- (Ch 5)

a) polymerization → oxidation → halogenation → alkylation

b) polymerization → alkylation → oxidation → halogenation

c) alkylation → polymerization → halogenation → oxidation

d) oxidation → polymerization → halogenation → alkylation

Faraday's law of electrolysis: mass (m)= $\frac{Q \cdot M}{n \cdot F}$

Where:

Q= charge in coulombs = 58233 C

M= molar mass (atomic mass) of X (what we need to find)

n= number of electrons = 3 (from the half-equation)

F= Faraday's constant ≈ 96500 C/mol

m= mass of X deposited = 11.23 g (since it's "11.23%", this must be referring to grams in this case)

Step 2: Plug values into Faraday's equation

$11.23 = \frac{58233 \cdot M}{3 \cdot 96500} = \frac{58233M}{289500}$, $M = \frac{11.23 \cdot 289500}{58233}$, $M \approx \frac{3252298.5}{58233} \approx 55.84$ g/mol

✅ Final Answer: Atomic mass of element X ≈ 55.84 g/mol

This value corresponds closely to iron (Fe), which forms Fe^{3+} ions and has an atomic mass of approximately 55.85 g/mol.

Q2: (A) Choose the correct answer from the answers given for each of the following statements:

1) If the standard reduction potentials for cadmium are -0.40 V and lead are -0.12 V, then the emf of the cell is equal to ----

a) (-0.28 V) b) (+0.52 V) c) (-0.52 V) d) (+0.28 V)

2) When water is added to sodium methoxide and then formic acid is added to the resulting compound, ---- is formed.

a) CH_3COOH b) $HCOOCH_3$ c) $CH_3COOC_2H_5$ d) CH_3COOCH_3

3) When $AgNO_3$ solution is added to salt solution (X), a white precipitate is formed that dissolves in concentrated ammonia solution.
When $(NH_4)_2CO_3$ solution is added to the same solution (X), a white precipitate is formed that dissolves in acids.
Therefore, the solution of salt (X) is ----

a) sodium chloride b) sodium bromide
c) calcium chloride d) calcium bromide

4) The reagent that does not distinguish between a solution with a pOH of 7 and another solution with a pOH of greater than 7 is ----

a) Phenolphthalein b) Methyl orange c) Bromothymol blue d) litmus

5) When dilute hydrochloric acid is added to a mixture of iron filings and magnetic iron oxide, the following is formed ----

a) $FeCl_2.2H_2O$ b) $FeCl_3.H_2O$ c) $FeCl_2.H_2$ d) $FeCl_2$, $FeCl_3$, H_2O

6) Which of the following is the correct IUPAC name for an organic compound?

a) 2-chloro-3-bromo-2-pentene b) 3-bromo-2-chloro-2-pentene
c) 3- bromo-2-chloro-3-pentene d) 2-chloro-3-bromo-3-pentene

B) Arrange the following steps:
To obtain aspirin from methane, write the equations
(catalytic hydration - heating and rapid cooling - esterification - oxidation)

✅ Correct Order: Catalytic hydration → Oxidation → Heating and rapid cooling → Esterification

41) Molecular formula C_6H_{12} represents three cyclic aliphatic hydrocarbons: X, Z and W
X: Does not contain methyl groups.
Z: Contains one group (–CH–)
W: Contains two methyl groups.
-Arrange these compounds in increasing order of activity. (Ch 5)

a) X < Z < W b) Z < W < X c) X < W < Z d) W < X < Z

42) Which of the following steps can be required to obtain benzoic acid from sodium benzoate? (Ch 5)

a) Dry distillation → Chlorination → Alkylation → Oxidation
b) Dry distillation → Alkylation → Oxidation
c) hydration → Chlorination → Alkylation→ Oxidation
d) Alkylation →Oxidation → Chlorination

43) If you know that (A) and (B) react with sodium hydroxide, (C) doesn't react with alcohol.
- Which of the following choices is correct? (Ch 5)

a) (A): Benzene, (C): 2-methyl-2-Propanol.
b) (C): Benzene, (B): Ethyl alcohol.
c) (A): Propanoic acid, (B): di-Methyl ether.
d) (A): Ethanoic acid, (C): Phenol.

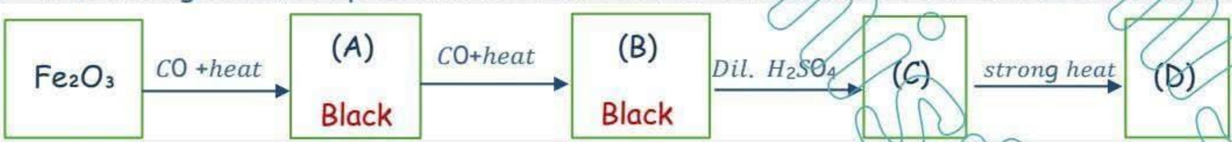
44) During the hydrolysis of butyl butanoate in alkaline medium.
- Which of the following is an isomer for the produced alcohol? (Ch 5)

a) Butanoic acid b) diethyl ether c) 1-butanol d) 2-methyl propanal

45) What are the processes needed to convert the simplest secondary alcohol to primary alcohol. (Ch 5)

1- Dehydration 2- Hydrogenation
3- Substitution Halogenation 4- Alkaline hydration

46) The following scheme represents the reactions of iron and its oxides at different conditions:



What are (A), (B), (C), (D)? (Ch 1)

(A): Magnetic iron oxide , (B): Iron (II) oxide , (C): Iron (II) sulphate , (D): Iron (III) oxide.

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24) If one mole of electrons is passed through molten of $MgSO_4$, $AgNO_3$ and $AlCl_3$, connected in series, the proportion of moles precipitated from Mg, Ag and Al is ---- (Ch 4)

	Mg	Ag	Al
A	3	2	6
B	24	108	27
C	3	1	2
D	3	6	2

25) Which of the following makes the Mercury cell stop working? (Ch 4)

a) Increase in the temperature of the cell. b) Concentration of electrolytes in is different.

c) All ions in the cathode half cell are consumed. d) Two electrodes corrode completely.

26) If a current of 0.5 A is passed for 20 minutes through molten NaCl, the volume of produced gas at STP is: (Na=23, Cl=35.5) (Ch 2 & 4)

a) 19.6 ml b) 22.4 ml c) 69.7 ml d) 445 ml

27) Zn is used in anodic protection of iron because: (Ch 4)

a) $E°(Zn^{2+}/Zn) > E°(Fe^{2+}/Fe)$ b) $E°(Zn^{2+}/Zn) < E°(Fe^{2+}/Fe)$

c) Zn is cheaper than iron d) Zn does react easily with air

28) Which of the following is correct in charging a lead-acid battery? (Ch 4)

a) Lead is converted to lead oxide at the cathode.

b) Lead is converted to lead sulphate at the cathode.

c) Lead sulphate is converted to lead oxide at the anode.

d) Lead sulphate is converted to elemental lead at the anode.

29) A fuel cell differs from other galvanic cells because it ----- (Ch 4)

a) operates on oxidation and reduction reactions.

b) stores reactants inside the cell for a long period.

c) acquires fuel from an external source.

d) has a higher total cell voltage compared to other cells.

30) If you have the following compounds:

(x) : high boiling point and sparingly soluble in water

(Y) : Used to detect water

(Z) : Starting material in preparation aspirin

Choose what is X ,Y and Z? (Ch 4)

	(X)	(Y)	(Z)
a)	Acetic acid	Copper oxide	ethanol
b)	Formic acid	Copper sulphate	Toluene
c)	Benzoic acid	Copper sulphate	Salicylic acid
d)	propanol	Magnesium sulphate	benzene

38) The following table represents the standard reduction potential of four elements A,B,C and D. The galvanic cell produces the highest e.m.f is ----

Element	A	B	C	D
Standard reduction potential (volt)	-2.711	-0.28	+1.2	+2.87

a) (B) as an anode , (D) as a cathode
b) (D) as an anode , (A) as a cathode
c) (A) as an anode , (D) as a cathode
d) (D) as an anode , (C) as a cathode

39) Which of these reactions leads to producing Hydrogen gas with faster rate?
a) Zinc powder with (2M) HCl.
b) Zinc strip with (2M) HCl.
c) Zinc powder with (1M) HCl.
d) Zinc strip with (1M) HCl.

40) Which of the following statements compare between two d-block elements is correct?
a) Titanium is denser than Nickel but has a smaller atomic radius.
b) Titanium is less dense than Nickel but has a larger atomic radius.
c) Titanium is denser than Nickel and has a larger atomic radius.
d) Titanium is less dense than Nickel and has a smaller atomic radius.

41) Which of the following is the preferred Iron ore for extraction in a blast furnace?
a) Siderite
b) Magnetite
c) Limonite
d) Hematite

42) The number of alcoholic isomers of the molecular formula $C_4H_{10}O$ equals ----
a) 2 isomers
b) 3 isomers
c) 4 isomers
d) 5 isomers

43) From the properties of fuel cells ----
a) consumed by time
b) supplied with external source of electricity
c) store electrical energy as chemical anode and cathode material
d) oxygen gas reduced at cathode of fuel cell

44) Oils and fats could be hydrolyzed using ---- to produce glycerol and ----
a) NaOH, detergent
b) HCl, detergent
c) HCl, soap
d) NaOH, soap

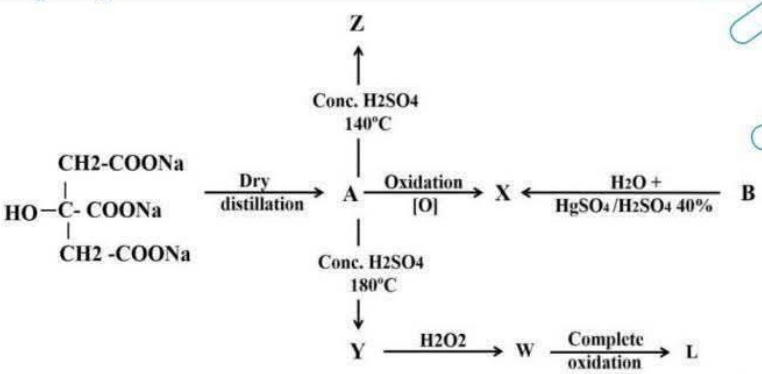
45) Arrange the following compounds according to their magnetic moment:

$Fe_2(SO_4)_3$, $CuCl_2$, $ScCl_3$, $Ni_2(SO_4)_3$

Consider their electronic configurations and oxidation states. Generally, the order from highest to lowest magnetic moment is:

$Fe_2(SO_4)_3$ (high-spin Fe^{3+}) > $Ni_2(SO_4)_3$ (Ni^{3+}) > $CuCl_2$ (Cu^{2+}) > $ScCl_3$ (Sc^{3+}, diamagnetic)

46) Study the following diagram:



32) Which of the following represents the possible masses of aluminum and silver deposited when the same quantity of electricity is passed through their molten salt connected in series? [Al = 27, Ag = 108] (Ch 4)

Options	Mass of Aluminum (g)	Mass of Silver (g)
A	24	2
B	108	27
C	2	24
D	27	108

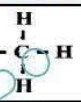
33) The following equation represents the catalytic cracking of $C_{18}H_{38}$:
$C_{18}H_{38} \rightarrow n\,C_2H_4 + X$, By catalytically reforming X is the simplest aromatic compound is obtained. What is the value of n? (Ch 5)

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

34) solution is prepared by dissolving 0.05 mol of strong monoprotic acid in water to make a 1000 mL solution. Which of the following is correct? (Ch 3)

a) $[H^+] = 0.5$ mol. b) $[OH^-] = 0.1$ mol/L. c) pH = 1.3. d) pOH = 1.3.

35) How many groups from the table are present in the compound 2-methyl-2-butene? (Ch 5)

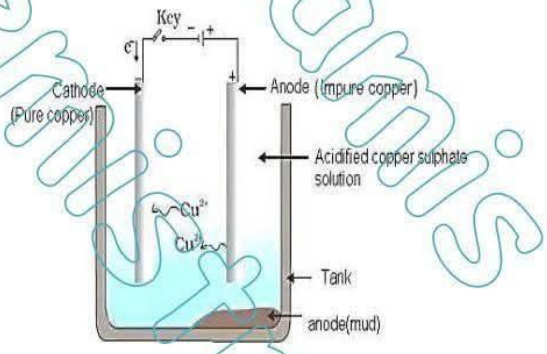
	≡C–H		
A	2	1	2
B	2	2	1
C	1	0	3
D	1	2	1

36) What is the correct IUPAC name for the compound $CH_3CH_2CHOHCH_2COOH$? (Ch 5)

a) 3-hydroxy pentanoic acid. b) 2-hydroxy pentanoic acid.
c) ortho-hydroxy butyric acid. d) 3-hydroxy butyric acid.

37) In the electrolytic cell showed in the figure, copper is purified from impurities like aluminum, silver, lead, and gold under the suitable conditions. Which cations of the impurities are present in the electrolyte?

a) Aluminum, silver.
b) Aluminum, lead.
c) Lead, gold.
d) Silver, gold.



38) (0.01) mol of NaOH is added to (1) L of distilled water (at 25°C). What is the resulting change in the pH of water? (Ch 3)

a) Increases by 2. b) Increases by 5. c) Decreases by 2. d) Decreases by 5.

39) The solubility product of A_2X_3 is 1.08×10^{-23}. What is its degree of solubility? (Ch 3)

a) 1×10^{-3} M. b) 1×10^{-4} M. c) 1×10^{-5} M. d) 1×10^{-6} M.

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Faraday's law of electrolysis: mass (m)= $\frac{Q \cdot M}{n \cdot F}$

Where:

Q= charge in coulombs = 58233 C

M= molar mass (atomic mass) of X (what we need to find)

n= number of electrons = 3 (from the half-equation)

F= Faraday's constant ≈ 96500 C/mol

m= mass of X deposited = 11.23 g (since it's "11.23%", this must be referring to grams in this case)

Step 2: Plug values into Faraday's equation

$11.23 = \frac{58233 \cdot M}{3 \cdot 96500} = \frac{58233M}{289500}$, $M = \frac{11.23 \cdot 289500}{58233}$, $M \approx \frac{3252298.5}{58233} \approx 55.84$ g/mol

✅ Final Answer: Atomic mass of element X ≈ 55.84 g/mol

This value corresponds closely to iron (Fe), which forms Fe^{3+} ions and has an atomic mass of approximately 55.85 g/mol.

Q2: (A) Choose the correct answer from the answers given for each of the following statements:

1) If the standard reduction potentials for cadmium are -0.40 V and lead are -0.12 V, then the emf of the cell is equal to ----

a) (-0.28 V) b) (+0.52 V) c) (-0.52 V) d) (+0.28 V)

2) When water is added to sodium methoxide and then formic acid is added to the resulting compound, ---- is formed.

a) CH_3COOH b) $HCOOCH_3$ c) $CH_3COOC_2H_5$ d) CH_3COOCH_3

3) When $AgNO_3$ solution is added to salt solution (X), a white precipitate is formed that dissolves in concentrated ammonia solution.
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Therefore, the solution of salt (X) is ----

a) sodium chloride b) sodium bromide
c) calcium chloride d) calcium bromide

4) The reagent that does not distinguish between a solution with a pOH of 7 and another solution with a pOH of greater than 7 is ----

a) Phenolphthalein b) Methyl orange c) Bromothymol blue d) litmus

5) When dilute hydrochloric acid is added to a mixture of iron filings and magnetic iron oxide, the following is formed ----

a) $FeCl_2.2H_2O$ b) $FeCl_3.H_2O$ c) $FeCl_2.H_2$ d) $FeCl_2$, $FeCl_3$, H_2O

6) Which of the following is the correct IUPAC name for an organic compound?

a) 2-chloro-3-bromo-2-pentene b) 3-bromo-2-chloro-2-pentene
c) 3- bromo-2-chloro-3-pentene d) 2-chloro-3-bromo-3-pentene

B) Arrange the following steps:
To obtain aspirin from methane, write the equations
(catalytic hydration - heating and rapid cooling - esterification - oxidation)

✅ Correct Order: Catalytic hydration → Oxidation → Heating and rapid cooling → Esterification

23) Which of the following options is correct?

Option	Organic Compound	Number of Methyl Groups	Number of Methylene Groups
A	Methyl benzene	1	1
B	Cyclopropane	1	2
C	Methyl propane	3	0
D	Butane	3	1

24) During the polymerization of the first members of the acetylenes Which statement is correct? (Ch 5)

a) The number of σ bonds in the reactants is greater than that in the products / The total bonds in the products is greater than that in the reactants.

b) The number of σ bonds in the reactants is less than that in the products / The total bonds in the products is equals to that in the reactants.

c) The number of π bonds in the reactants is equal to that in the products / The total bonds in the products is equal to that in the reactants.

d) The number of π bonds in the reactants is greater than that in the products / The total bonds in the products is greater than that in the reactants.

25) Which of the following reacts with calcium carbonate to form $(C_2H_5COO)_2Ca$? (Ch 5)

a) Propanol. b) Butanol. c) Propanoic acid. d) Butanoic acid.

26) The following table shows the molecular formulas of three organic compounds--- (Ch 5)
Which of the following is correct?

Compound	Formula
X	$C_2H_6O_2$
Y	$C_3H_8O_3$
Z	C_2H_6O

a) Y is mixed with gasoline and used as fuel in some countries.

b) X is used to prepare P.E.G.

c) Z is an acid used in the silk industry.

d) Y is produced by esterification reactions.

27) Three alcohols(X, Y and Z) shown in the table :

Alcohol	Formula
X	$C_2H_5COH(CH_3)_2$
Y	$C_2H_5CHOHCH_3$
Z	$(CH_3)_2CHCH_2OH$

Which of the following is correct? (Ch 5)

a) X reduces to give a carboxylic acid and has a boiling point higher than Z.

b) Y is insoluble in water and oxidizes to a dibasic acid.

c) X has a higher boiling point than Y and doesn't oxidize under normal conditions.

d) Z dissolves in water and does not oxidize under normal conditions.

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11) One of iron compounds (X) when heated in air, a solid substance (B) is formed along with two different gases, one of them turbid clear lime water. Which of the following statements best compare between (X) and (B). (Ch 1)

a) X is diamagnetic substance while B is paramagnetic one.
b) X is paramagnetic substance while B is diamagnetic one.
c) X has magnetic moment more than that of B.
d) X has magnetic moment less than that of B.

12) Which of the following salts when heated becomes insoluble in water? (Ch 2)

a) $NaHCO_3$ b) NH_4HCO_3 c) $Ca(HCO_3)_2$ d) $KHCO_3$

13) Which of the following is the chemical formula for the basic radical whose salt solution forms a white precipitate when dilute Sulfuric acid added to it. (Ch 2)

a) Cu^{2+} b) Fe^{2+} c) Ca^{2+} d) Al^{3+}

14) Which of the following could act as a standard solution for the determination of ammonium hydroxide? (Ch 2)

a) Ammonium chloride b) Ammonium carbonate
c) Hydrochloric acid d) Sodium carbonate

15) What is the mass of the precipitate produced from the addition of 100 mL of a 0.1 M sodium hydroxide solution to an excess of iron (II) sulfate. [NaOH = 40 g/mol and $Fe(OH)_2$ = 90 g/mol] (Ch 2)

a) 0.005 g b) 0.900 g c) 0.760 g d) 0.450 g

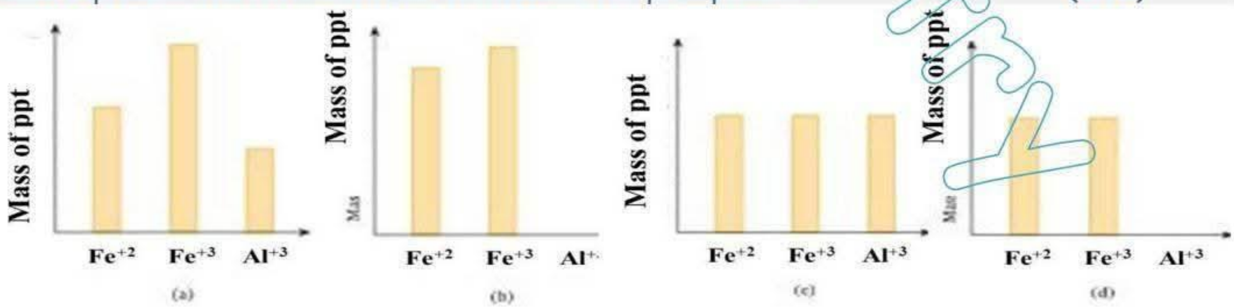
16) Which of the following is correct to detect the sulphite anion ? (Ch 2)

a) Adding an equal volume of dilute HCl, followed by heating, which results in production of a gas that turns filter paper soaked in acidified aqueous $KMnO_4$ from purple to colorless.
b) Adding an equal volume of dilute NaOH, followed by heating, which results in production of a gas that turns moist litmus paper blue.
c) Adding an aqueous Ammonia solution, which produces a yellow precipitate.
d) Adding an equal volume of Acetic acid, followed by Silver nitrate, which gives a white precipitate.

17) Which of the following used to differentiate between two separated solid salts of barium sulphate and barium phosphate? (Ch 2)

a) Concentrated sulphuric acid. b) Concentrated ammonia solution.
c) Acidified potassium permanganate. d) Dilute HCl.

18) On adding excess amount of sodium hydroxide to three different solutions containing equal amount of Fe^{+2} , Fe^{+3} and Al^{+3}, respectively. Three different precipitates are formed. Which of the following diagrams expresses the ratio between the mass of the precipitate ? (Ch 2)

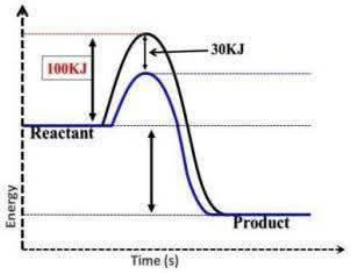


31) In which of the following compounds the oxidation number of Iron not changed when heated in air?

a) Iron II oxalate b) Iron II sulphate c) Siderite d) Limonite

32) Study the figure below that show the activation energy before and after using transition element as catalyst, what's the value of activation energy after using catalyst?

a) 130 kJ b) 30 KJ c) 50 kJ d) 70 kJ



33) The chemical equilibrium in ----- reactions is a ----- system that takes place when rate of forward equals the rate of backward.

a) irreversible, static b) reversible , static

c) irreversible, dynamic d) reversible , dynamic

34) Which one of the following is not a purpose of the salt bridge?

a) Keep the liquid levels the same. b) Neutralizes excess of ions in both half cells.

c) Keep the solutions separated. d) Complete the circuit.

35) A Magnesium halide salt has the formula MgX_2. A 0.415 g sample of MgX_2 was dissolved in 100 ml of pure water, followed by the addition of excess NaOH. The precipitate of $Mg(OH)_2$ was filtered, washed, and dried. The precipitate was found to have a mass of 0.131 g. What is the identity of X.

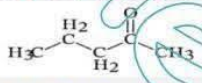
[Mg = 24 g/mol, O = 16g/mol, H = 1g/mol, F = 19g/mol, Br = 80g/mol, Cl = 35.5g/mol, I = 127g/mol]

a) Al b) Br c) Cl d) F

36) Which of the following compounds used as a cleaner of electronic sets?

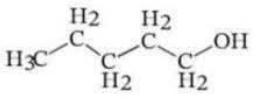
a) $CHBrClCF_3$ b) C_2H_4 c) CF_2Cl_2 d) CH_4

37) The following product produces from the oxidation of an alcohol:

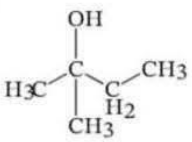


Which of the following alcohols could be the reactant

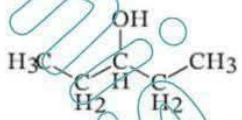
A

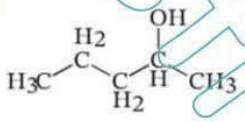


B



C





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