Final full mark Revision

ملزمة الدرجات النهائية

King of Excellence

تشمل على

مع الكينج التفوق حليفك

Full mark revision مع الكينج التفوق حليفك Chemical formula

Radicals

(1) Monovalent radicals		(2)Divalent radical	
cyanate	CNO^-	Sulphate	SO_4^{2-}
Hydroxide	OH^-	Sulphite	SO_3^{2-}
Bicarbonate	HCO_3^-	thiosulphate	$S_2O_3^{2-}$
Nitrate	NO_3^-	Carbonate	CO_3^{2-}
Nitrite	NO_2^-	Dichromate	$Cr_2O_7^{2-}$
Acetate	$CH3COO^-$		
Thio cyanate	SCN^-	**(3) Trivalent radicals**	
permanganate	$MnO4^-$	Phosphate	PO_4^{3-}
ammonium	NH_4^+		

Symbols of important elements and its general valency

Monovalent		divalent		trivalent	
Hydrogen	H^+	Oxygen	O	Aluminum	Al
Potassium	K^+	Barium	Ba	Nitrogen	N
Lithium	Li^+	Calcium	Ca	Phosphurs	P
Sodium	Na^+	Magnesium	Mg	Iron III (ferric)	Fe
Chlorine	Cl^-	Zinc	Zn		
Silver	Ag^+	Copper	Cu		
Bromine	Br^-	Iron II (ferrous)	Fe		
Fluorine	F^-	Lead	Pb		
		Sulphur	S^2		
		Mercury	Hg		

When Alone Do not forget the diatomic molecules of element are

$$H_2, O_2, N_2, Cl_2, Br_2, F_2, I_2$$

In equation Calculation

1-Any acid (inorganic) begins with H (positive hydrogen)
2-Any radical takes valency put it between two brackets
3-Any element ends by ide is element مدلع Carbide carbon

Organic compounds

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Methyl Ethyl

The class	General formula	functional group name	IUPAC name	Example
Alcohols	R – OH	hydroxyl - OH	alkanol	methanol Methyl alcohol CH_3OH
Aldehydes	R – CHO	formyl	Alkanal	ethanal Acetaldehyde CH_3CHO
Carboxylic acids		carboxylic - COOH	alkanoic	Ethanoic acid Acetic acid CH_3COOH
Esters		ester -COO-	Alkyl alkanoate	ethyl ethanoate Ethyl acetate

R alkyl as CH_3 - , C_2H_5 - ... **aliphatic**

				$CH_3COOC_2H_5$

Element	$_{21}Sc$	$_{22}Ti$	$_{23}V$	$_{24}Cr$	$_{25}Mn$	$_{26}Fe$	$_{27}Co$	$_{28}Ni$	$_{29}Cu$	$_{30}Zn$

Fe^{+3} (Ar_{18}) $4S^2$,$3d^5$ ↑ ↑ ↑ ↑ ↑ or Zn^{+2} (Ar_{18}) $3d^{10}$,$4S^0$

CH(1)

1-Transition element

2-Coloured

d

3- paramagnetic

Partially filled

unpaired electrons

1-not transition element

2-Colourless

d **Completely**

3- diamagnetic

filled or empty

paired electrons

2-Comparison

1-The three main transition series

Series no.	Location In the table	Begins with	Ends with

1st-T.s	4th period	Scandium $_{21}Sc\ (Ar_{18})\ 3d^1,4s^2$	Zinc $_{30}Zn\ (Ar_{18})\ 3d^{10}4S^2$
2nd T.S	5th period	Yttrium	Cadmium
3rd T .S	6th period	Lanthanum	Mercury

2-iron ores

3- Blast furnace and Medrix furnace according to:-

P .O .C	Blast furnace	Medrix furnace
iron ore	Fe_2O_3	Fe_2O_3
Source of reducing agent	from coke coal [C]	from natural gas
Reducing agent	CO	$CO + H_2$
equation in Blast furnace	$Fe_2O_{3(s)} + 3CO_{(g)} \xrightarrow{\Delta} 2Fe_{(s)} + 3CO_{2(g)}$	
equation in Medrix furnace	$Fe_2O_{3(s)} + 2CO_{(g)} + H_{2(g)} \xrightarrow{\Delta} 2Fe_{(s)} + 2CO_{2(g)} + H_2O_{(g)}$	

4- Types of alloys

Interstitial alloy	Substitional alloy	Intermetallic alloy
It is formed when a small metal atoms introduces to pure metal in intermolecular spaces and prevent sliding of layers	It is formed when a some atom of pure metal is replaced by the atoms of other metal atoms have same size & chemical acivity	It is formed when two metals or more combine chemically form new compounds with new properties as alloy of

Name	Chemical Formula	Chemical name	Colour
Magnetite	Fe_3O_4 Mixed oxide	Magnetic iron oxide	Black Has Magnetic property
Haematite	Fe_2O_3	Iron III oxide	Blood red Easy reduced
Limonite	$2Fe_2O_3 .3H_2O$	Hydrate iron III oxide	Yellow Easy reduced
Siderite	$FeCO_3$	Iron II carbonate	Yellowish grey

as steel iron alloy (carbon & iron)	as 1-iron ,chromium alloy 2-copper , gold alloy	1-Aluminum nickel alloy & Aluminum copper alloy Which named Dior Alumin . lead gold alloy(Au_2Pb) 2-cementite Fe_3C

5-Mention the use of the following alloy or mention the alloy which is used in

Alloys or Substance	Use or Economic importance
1- Scandium aluminum alloy	1-MIG fighter planes,
2-Titanium-aluminum alloy	2-planes and space crafts,
3-Vanadium steel alloy	3-car springs
4-iron manganese alloy (ferromanganese)	4-railways industry
	5-drinks cans
5-Manganese aluminum alloys	6-hard , resistance rust and acid (keep acids)
6-Nickel steel alloy	
7-Nickel chromium alloy	7-heating coils and electrical ovens
8-nickel- cadmium	8-rechargeable batteries
9-Copper tin alloy (Cu –Sn)	9- Bronze alloy
10-(Cu -Zn) brass alloy	10-electro plating of iron handles

6- Important processes

1- Crushing process	2- Sintering process	3-Concentration of iron ore	4-Roasting process
Process of converting the **large size** of the iron ore to **small size** to be easily reduced .	Process of converted the **fine particles** of the iron ore to **large particles** to be easily reduced .	Process of **removing** of **impurities** which mix or combine chemically with ore by **surface tension or electrical or magnetic separation**	Process of **heating the iron ores** in air strongly to expel humidity

7-Paramagnetic & diamagnetic substances

Paramagnetic substance	Diamagnetic substance
It is the substance which is **attracted** to the magnetic field due to the presence of **unpaired electrons** in (d) orbitals .	It is the substance which is **repelled** to the magnetic field due to the presence of **paired electrons** in (d) orbitals .

Its magnetic moment is equal to the number of unpaired electrons in (d) sublevel as Cu^{++} , Fe, Ni , Mn , Co , Sc	its magnetic moment is equal zero because electrons are paired in d orbitals or empty such as Zn^{+2}, sc^{+++}

3-Mention the use of the following element

element or Substance	Use or Economic importance
1-Scandium	1-mercury vapour lamps
2-Titanium	2-dental implant and replacement joints
3-Chromium	3-plating metals& leather industry
4-Iron	4-concrete -Electricity Towers -knives - gun Pipes and cannons -In surgical instruments -catalyst in the preparation of ammonia gas (Haber- Bush) -catalyst in the conversion of water gas ($CO + H_2$) to liquid fuel (Fischer-Tropsch) method
5-Cobalt 60	5 -food preservation - examining of industry products - medicine in the detection and treatment of cancer
6-Nickel	6-catalyst in hydrogenation of oil - painting metals
7-Copper	7-electrical wires or cables
8-Zinc	8- galvanizing of metals

4-Mention the use of the following compound or mention the compound which is used in

Compound orSubstance	Use or Economic importance

1-titanium dioxide -TiO_2	1-in sunscreens or sun cream
2-vanadium pentoxide V_2O_5	2-Pigment in ceramic and glass industry catalyst in production of sulphuric acid by contact method catalyst in magnets industry of super conducting
3- chromium oxide Cr_2O_3	3-making pigments
4-$K_2Cr_2O_7$	4-oxidizing agent
5-$KMnO_4$	5-strong oxidizing agent and disinfectant
6-Manganese dioxideMnO_2	6-oxidizing agent - dry cell
7- manganese II sulphate $MnSO_4$	7-fungicide
8-Copper IIsulphate $CuSO_4$	8- Insecticide -Fungicide -purification of drinking water
9-Fehleng solution	9- it is used in the detection of glucose
10-zinc oxide ZnO	10-paints, rubber and cosmetics industry
11- zinc sulfide ZnS	11-bright coatings & X-ray screens industry

5-What is the effect of heat on

1- Iron II oxalate

$$\begin{matrix}COO\\ \\ Fe\\ \\ COO\end{matrix} \xrightarrow[\text{Absence of air}]{\Delta} FeO + CO_2 + CO$$

$$2FeO + O_2 \xrightarrow[\text{Presence of air}]{\Delta} Fe_2O_3$$

2- Iron II carbonates (siderite)

$$FeCO_3 \xrightarrow{\Delta} FeO + CO_2$$

3- Limonite

$$2Fe_2O_3.3H_2O \xrightarrow{\Delta} 2Fe_2O_3 + 3H_2O$$

4- Iron II sulphate

$$2FeSO_4 \xrightarrow{\Delta} Fe_2O_3 + SO_2 + SO_3$$

5- Iron III hydroxide

$$2Fe(OH)_3 \xrightarrow{>200^\circ c} Fe_2O_3 + 3H_2O$$

6-Reactions of iron

$$1-\ 3Fe + 2O_2 \xrightarrow{\Delta} Fe_3O_4$$

2- $3Fe + 4H_2O \xrightarrow{\Delta} Fe_3O_4 + 4H_2$

3- $2Fe + 3Cl_2 \xrightarrow{\Delta} 2FeCl_3$ Iron III chloride (oxidizing agent)

4- $Fe + S \xrightarrow{\Delta} FeS$ (reducing agent)

5- $Fe + 2HCl \xrightarrow{dil.} FeCl_2 + H_2$ (reducing agent)

6- $Fe + HNO_3 \xrightarrow{conc.}$ No reaction . Why (passivity)

7-Reactions of sulphuric acid

7- $Fe + H_2SO_4 \xrightarrow{dil.} FeSO_4 + H_2$ (reducing agent)

8- $3Fe + 8H_2SO_4 \xrightarrow{conc.} FeSO_4 + Fe_2(SO_4)_3 + 4SO_2 + 8H_2O$

3- $FeO + H_2SO_4 \xrightarrow{dil.} FeSO_4 + H_2O$

4- $Fe_2O_3 + 3H_2SO_4 \xrightarrow{conc.} Fe_2(SO_4)_3 + 3H_2O$

5- $Fe_3O_4 + 4H_2SO_4 \xrightarrow{conc.} Fe_2(SO_4)_3 + FeSO_4 + 4H_2O$

8- Write the scientific expression of the following

1-They are elements of d- block including four series which are located in periods 4, 5 6 and 7 each has 10 elements

2-Elements of (4f) sublevel, is located in period 6

3- Elements of (5f) sublevel is located in period 7

4- First element in second transition series

5-It is used as Pigment in ceramic , glass industry and catalyst in production of sulphuric acid by **contact method**

6-It is used in plating metals& leather industry

7-the method of conversion of water gas to liquid fuel

8- Mixture of hydrogen and carbon monoxide

9- It is used in the detection of glucose by changing its colour from blue to orange

10- It is the element that incompletely filled (d) or (f) sublevel in either the free or in one of its oxidation states .

11-It is the substance which is attracted to the magnetic field due to the presence of unpaired electrons in (d) orbitals.

12-is equal to the number of unpaired electrons in (d) sublevel

13-The colour that is not absorbed by the substance.

14- Formula of lead gold alloy

15- Chemical formula of cementite

16- Formation of a thin non – porous layer of oxide which protects iron from further oxidation

17-Methods of preparation of alloys

18-Elements that fills the 3d energy sub - level by electrons sequentially located at the fourth period in the periodic table .

Answer scientific term

1-main transition elements **2-lanthanides** **3- actinides**
4-yetrium **5-vandium pdentaoxide V_2O_5**
6-Chromium **7- Fischer-Tropsch** **8-water gas**
9- Fehleng solution **10- Transition elements**
11- paramagnetic **12- magnetic moment**
13- complementary colour **14- Au_2Pb** **15- Fe_3C**
16- Passivity **17-Melting & electric deposition** **18-- First transition series**

9-Give the scientific explanation

1) Titanium is used in implant and replacement joints

Because it is compatible metals with human body with no impact or poisoning.

2) titanium dioxide TiO_2 used in sunscreens

B.its **nanoparticles** prevent the arrival of ultraviolet rays to the skin

3) titanium is used in the manufacture of car springs

to be more hardness and high ability to resist corrosion.

4) Although chromium has more chemical activity but it resists weather

due to **formation a thick layer of metal oxide on the surface** , its size more than element size, which gives non-porous surface which prevent reaction of metal with atmospheric oxygen

5) Fehling solution is used in the detection of glucose

B. it colour changes from blue to orange

6) Electronic configuration of Chromium and Copper are abnormal .

B.in case of chromium **Cr_{24} : (Ar_{18}) $4S^1$ $3d^5$** so these sublevels 4S and 3d becomes half filled this makes the atom has less energy and more stability .

In case of Copper **Cu_{29} : (Ar_{18}) $4S^1$ $3d^{10}$** so the sublevels 4S becomes half filled and sublevels 3d become completely filled this makes The atom has less energy and more stability

7) Iron II is easily oxidized to iron III while Mn II in not easily oxidized to Mn III

B. Iron III ions is more stable as the 3d sublevel is half filled and the oxidation of iron (II) is easy

$Fe_{26} = (Ar_{18})$ $4S^2$ $4d^6$

Fe^{++} $3d^6$ Fe^{+++} $3d^5$

less stable more stable

but in the case of manganese atom the electronic configuration is :

$Mn_{25} = (Ar_{18})\ 4s^2\ 3d^5$

$Mn^{++}\ 3d^5$ $Mn^{+++}\ 3d^4$

Half- filled more stable less stable

8) The element of the first transition series loses its 4S electrons before losing the 3d electrons ?

Because the **4S has energy less than the energy of 3d**

9) Scandium cannot give oxidation state (+2) but it gives oxidation state (+3) only .

Because it **loses** two electrons from the sublevel 4S then one electron from 3d sublevel to be more stable.

10) Transition elements are characterized by having variable oxidation states.

Because the two sublevels 4S and 3d of nearly equal energy and their electrons are lost in sequence when the atom is oxidized.

11) Scandium cannot give oxidation state (+4) ?

Or we can not get Na^{2+}, Mg^{3+} Al^{4+} Sc^{4+}

Because we need **great amount of energy to break energy level complete** full by electrons.

12) The coinage metals whish are (Cu_{29} - Ag_{47} - Au_{79}) are considered as transition elements, although the orbitals of (d) sublevel are completely filled with electron

Because in their higher oxidation state Cu^{++} , Ag^{++} , Au^{+++} contain (9) or (8) electrons in d sublevel or unpaired electrons

$Cu^{++}\ (Ar_{18})\ 3d^9\ 4s^0$

$Ag^{++}\ (kr_{36})\ 4d^9\ 5s^0$

$Au^{+++}\ (Xe_{54})\ 5d^8\ 6s^0$

13) Zn_{30} , Cd_{48} , Hg_{80} , are not considered transition elements

Because the orbitals of (d) sublevel are completely filled with electrons in ground states and in their higher oxidation states .

$Zn^{++}\ (Ar_{18})\ 3d^{10}\ 4S^0$

$Cd^{++}\ (Kr_{36})\ 4d^{10}\ 5S^0$

$Hg^{++}\ (Xe_{54})\ 5d^{10}\ 6S^0$

14) Transition elements atomic radii are nearly constant from chromium to copper

Due to two opposite factors;

1- by increasing atomic number the effective nuclear charge increases and number of electrons increases so attraction force of nucleus to electrons increases so atomic radius decreases

2- By increasing the atomic number, number of electrons in 3d sublevel increases causes increasing the repulsion force between electrons so atomic radius increases

15) Transition elements are used in alloys manufacture.
due to their stability in their atomic radii

16) They have high melting and boiling point .
Because they have **strong metallic bonds** resulting from sharing of both the 4S and 3d electrons .

17) The densities of transition elements increase with the increase of atomic number.
Due to the increase of atomic mass while the atomic radius is nearly constant.

18) Transition elements are paramagnetic and coloured .
Due to the presence of **unpaired electrons** in d orbitals in normal state or oxidizing state

19) The transition elements have catalytic activity .
or the transition elements are ideal catalyst .
due to the presence of unpaired electrons in the orbitals of 4s, 3d sublevels which form bonds between the reactant molecules and the atoms of the metals surface so the **concentration of reactants increase** on the catalyst surface and weakness the bond between molecules of reactants and **decreasing the activation** energy so the speed of reaction increase.

20) Cu^{++} (Ar_{18}) $4S^0$ $3d^9$ has blue colour
when the light falls on the cu^{++} ions **unpaired electron absorb amount of energy equal to the energy of the orange** colour therefore unpaired electron can excite and jump to a higher energy level and it appear with complementary colour which is **blue**

21) Cr^{+++} ions has red colour Or compounds of chromium III are coloured by red
due to the presence of unpaired electrons in the orbitals of (d^3) sublevel when the light falls on the cr^{+++} ions some of these electrons absorb the amount of energy which is equal to the energy of the green colour therefore unpaired electrons can excite and jump to a higher energy level and it appears with complementary colour which is red .

22) **Cu^+ (Ar_{18}) $3d^{10}$ and Zn^{2+}($3d^{10}$) are colourless**
Due to absence of unpaired electrons in 3d sublevel which is completely full by electrons

23) Ions of non – transition elements are coluorless
Or (representative elements) are coluorless

because they are needed a large amount of energy higher than energy of the visible light to excite the electrons to higher energy level and orbitals of (d) sublevel are empty or completely filled with electrons

24) Reaction of iron with chlorine form iron III chloride

Because chlorine is a **strong oxidizing agent** so it prevents the formation of iron II salt

$$2Fe + 3Cl_2 \xrightarrow{\Delta} 2FeCl_3$$

25) Reaction of iron with dilute hydrochloric acid form iron II chloride

Because hydrogen is a strong **reducing agent** so it prevents the formation of iron III salt

$$Fe + 2HCl \xrightarrow[dil.]{\Delta} FeCl_2 + H_2$$

26) Iron does not react with conc. nitric acid

Due to formation of a **thin non – porous layer** of oxide which protects iron from further oxidation. (Passivity)

27) Magnetite reacts with conc. acids and gives two salts of iron II and III .

B.it is a mixed oxide of Fe_2O_3 , FeO

$$Fe_3O_4 + 4H_2SO_4 \xrightarrow{conc} Fe_2(SO_4)_3 + FeSO_4 + 4H_2O$$

Different questions

1 -Which of the following elements paramagnetic and which is diamagnetic
Zn , Cu^{++} , TiO_2 , Write the value of their magnetic moment

$_{30}Zn$ $(Ar_{18})4S^0 ,3d^{10}$
Number of unpaired electrons =0
Magnetic moment = 0
Diamagnetic
$_{29}Cu^{++}$ (Ar_{18}) $4S^0 ,3d^9$
Number of unpaired electrons 1
Magnetic moment = 1
Paramagnetic
$_{22}Ti^{+4}$ (Ar_{18}) $4S^0 , 3d^0$
Number of unpaired electrons 0
Magnetic moment = 0
dimagnetic

2-How can you get

1- The three iron oxides from iron

$$3Fe + 2O_2 \xrightarrow{\Delta} Fe_3O_4$$

$$\xrightarrow[400:700^0c]{\Delta}$$

$$Fe_3O_4 + H_2 \longrightarrow 3FeO + H_2O$$

$$2FeO + O_2 \xrightarrow{\Delta} Fe_2O_3$$

2-Iron III oxide from iron III chloride

$$FeCl_3 + 3NH_4OH \longrightarrow 3NH_4Cl + Fe(OH)_3$$

$$2Fe(OH)_3 \xrightarrow{>200^\circ c} Fe_2O_3 + 3H_2O$$

3-Iron II hydroxide from iron III hydroxide

$$2Fe(OH)_3 \xrightarrow[>200^\circ c]{} Fe_2O_3 + 3H_2O$$

$$Fe_2O_3 + H_2 \xrightarrow[400.700^\circ c]{\Delta} 2FeO + H_2O$$

$$FeO + H_2SO_4 \xrightarrow{dil} FeSO_4 + H_2O$$

$$Fe\,SO_4 + 2NaOH \longrightarrow Na_2SO_4 + Fe(OH)_2$$

3-What is the rule of

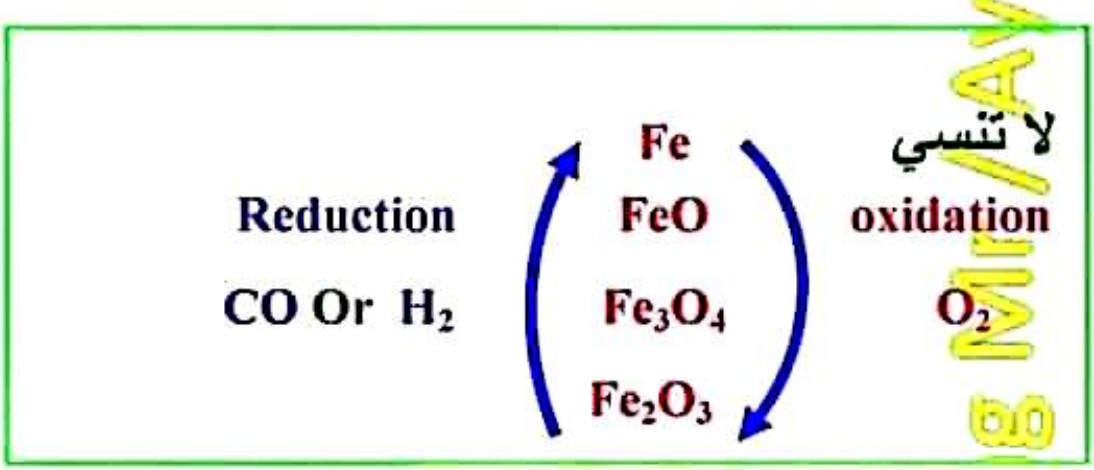
a-coke coal in blast furnace? Producing CO

$$C + O_2 \xrightarrow{\Delta} CO_2$$

$$2CO_2 + C \xrightarrow{\Delta} 2CO$$

b. Natural gas in Midrex furnace Producing water gas

$$2CH_4 + CO_2 + H_2O \xrightarrow{\Delta} 3CO + 5H_2$$



4)Choose the correct answer then write the balanced chemical equations which illustrate your choice :if possible

1-The reaction of iron and sulphur gives .....

a-$Fe_2(SO4)_3$ b-$FeSO_4$ c-Fe_2O_3 **d-FeS**

2-Iron dissolved in dil .acids giving.....

a-iron(II)salts b-iron(II)oxide c-iron(III) salt d-iron(III)oxide

3-Black iron oxide is a mixed oxide, it reacts with conc. hot acids giving .....

a-iron(II)salts b-iron(III) salts **c-(a and b) together** d-iron (III) oxide

4-Reducing magnetic iron oxide at 400-700°C gives.....

a-Fe **b-FeO** c-Fe_2O_3 d-$FeSO_4$

5-FeO reacts with dil. acids to give .....

a-iron(II) salt only b-iron(III) salt only

c- iron(II) salt and water d-iron(III)salt and water

6-Heating iron (II)sulphate, produces iron (III)oxide ,sulphur dioxide and .....

a- hydrogen b-water **c-sulphur trioxide** d-hydrogen sulphide

7- Type of alloys in which the elements are bind together chemically is.....alloy

a-interstitial b- substitutional **c-intermetallic** d-(a and b)together

8- Chromium and iron forms ..... alloy .

a- interstitial **b-substitutional**

c- intermetallic d- (a and c) together

9- When iron (III) hydroxide is heated above 200 °c,.....is Produced.

(a) Iron (II)oxide. (b) Magnetic iron oxide.

(c) Iron (III)oxide. (d) Iron (II)hydroxide.

10 -Compound $FeCl_2$ is.....

a) Paramagnetic and colorured. b) Diamagnetic and colourless

c) Diamagnetic and colorured. d) Paramagnetic and colourless

11- Transition element with electronic configuration $[\ {}_{18}Ar]\ 4s^1\ ,\ 3d^{10}$ is .....

a) scandium b) vanadium c) Mn **d) Copper**

12- We can detect glucose by using .....

a) Schiffs reagent b) iron tri chloride **c) Fehling's solution**

5)Write the chemical formula for two compounds of transition-elements compounds, at which one of them has an oxidation state (+3) and the other is (+4) Then mention one usage for each of them.

(+3) Sc ,Fe , Cr

(+4) Ti , Mn

6-By using the figure below that shows the activation energy before and after using a transition element as a catalyst,

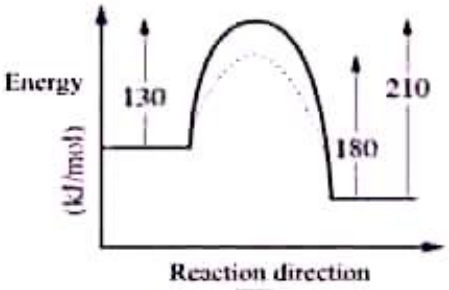
Answer the following questions:-

a) What is the value of the activation energy without using a catalyst?

130KJ/mol.

b) What is the value of the activation energy after using a catalyst?

100KJ/mol



c) Is this reaction an endothermic or an exothermic reaction?

Exothermic reaction

d) Write equations of preparation of sulphuric acid by the contact method , mention the catalyst used

$$2SO_2(g) + O_2(g) \xrightarrow[450^0C]{V_2O_5} 2SO_3(g)$$

$$SO_3(g) + H_2O \longrightarrow H_2SO_4(aq)$$

7)How can you differentiate between:

Dilute and conc. H_2SO_4

EXP.	Dilute. H_2SO_4	conc. H_2SO_4
By using iron Filling	It gives pop sound of hydrogen gas	It gives gas SO_2 has irritating smell

CH(2) 1 -Comparison

1-types of chemical analysis

Qualitative analysis	Quantitative analysis
Analysis that aims to identify the constituents or components of the substance if it is pure (simple salt)or mixture from different substances.	Analysis that aims to measure the percent or ratio or weight of each constituent of the substance.

2-types of qualitative analysis

qualitative organic analysis	qualitative inorganic analysis
Identification of the elements and the functional groups composing the compound to identify it.	test for 1-test for anions (acidic radical of salts). 2-test for cations (basic radical of salts)

3- importance of chemical analysis in .....felids

1- medical field	2-environmental field	3- agricultural field	4- industrial field
diagnose and treatment of diseases depends on it to 1. Determine the concentration of sugar, urea. 2. Determine active ingredients (elements) in drugs.	1. Determine the harmful environmental pollutants in water and food. 2. Determine the amount of carbon monoxide, sulphur dioxide and nitrogen oxides in air pollutant gases.	**Improving soil properties and its crops depends on it to** Determine the soil properties as acidity or alkalinity, type and ratio of elements in soil so we can treat it by suitable fertilizers	Determines the concentration of many constituents of industrial products.

4-Groups of acidic radicals or anions

Diluted hydrochloric acid Dil. HCl	Conc.sulphuric acid Conc. H_2SO_4	Barium chloride $BaCl_2$
Carbonate CO_3^{2-} Bicarbonate HCO_3^{1-} sulphite SO_3^{2-} Thiosulphate $S_2O_3^{2-}$ Sulphide S^{2-} nitrite NO_2^{1-}	Chloride Cl^{1-} Bromide Br^{1-} Iodide I^{1-} Nitrate $NO3^{1-}$	Phosphate $PO4^{3-}$ Sulphate $SO4^{2-}$

5-Analytical groups and their reagent

Analytical group	Example	Group reagent	precipitated as
1st Analytical group	silver(I) Ag mercury (I) Hg lead (II) Pb	HCl	chloride
2nd Analytical group	copper II Cu	H_2S +HCl Or H_2S in acidic medium	sulphide
3rd Analytical group	Aluminum Al iron(II) iron(III)	Ammonium hydroxide NH_4OH	hydroxides.
5th Analytical group	Calcium	ammonium carbonate	carbonates

	Ca	$(NH_4)_2CO_3$	

6-Indicators

Indicator	acidic medium	basic medium	Neutral medium
Methyl orange	Red	Yellow	Orange
Phenolphthalein	Colorless	Red	Colorless
Litmus	Red	Blue	Violet
Bromothymol blue	Yellow	Blue	Green

2-How can you differentiate between

1-methy orange and Bromothymol blue

Exp.	Methyl orange	Phenolphthalein	Bromothymol blue	Litmus
HCl acid	Red colour	Colourless	Yellow	red
NaOH base	Yellow	red	Blue	blue

2- Carbonate salt and Bicarbonate salt

Exp	Carbonate salt	Bicarbonate salt
By using magnesium sulphate solution	a white ppt. of magnesium Sulphate is formed on cold	a white ppt. of magnesium Sulphate is formed after heating

3- Iron II salt , Iron III salt and Aluminum salt

Exp.	Iron II salt	Iron III salt	Aluminum salt
By using sodium or ammonium hydroxide	White ppt. turns green When it exposed to air	Reddish brown ppt. Soluble in acids	White gelatinous ppt. of Aluminum hydroxide soluble In dil. Acids and in caustic soda

4- Sodium sulphite salt & Sodium Thiosulphate salts

Experiment	Sodium sulphite salt	Sodium Thiosulphate salts

1-By using dilute hydrochloric acid	gives Sulphur dioxide gas evolved which has irritating smell and turns a paper wet with acidified potassium dichromate to green	evolved SO_2 gas which has irritating smell and yellow ppt of colloidal suphur is formed

5- Sodium sulphide & Sodium sulphite salt

Experiment	Sodium sulphide salt	Sodium sulphite salt
1-By using dilute hydrochloric acid	gas has bad smell turns a paper wet with lead acetate to black	gives Sulphur dioxide gas evolved which has irritating smell and turns a paper wet with acidified potassium dichromate to green
1- By using silver nitrate	black p.pt. is formed from silver sulphide	a white p.pt is formed which turn black by heat

6- Sodium Nitrite & Sodium Nitrate salt

Experiment	Nitrite salt	Nitrate salt
1-By using dilute hydrochloric acid	Colourless gas evolves (NO)which turns reddish brown at the mouth of the test tube (NO_2)	No reaction
2- Adding acidified potassium permanganate	Its purple colour is removed	No reaction
3- Adding solution of iron II sulphate and drops of conc H_2SO_4	No reaction	A brown ring appears of $FeSO_4.NO$ disappears by heat or shaking

7- barium phosphate & barium sulphate

Exp.	barium phosphate	barium sulphate
By using HCl	soluble in dil HCl	insoluble in Dil HCl

8-Hydrochloric acid and sulphuric acid "by using sodium chloride".

Exp.	Hydrochloric acid	sulphuric acid

By using sodium chloride	No reaction	HCl gas is evolved , which is colourless . it gives white fumes with glass rod wet with ammonia solution .

9-Sodium bromide & Sodium iodide

Exp.	Sodium bromide	Sodium iodide
By using conc. sulphuric acid	Colourless gas evolved of HBr by excess sulphuric acid form yellowish red fumes of bromine which turns a paper wet by starch to yellow.	Colourless gas evolved of HI by excess sulphuric acid violet fumes from iodine which turns a paper wet by starch to blue.

10-Silver phosphate & silver iodide

Exp.	Silver phosphate	silver iodide
By using ammonia solution	It dissolves in ammonia solution and nitric acid	It does not dissolve in ammonia solution

11-Sodium phosphate & Sodium iodide

Exp.	Sodium phosphate	Sodium iodide
By using silver nitrate	yellow ppt. is formed from silver phosphate soluble in ammonia solution and nitric acid	yellow ppt. is formed from silver iodide insoluble in ammonia solution

12- How can you distinguish, without using reagents, between silver chloride and sodium chloride salts?

Exp.	silver chloride	sodium chloride
By adding water	is sparingly or slightly soluble in water	It completely dissolve in water

13- Solutions of magnesium bicarbonate and potassium bicarbonate, without using any chemical reagents.

Exp.	magnesium bicarbonate	potassium bicarbonate
By heating	White ppt. is formed after heating i nsoluble in water	.it forms potassium carbonate soluble in water

14 -Nitric and nitrous acid

Exp.	nitrous acid	Nitric acid

By heating	Coluorless Nitric oxide (NO) is gas evolves which turns reddish brown at the mouth of the test tube $3HNO_{2(aq)} \longrightarrow HNO_{3(aq)} + H_2O_{(l)} + 2NO_{(g)}$	. reddish brown nitrogen-dioxide evolves $4HNO_{3\ (l)} \longrightarrow 2H_2O_{(l)} + 4NO_{2(g)} + O_{2(g)}$

1) Write the scientific expression of the Following	What is meant by
1- Gas evolved which has **irritating smell** and turns a paper wet with acidified potassium dichromate to green	1-sulphur dioxide SO_2
2-gas has **bad smell** turns a paper wet with lead acetate to black	2- Hydrogen sulphide H_2S
3- **Colourless** gas evolves which **turns reddish brown** at the mouth of the test tube	3- nitric oxide NO
4-gas is evolved, which is **colourless, it gives white fumes** with glass rod wet with ammonia solution	4-Hydrogen chloride HCl
5-gas is evolved , which is **colourless** it partially oxidizes by sulphuric acid to form **yellowish red fumes**	5- hydrogen bromide
6- gas evolves, which is **colourless** .it partially oxidizes quickly by sulphuric acid and **violet fumes**	6-hydrogen iodide
7-the **anion** which form **colourless gas turns to reddish** brown fumes in air	7-nitrite
8- **anion** forms **brown ring** appears at the interface disappears by heat or shaking	8- nitrate
9- The **reagent** of anions of phosphates (PO4)$^{3-}$, and sulphate (SO4)$^{2-}$	9- barium chloride
10- They are **precipitated as hydroxides**. Its reagent is ammonium hydroxide	10- third analytical group
11- Cations of this group are **precipitated as carbonates** by addition of ammonium carbonate	11- fifth analytical group
12- It is used to **differentiate** between carbonate and bicarbonate salts	12-magnisium suphate
13- **Formula** of brown ring appears by anions of nitrate disappears by heat or shaking	13- $FeSO_4.NO$
14- Cation group precipitated as **sulphides** in acidic	14- second analytical

medium 15 it gives red brick colour by flame taste 16-It is the **positive radical** of the salt	group 15- Calcium 16- cation
17-it is **formed when CO_2 passes in lime water** for short time	17-calcium carbonate
18- Acids have **high boiling point and less volatile;** decompose at high temperature	18- stable acids
19- The **number of atoms or molecules** or ions or electrons or concentration of various substances .	19- Avogadro number
20- Dissolving **1 mole of a substance in water** and completing the solution **to 1 liter.**	20- molar solution
21- Identification the **constituents** of the substance.	21-Qualitative analysis
22-Determination of the the **constituents** of the substance **and their concentration** or quantity of the constituents of the sample	22- chemical analysis
23- The reactions which are used for **determination concentration of acids or bases.**	23- neutralizatin reactions
24- The reactions which are used for determination of substances that form **sparingly soluble products.**	24- precipitation reaction
25-Substace is used to detect the **end point** at which complete reaction takes place.	25- Indicator
26-The indicator that its colour in the acidic medium is red and basic is yellow.	26- methyl orange
27-It is number of **moles of solute which dissolve in one liter of solvent.**	**27-Concentration (Molarity)**
28-It is a solution of **known concentration** used to measure concentration of another analysts	**28- Standard solution**
29-**It is the point** at which quantity of the acid is completely equivalent to the quantity of the base added	**29- End point**
30-It is a kind of filter paper **doesn't leave ash** on burning	**30-Ash less filter paper**

2-Give reasons for

1- 2 grams of H_2 occupies the same volume of 28 grams of N_2 at S.T.P.

B.equal number of moles of different gases have same volume at stp

Or mole of any gas has volume equals 22.4 L

2-Density of CO_2 gas is more than that of O_2

Because molar mass of CO_2 is more than that of O_2

3- Phenolphthalein is not used to detect the acidic medium.

Because it is colourless in acidic medium

4-Identification of basic radical is more complicated than that of acidic

radicals

Due to the presence of a **great number of basic radicals** and the same basic radical may have **more than one oxidation state**

5-Qualitative Analysis must be first

To **identify the components** of the material then choosing suitable method for quantitative analysis

6-Hydrochloric acid is the suitable reagent that used to test for carbonates , bicarbonate , sulphites , sulphides , thiosulphates , nitrites.

B. **HCl is more stable** than their acids. so it replaces the acids of these anions in the form of gases can be identified with the suitable reagent.

7-Sulphuric acid or H_2SO_4 is the suitable reagent that used to test for Chlorides (Cl^{1-}) , Bromides(Br^{1-}) , Iodides (I^{1-}) , Nitrates ($NO3^{1-}$) .

B.sulphuric acid H_2SO_4 is more stable than their acids. so it replaces the acids of these anions in the **form of gases** can be identified with the suitable reagent.

8-The anions of phosphates and sulphates are identified by barium chloride solution and cannot be identified by dil. hydrochloric acid or by conc sulphuric acid .

B .they don't react with dil HCl or conc. H_2SO_4 , but they give p.pt with barium chloride

9- When testing for carbonate radical Carbon dioxide gas CO_2 should pass for short time.

To avoid the conversion of calcium carbonate of white p.pt to soluble calcium bicarbonate so the p.pt disappear.

10-Slight Heating is preferred during the anion detection.

To evolve gases.

11-Discoloring of brown iodine when it reacts with sodium thio sulphate solution.

Due to the formation of sodium iodide (NaI) .

$$2\,Na_2S_2O_3\,(aq) + I_2\,(aq) \rightarrow Na_2S_4O_6(aq) + 2NaI(aq)$$

Sodium tetra thionate

12-The formation of white ppt on cold on adding magnesium sulphate to sodium carbonate solution while on adding magnesium sulphate solution to sodium bicarbonate solution the white ppt is formed after heating .

In 1st case due to the formation **of magnesium carbonate** . While in the 2nd case ; **magnesium bicarbonate** is formed then decomposed by heat into white p.pt of magnesium carbonate .

13-The basic solution cannot be used to differentiate between litmus indicator and bromothymol blue indicator.

Bec. Both are blue in the basic medium

14-The acidic solution cannot be used to identify phenolphthalein indicator.

Bec it is colorless in the acidic solution.

5- Write your conclusions or results

(A) Observation	(B)Results
1-Effervescence and a colourless gas is evolved which turns limewater milky.	1. The gas is .....CO_2.. 2. The anion is ..carbonate.. .. or ..bicarbonate... 3. To differentiate between them :salt solution + magnesium sulphate-
2-Colourless gas is evolved which turned at the mouth of the test tube to reddish-brown fumes.	1. The gas is ...NO. .. and the reddish-brown fumes are ...NO_2... 2-The anion is ...Nitrite..
3-Colourless gas is evolved which has irritating smell and turns an acidified potassium dichromate paper into green.	1. The gas is ....SO_2. .. and the green colour is chromium sulphate The anion is ...Sulphite..
4-Colourless gas is evolved, which has irritating smell and turns an acidified potassium dichromate paper into green and a yellow precipitate is formed.	1. The gas is ....SO_2 .. the p.pt. is ...colloidal sulphur.. .. and the green colour is chromium sulphate. 2. The anion is ..thiosulphate.
5-Colourless gas is evolved which is characterized by its bad odour and turns lead acetate paper black	The gas is ..H_2S. .. and the black P.Pt is ..PbS .. The anion is ......Sulphide..... ..
6-Colourless gas is evolved which forms white fumes with a glass rod wetted with ammonia solution.	1. The gas is ..HCl. .. and the white fumes are ....NH_4Cl.. .. 2. The anion is ....Chloride or Cl^-...
7-Colourless gas is evolved which is oxidized by H_2SO_4 forming reddish-orange fumes which turns a paper wetted by starch solution yellow.	The gas is ....HBr.... .. and the fumes are ...Br_2.. .. The anion is ....Bromide or Br^-.
8-Colourless gas is evolved which is oxidized by H_2SO_4 forming violet	1. The gas is ....HI... .. and the fumes

fumes after heat which turns a paper wetted by starch solution blue.	2. are ...I_2.. 3. The anion is ...iodine or I^-
9-Brown vapour is evolved and its density increases by adding copper felling.	4. The gas is ....NO_2. .. The anion is ....Nitrate or NO_3^-..

6-Show by balanced chemical reactions what happens in each of the following :

(1) Passing carbon dioxide in limewater.

$$CO_{2\,(g)} + Ca(OH)_{2(aq)} \xrightarrow{\text{short time}} CaCO_{3(s)} + H_2O_{(l)}$$

$$2CO_{2\,(g)} + Ca(OH)_{2(aq)} \xrightarrow{\text{long time}} Ca(HCO_3)_{2\,(aq)}$$

(2) Adding hydrochloric acid to the white precipitate which is formed by reacting the salt solution of carbonate with magnesium sulphate.

$$MgCO_{3(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_2O_{(l)} + CO_{2\,(g)}$$

(3) Decomposing magnesium bicarbonate.

$$Mg(HCO_3)_{2(aq)} \xrightarrow{\Delta} MgCO_{3(aq)} + H_2O_{(l)} + CO_2$$

(4) Exposing filter paper moistened with acidified potassium dichromate solution to the gas which is evolved when the solid salt of sulphite reacts with dil. HCl

$$K_2Cr_2O_{7(aq)} + 3SO_{2(g)} + H_2SO_{4(aq)} \longrightarrow K_2SO_{4(aq)} + Cr_2(SO_4)_{3(aq)} + H_2O_{(l)}$$

(5) Exposing filter paper moistened with lead acetate (II) solution to the gas which is evolved when the solid salt of sulphide reacts With dil. HCl

$$(CH_3COO)_2Pb_{(aq)} + H_2S_{(g)} \longrightarrow PbS_{(s)}\downarrow + 2CH_3COOH_{(aq)}$$

(6) Adding iodine solution to sodium thiosulphate.

$$2Na_2S_2O_{3(aq)} + I_{2\,(aq)} \longrightarrow Na_2S_4O_{6(aq)} + 2NaI_{(aq)}$$

(7) Decomposing isolated acid from the reaction of sodium nitrite with dil. HCl

$$3HNO_{2(aq)} \longrightarrow HNO_{3(aq)} + H_2O_{(l)} + 2NO_{(g)}$$

(8) Exposing nitric oxide to the oxygen.

$$2NO_{(g)} + O_2 \longrightarrow 2NO_{2(g)}$$

(9) Adding acidified potassium permanganate solution to sodium nitrite.

$$5NaNO_{2(aq)} + 2KMnO_{4(aq)} + 3H_2SO_{4(aq)} \longrightarrow 5NaNO_{3(aq)} + K_2SO_{4(aq)} + 2MnSO_{4(aq)} + 3H_2O_{(l)}$$

6- Show by balanced chemical reactions what happens in each of the following :

(1) Exposing a glass rod moistened with ammonia solution to the gas which is evolved from the reaction of sodium chloride with conc. sulphuric acid.

$$HCl_{(g)} + NH_{3(g)} \longrightarrow NH_4Cl_{(s)}$$

(2) The partial oxidation of hydrogen bromide by concentrated sulphuric acid.

$$2HBr_{(g)} + H_2SO_{4\,(l)} \longrightarrow 2H_2O_{(l)} + SO_{2(g)} + Br_{2(v)}$$

(3) Adding a small piece of copper metal to the isolated acid from the reaction of sodium nitrate with conc. sulphuric acid.

$$4HNO_{3\,(l)} + Cu \longrightarrow Cu(NO_3)_{2(aq)} + 2H_2O_{(l)} + 2NO_{2(g)}$$

(4) Mixing sodium nitrate with freshly prepared iron (II) sulphate and adding conc. H2SO4 to them.

$$2NaNO_3 + 6FeSO_4 + 4H_2SO_4 \xrightarrow{\text{hot conc}} Na_2SO_{4(aq)} + 3Fe_2(SO_4)_{3(aq)} + 4H_2O_{(l)} + 2NO_{(g)}$$

$$FeSO_{4(aq)} + NO_{(g)} \longrightarrow FeSO_4.NO_{(s)}$$ brown ring compound

(5) Adding barium chloride to sodium phosphate.

$$Na_2SO_{4(aq)} + BaCl_{2\,(aq)} \longrightarrow BaSO_{4\,(s)} + 2NaCl_{(aq)}$$

(6) Adding lead acetate solution to sodium sulphate.

$$Na_2SO_{4(aq)} + (CH_3COO)_2Pb_{(aq)} \longrightarrow CH_3COONa_{(aq)} + PbSO_{4(s)}$$

(7) Adding sodium hydroxide solution to iron (II) sulphate.

$$FeCl_2 + 2NaOH_{(aq)} \longrightarrow 2NaCl + Fe(OH)_{2(s)}$$ white turns green p.pt

(8) Adding excess of sodium hydroxide solution to aluminum sulphate.

$$Al_2(SO_4)_{3\,(aq)} + 6NaOH_{(aq)} \longrightarrow 3Na_2SO_{4(aq)} + 2Al(OH)_{3(s)}$$ white gel p.pt

$$Al(OH)_{3(s)} + NaOH_{(aq)} \longrightarrow NaAlO_{2\,(aq)} + 2H_2O_{(l)}$$ soluble in water

(9) Adding Water containing carbon dioxide to the precipitate which is produced when calcium chloride reacts with ammonium carbonate.

$$CaCO_{3(s)} + H_2O_{(l)} + CO_{2(g)} \longrightarrow Ca(HCO_3)_{(aq)}$$

(10) Colourless, turns filter paper moistened with starch yellow.

$2NaBr_{(s)} + H_2SO_4 \xrightarrow{hot\ conc} Na_2SO_{4(aq)} + 2HBr_{(g)}$

(11) Colourless, gives white fumes with glass rod moistened with ammonia solution.

$2\ NaCl_{(s)} + H_2SO_{4\ (aq)} \xrightarrow{hot\ .conc.} Na_2SO_{4(aq)} + 2HCl_{(g)}.$

(12) Colourless, turned into violet vapours by heating.

$2KI_{(s)} + H_2SO_{4\ (l)} \xrightarrow{hot\ conc} K_2SO_{4(aq)} + 2HI_{(g)}$

(13) Brown vapour turned into dense vapour when copper felling is added

$4HNO_{3\ (l)} \longrightarrow 2H_2O_{(l)} + 4NO_{2(g)} + O_{2(g)}$

(14)Conc. sulphuric acid with sodium chloride salt.

$2\ NaCl_{(s)} + H_2SO_{4\ (aq)} \xrightarrow{hot\ .conc.} Na_2SO_{4(aq)} + 2HCl_{(g)}.$

(15) Conc. sulphuric acid with sodium bromide salt.

$2NaBr_{(s)} + H_2SO_4 \xrightarrow{hot\ conc} Na_2SO_{4(aq)} + 2HBr_{(g)}$

(16) Conc. sulphuric acid With sodium iodide salt.

$2NaI_{(s)} + H_2SO_{4\ (l)} \xrightarrow{hot\ conc} Na_2SO_{4(aq)} + 2HI_{(g)}$

(17) Conc. sulphuric acid with sodium nitrate salt.

$2NaNO_{3\ (s)} + H_2SO_{4(l)} \longrightarrow Na_2SO_{4(aq)} + 2HNO_{3\ (l)}$

8-Mention one confirmatory test for each of the following

(1) Chloride anion.

$NaCl_{(aq)} + AgNO_{3(aq)} \longrightarrow AgCl_{(s)}\downarrow + 2NaNO_{3(aq)}$

white ppt.

(2) Iodide anion.

$NaI_{(aq)} + AgNO_{3(aq)} \longrightarrow AgI_{(s)} + NaNO_{3(aq)}$

yellow ppt.

(3) Phosphate anion.

$Na_3PO_{4\ (aq)} + 3\ AgNO_{3\ (aq)} \longrightarrow \underset{\text{yellow p.pt}}{Ag_3PO_4}\ _{(s)} + 3\ NaNO_{3\ (aq)}$

(4) Thiosulphate anion.

Salt solution + iodine solution the brown colour of iodine is removed

$2Na_2S_2O_{3(aq)} + I_{2\ (aq)} \longrightarrow Na_2S_4O_{6(aq)} + 2NaI_{(aq)}$

9-Write the balanced chemical reactions that give the gases which can be detected by the following :

(1) Colourless, turns the limewater milky.

$Na_2CO_{3(s)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

(2) Ability to turn acidified potassium dichromate paper green.

$Na_2SO_{3(s)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + H_2O_{(l)} + SO_{2(g)}$

(3) Bad odour, turns the lead acetate paper black.

$Na_2S_{(s)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + H_2S_{(g)}$

(4) Colourless, turns into reddish-brown fumes When it is exposed to air at the mouth of the test tube.

$NaNO_{2(s)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + HNO_{2(aq)}$

$3HNO_{2(aq)} \longrightarrow HNO_{3(aq)} + H_2O_{(l)} + 2NO_{(g)}$

(5) Dil. hydrochloric acid with sodium carbonate salt.

$Na_2CO_{3(s)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

(6) Dil. hydrochloric acid With sodium sulphite salt.

$Na_2SO_{3(s)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + H_2O_{(l)} + SO_{2(g)}$

(7) Dil. hydrochloric acid with sodium sulphate salt.

$Na_2SO_{4(s)} + 2HCl_{(aq)} \longrightarrow$ no reaction

(8) Dil. hydrochloric acid with sodium thiosulphate salt.

$Na_2S_2O_{3(s)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + H_2O_{(l)} + SO_{2(g)} + S_{(s)}$

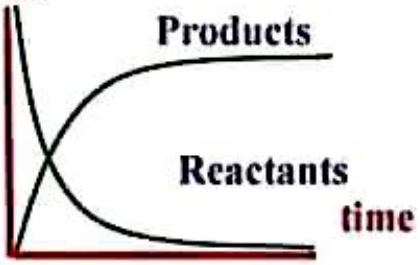
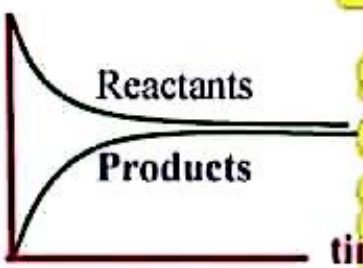
CH(3) 1-compersion

1-Compare between chemical and ionic equilibrium

Chemical Equilibrium	Ionic Equilibrium

it is a dynamic system in which the rate of forward reaction equals the rate of backward reaction , and concentration of reactants and products are still found in medium of reaction,	It is equilibrium of weak electrolytes , between it's non ionized molecules , and formed ions . non ionized molecules $\rightleftharpoons$ Dissociated ions

2-Compare between Complete reaction and Reversible reaction

Complete reaction	Reversible reaction
Reaction takes place in **forward direction only**, gas or precipitate is formed. $Zn + 2HCl = ZnCl_2 + H_2$ $NaCl + AgNO_3 = NaNO_3 + AgCl.$ Conc.  	Reaction takes place in both **forward, and backward directions** so that both reactants and products are found in reaction medium $CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$ Conc. 

2-Write the scientific term of the following phrases	What is meant by
(1) At constant temperature the speed of chemical reaction directly proportional to the product of the concentrations of the reactants (2) The minimum energy that molecule must be gained in order reacts at the collision (3) The concentration of hydrogen ion multiplied by the concentration of hydroxyl ion equal to 10-14 mole /L (4) The change of the concentration of the reactants and product in the unit time (5) Material conduct electric current through the movement of ions (6) An expression of the degree of acidity or alkaline aqueous solutions of sequence positive numbers	1-Law of mass action 2-activation energy 3-Ionic product of water K_w 4- 5-Rate of chemical reaction 6- Electrolytic conductors 6-PH Value

(7) Material change the rate of chemical reaction without being changed and do not change the status of equilibrium	7-Catalyst
(8 Particles with a kinetic energy equal to or exceed the activation energy.	8- activated molecules
(9) The negative logarithm of the hydrogen ion concentration.	9- PH value (hydrogen exponent)
(10) The maximum pressure of water vapour can be present in the air at a given temperature	10- Saturated vapour pressure
(11)The reactions which proceed in both forward and backward directions and the reactants and products are continuously exist in the reaction medium.	11- Reversible reaction
(12)If any of the factors affecting a system under equilibrium such a pressure, concentration or temperature, the equilibrium will shift in the direction which will oppose this change	12- Le Chatelier's principle states
(13) A stationary system apparently but a dynamic system reality	13- Dynamic equilibrium
(14)A dynamic state reached when the rate of forward reaction equal to the rate of backward reaction.	14- Chemical equilibrium
(15)- Reactions proceed in one direction only (forward direction) due to escaping one of the products from the system	15- Complete reaction
(16)A process in which unionized molecules are changed into ions	16- Ionization
(17) The positive ion which is formed when water molecule combine with the hydrogen ion (proton) and has an acidic effect on litmus	17-Hydroniuom ion or H_3O^+
(18)A state of equilibrium a rising between molecules of a weak electrolyte and ions resulting from it.	18- Ionic equilibrium
(19)A solution has (pH) value more than (7)	19- Basic or alkaline solution
(20) A solution has (POH) value more than (7)	20- Acidic solution
(21)It is the pressure of water vapour at certain temperature	21- Water vapour pressure:
(22) They are biological catalyst ,are **protein of high molecular mass**	22- Enzymes
(23)At constant temperature, the degree of ionization increases by dilution.	23- Ostwald law
	24- Solubility product Ksp

(24) It is the product of multiplication of the concentration of ions of **sparingly soluble** substance in its saturated solution each is raised to power number of moles in balanced equation. 25)The ratio between the rate constant of forward reaction and the rate constant of backward reactions	**25 -Equilibrium constant**

3-G.R.F ch(3)

1- Equilibrium state is a dynamic process but not a stationary one
Because at equilibrium state the changes take place in the two directions, forward and the backward, at the same rate .

2- The reaction of Zinc with dil.acids is a complete reaction while that of acetic acid with ethyl alcohol is a reversible one.
Because in the first reaction the evolved hydrogen escapes from the system so, the reaction proceeds in one direction only
While in the second reaction both the reactants and products are still found in the system, so the reaction continues in the two directions, the forward and backward

3 - Ionic compounds react faster than covalent compounds.
Because ionic compounds ions combine with each other instantly but covalent bonds need an amount of energy to be broken , so the time of the reaction increases

4 - Iron fillings collide faster than a block of iron and also, saw dust combust faster than a block of wood
Because the rate of the reaction increases by increasing the surface area of reactants so iron fillings react faster as they have a larger surface area exposed to the reaction .

5 - Raising the temperature, increases the rate of the reaction
Because raising the temperature increases the kinetic energy of the reacting molecules so, the rate of collision between them increases , so the rate of the reaction increases .

6 - The hydrogen ion does not exist freely in the aqueous solutions of acids. Or The hydrogen ion is called hydrated proton.
Because the hydrogen ion contains an empty orbital, so it can accept the lone pair of electrons on the oxygen atom in a water molecule by a coordinate bond forming the hydrated proton or hydronium ion

7 - Sodium chloride solution has a neutral effect on litmus.

$$NaCl \longrightarrow Na^+ + Cl^{-1}$$
$$H_2O \longrightarrow H^+ + OH^- \quad \text{by addation}$$
$$NaCl + 2H_2O \longrightarrow H^+ + Cl^- + Na^+ + OH^-$$

Because NaCl dissociates in water giving hydrochloric acid and sodium hydroxide which are **strong electrolytes** and completely ionized , so the concentration of H^+ ions equals that of OH^- ions ,

8) Butagas cylinders must not be heated if you need to get gas.

Because, heating process converts the Butagas from the liquefied state to the gaseous state so increases on the cylinder walls leading to its explosion.

9) Increasing temperature causes an increase in the rate of reaction.

Because heating causes

a) An increase in kinetic energy of the reacting molecules.

b) An increase in the velocity of molecules motion and the rate of collosion between them.

c) An increase in the activation energy of the reacting molecules, as a result, rate of reaction increases.

10) Food is cooked quickly in pressure cookers (presto).

Because the pressure of the vapours increases causing an increasing in the temperature in a short time, so the rate of the reactions needed for cooking food increases.

11) In summer, food goes rotten quickly if it is left in the air.

Because, in summer, the temperature rises so it speeds up decomposition reactions in food, so food spoils and goes rotten quickly.

12) Catalysts have an economical importance.

Because, catalyst increases the rate of reaction instead of raising the temp. which saves a lot of money.

13) pH Value of pure water = 7

Because the concentration of hydrogen ion equals the concentration of hydroxyl ion = 10^{-7}.

14) Ionization of hydrochloric acid is not affected by dilution but the extent of ionization of acetic acid increases by dilution.

Because HCl acid is completely ionized while acetic acid contains unionized molecules which ionize gradually by increasing dilution

15) Ammonium chloride solution has an acidic effect on litmus.

$$H_2O \longrightarrow H^+ + OH^-$$

$$NH_4Cl \longrightarrow Cl^- + NH_4^+$$

$$NH_4Cl + H_2O \longrightarrow H^+ + Cl^- + NH_4OH$$

Because it dissolves in water forming ammonium hydroxide weak alkali and hydrochloric acid which is strong and completely ionized, so concentration of H^+ ion becomes greater than the concentration of OH ion/

16) Ammonium acetate solution has a neutral effect on litmus.

$$H_2O \longrightarrow H^+ + OH^-$$
$$CH_3COONH_4 \longrightarrow CH_3COO^- + NH_4^+ \quad \text{by addation}$$

$$CH_3COONH_4 + H_2O \longrightarrow CH_3COOH + NH_4OH$$

Because it dissolves in water forming acetic weak acid and ammonium hydroxide weak alkali, so the concentration of H^+ ion equals the concentration of OH^- ion

17-Adding water to sulphuric acid does not affect the electrical conductivity of the acid.

Bec. sulphuric acid is strong electrolyte that ionized completely

$$H_2SO_4 \longrightarrow 2H^+ + SO4^{-2}$$

4- Arranged the following solutions in ascending order according to PH value
Na_2CO_3 – H_2O - NH4Cl

Solution

Na_2CO_3 is basic its PH more 7

H_2O is neutral its PH= 7

NH4Cl is acidic its PH less 7

NH4Cl < H_2O <Na_2CO_3

5)Classify the following reactions into Irreversible and reversible reactions:

I-$2Cu(NO3)_2$ (s) = 2CuO (s) + $4NO_2$ (g) + O_2 (g) **Irreversible**

2 $CH_3COOH(aq) + C_2H_5OH(aq) = CH_3COOC_2H_5(aq) + H_2O(L)$ **reversible**

3 - In a closed vessel: $CO(g) + H_2O(g) = CO_2(g) + H_2(g)$ **Irreversible**

6) Pure water, which is a weak electrolyte, is a poor conductor to electricity, answer the following:

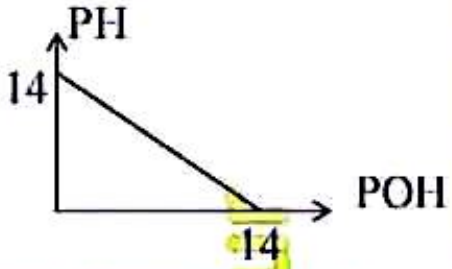
a) Write the equilibrium equation expressing ionization of water.

$$H_2O + H_2O \rightleftharpoons H_3O^+ + OH^-$$

b)What is the type of equilibrium of water ionization?

Ionic equilibrium

C) Draw the graph which shows the relation between PH and POH for the same solution.



7- Arranged the following solutions in ascending order according to PH value

1 - NaCl – $FeCl_3$ - $(CH3COO)_2Ca$

NaCl **neutral salt PH =7**

$FeCl_3$ **acidic salt PH < 7**

$(CH3COO)_2Ca$ **basic salt PH >7**

$FeCl_3$ < NaCl < $(CH3COO)_2Ca$

8- Complete the following table

No	POH	PH	$[OH^-]$	$[H^+]$	Type of solution
1	10	4	1×10^{-10}	$10^{-4} \times 1$	Acidic solution
2	3	11	$10^{-3} \times 1$	1×10^{-11}	basic solution
3	4	10	1×10^{-4}	1×10^{-10}	basic solution

What happens when

37) adding small ratio of vanadium to steel

.....

.....

38)to colour of mixing 50ml of sulphuric acid of concentration 0.2M with 100ml of sodium hydroxide of concentration of 0.1M has drops of litmus solution

CH(4) 1-compersion

(1)- Cations & Anions

Cations	Anions

is a particle that's poor in electrons & moves in solution towards the - ve pole Ag^{1+} , Na^{1+}, Cu^{2+} , Zn^{2+}, Al^{3+}	is a particle that's rich in electrons & moves in solution towards the +ve pole Cl^{-} o^{2-} , NO_3^{-} , SO_4^{2-}

(2) – Oxidation and reduction

Oxidation	Reduction
Process of **losing electrons** or **increasing positive charge** or **decreasing negative charge** $Zn^{\circ} \longrightarrow Zn^{2+} + 2e$ or $2Cl^{-1} \longrightarrow Cl_2 + 2e$	Process of **gaining electrons** or **decreasing positive charge** or **increasing negative charge** $Pb^{+4} + 2e \longrightarrow Pb^{2+}$ or $Cu^{\circ} + 2e \longrightarrow Cu^{2+}$

3-Electronic connectors and electrolytic connectors

	electronic conductors	Electrolytic conductors
1-	**metal** conductors	**solutions or molten** ionic compounds
2-	they transfer electric current through the displacement of **electrons** inside the material	they move electrical current by the movement of **positive and negative ions,**
3-	**not accompanied** by the transition of the material	**accompanied** by the transmission of the material
4-	chemical change in the composition **does not happen**	chemical change in the composition **happen**
5-	**Examples** copper - platinum - graphite - aluminum - iron – Mercury	**Examples** aqueous solutions of salts, acids, alkalis

(4)-Electrolytic cell and Galvanic cell

Electrolytic cell	galvanic cell
1-it changes electrical energy into chemical energy. 2-**Anode** is the electrode connected	1- It changes chemical energy into Electrical energy. 2-**Anode** is the electrode at which

to +ve pole of the electric source at which oxidation process takes place. **3-Cathode** is the electrode connected to **-ve Pole** of the electric source at which reduction process takes place. **4-Consumes** electric energy. 5- It can not be reversed. 6-The reactions take place inside it are **non-spontaneous** reactions. 7-The two electrodes are **not necessary** to be different	oxidation process takes place, it represents the **-ve Pole** of the cell **3-Cathode** is the electrode at which reduction Process takes place, it represents the **+ve Pole** of the cell. **4- Produces** electric energy. 5-Can be reversed (during charging). 6-The reactions take place inside it are **spontaneous** reactions, 7- The two **electrodes must be different** in oxidation potentials till a difference in potential found between them

(5) The primary cells and the secondary cells.

primary cells	Secondary cells.
It is galvanic irreversible cell	It is galvanic reversible cell.
Can not be recharged	Can be recharged
As 1 – Mercury cell 2- fuel cell 3-Daniel cell	As 1-car battery 2-Lithium ion dry battery

(6) Purification of metals &Electroplating

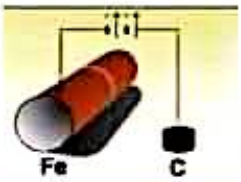
P.O.C	Electroplating	Purification
1-Anode	Pure meal we use in plating	impure meal
2-Cathode	metal want to be painted or spoon	Pure meal
3-electrolyte	solution of the metal salts want to paint	solution of the metal salts want to purify

(7) Anodic protection and Cathodic protection

(1) Anodic protection	(2) Cathodic protection
covering iron with more active metal than iron as zinc (called galvanizing) iron will be cathode and zinc will anode so when scratch happens zinc will corrode first and this protect iron	covering iron with less active metal than iron as tin (Sn) scratching takes place iron is the anode and corrode first

More active metal
Anode
Loses electrons
Oxidation
High oxidation potential

less active metal
Cathode
gains electrons
Reduction
Low oxidation potential



	A	B
Oxi. Pot.		
Red. Pot.		

	O.P	R.P
	+	−
H	0	0
	−	+

2-Write the scientific expression for each of the following:	What is meant by
1-Systems in which the chemical energy in an oxidation reduction processes is converted spontaneously to an electric energy	1-Galvanic cells
2-Systems in which electrical energy is converted to oxidation reduction processes but not spontaneously.	2-electrolytic cells
3-Materials that conduct the electric current through the migration of its ions.	3-electrolytic conductors
4-Materials that conduct the electric current through the migration of its electrons.	4- electronic conductors
5-The electrode at which reduction processes takes places	5-Cathode
6-The electrode of electrolytic cells at which oxidation processes takes place	6-anode –positive pole
7-The quantity of electricity consumed on passing a current with a strength of one ampere through a conductor for a time of one second .	7-coloumb
8- Particles which move in the electrolyte and carry negative charge.	8- anions or negative ions
9- When a given quantity of electricity is passed through solution of several electrolytes the weights of substances formed at the electrode are directly proportional to their equivalent weights.	9-Faraday second law
10-The quantity of electricity needed to precipitate or dissolve or evolve the equivalent gram of matter by electrolysis.	10-faraday
11 -The process of losing electrons associated with	11-Oxidation

the increase in the positive charge.	
12-The descending arrangement of elements according to their standard oxidation potential with respect to standard hydrogen electrode.	12-electro chemical series
13-It is electrochemical process in which metals oxidize or lose electrons	13-Corrosion
14-Process of covering iron with metal more reactive than iron as zinc	14- galvanization
15- The reactions in which the electrons are transferred between reactant substances.	15-Redox reactions
16- The electrode at which the oxidation reactions take place in the galvanic cell.	16- anode – negative pole
17- U shaped glass tube filled with an electrolyte solution and connects the solutions of the two half cells without allowing a direct contact.	17-salt bridge
18-The cells in which the oxidation - reduction reaction is a spontaneous irreversible reaction.	18-Primary galvanic cells
19-The cells which are characterized by their reversible chemical reactions and store electric energy in the form of chemical energy.	19-secondary galvanic cells
20-It is used in measuring the density of the acid solution in car battery	20- hydrometer
21- Electrolyte in the mercury cell.	21 –potassium hydroxide
22- the resultant water in it evaporates and can be condensed as drinking water for astronauts	22- fuel cell
23- Organic compound is used in making container of car batterywhich does not affect by acids	23-poly styrene
24-the active metal electrode which is connected with the positive source in covering metals and will corrode first	24-sacrificial electrode
25- He deduced the relationship between the quantity of electricity which flows in a solution and the quantity of material liberated at electrodes.	25-Faraday
26-It is the emf of galvanic cell consisting of S.H.E. acting as cathode and the element as anode.	26. Oxidation potential of an element

27- It is the emf of a galvanic cell consisting of S.H.E acting as anode and an element as cathode.	**27. Reduction potential of element**
28-the amount of chemical change takes place in electrolytic cell is **directly proportional** to quantity of electricity	**28. Faraday's first law**
29-the amount of chemical changes takes place in different electrolytic cells connected series is **directly proportion** to equivalent masses.	**29. Faraday's second law**
30-when **one faraday** (96500 coulomb) is passed through electrolyte, it will dissolve, evolved or precipitate **equivalent mass** at the two electrodes.	**30. General law of electrolysis**
31-it is the quantity of electricity needed to precipitate **1.118miligram** of silver	**31. Coulomb: equals ampere. second**

3-What is meant by corrosion ,write its chemical equation

Corrosion

It is **electro chemical process** of metals due to oxidation or losing electrons

a- **oxidation of iron**

$$2Fe \longrightarrow 2Fe^{2+} + 4e$$

b. At cathode (carbon) reduction takes place for oxygen of air as follow

$$2H_2O + O_2 + 4e \longrightarrow 4OH^-$$

c. Iron ions (Fe^{2+}) combine with hydroxide ions (OH^-) to form iron II hydroxide

$$2Fe^{2+} + 4OH^- \longrightarrow 2Fe(OH)_2$$

d. Iron II hydroxide oxidizes in air to iron III hydroxide as follow

$$2Fe(OH)_2 + H_2O + {}^1/_2O_2 \longrightarrow 2Fe(OH)_3$$

SO the total reaction is the sum of the above as follow:

$$2Fe + 3H_2O + {}^3/_2O_2 \longrightarrow 2Fe(OH)_3$$

4-What happens when we put copper chloride solution in electrolytic cell

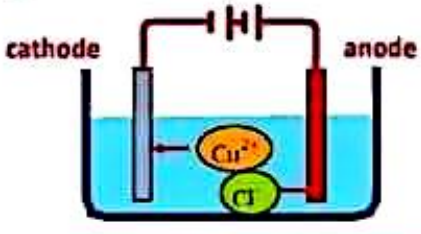
Oxidation &reduction reaction take place non spontaneously

a-at the cathode:

$$Cu^{+2} + 2e^- \rightarrow Cu$$

b - at the anode $2Cl^- \rightarrow Cl_2\uparrow + 2e$

Total reaction



$$Cu^{2+} + 2Cl^- \longrightarrow Cu + Cl_2$$

5-Give the scientific explanation for

1-The galvanic cell is reversible cells

Because if the cell is supplied from the outside source with an amount of electricity **slightly higher** than the original amount, the oxidation reaction is reversed to reduction and the reduction to oxidation.

3 - In galvanic cells , a salt bridge should be used .

Because it **prevents the saturation** of both half cells by excess ions , so that they become electrically neutral and the current flows continuously .

4-The elements at the beginning of the electrochemical series are strong reducing agents .

Because they **lose** the valence electrons easily.

5 - The elements at the end of the electrochemical series are oxidizing agents.

Because their **oxidation potential is very small** and they easily gain electrons .

6 - Copper does not replace hydrogen in acids or water.

Because oxidation potential of copper is less than that of hydrogen or it is less active than hydrogen , so it can not replace it in acids or water .

7- In galvanic cell, zinc plate is considered as an anode and the copper plate as cathode,

Because an oxidation reaction takes place at zinc plate and a reduction reaction takes place at copper plate .

$$Zn \longrightarrow Zn^{+2} + 2e$$

$$Cu^{+2} + 2e \longrightarrow Cu$$

8- Silver nitrate solution should not be kept in copper vessels.

Because the oxidation potential of copper is higher than that of silver i.e copper is more active than silver , so it replaces silver in its salt solution and vessel decay.

9-the color of copper sulfate disappear when put in zinc plate

Because **zinc replaces** copper and zinc sulphate formed which is colorless

10-We can save a solution of zinc nitrate in copper vessels
Because the oxidation of copper is smaller than the zinc oxidation of so it is less active than zinc and cannot replace it in its solution

11-electric current stops in a Daniel cell after some times?
B. **zinc metal dissolved** in the zinc half-cell or **copper ions are decreased** due to precipitation in the form of copper atoms in the copper half-cell

12- primary cells called dry cells?
Because electrolytic materials are in the form of **dry and not liquid**

13- mercury battery must be disposed of in a safe manner?
because they contain mercury, a **toxic substance**

14-mercury cell used in-ear headphones, watches?
B. they have **small size** and their voltage stay for long time

15-Lithium battery prefers to use than dry batteries?
Because it is a secondary **cell can be recharged** again

16-lead accumulator must recharge the from time to time
Due to the **consumption of sulfuric acid** and increase the amount of water and weak electric current and turns lead and lead dioxide to lead sulfate

17-Electroplating of metal has a great economic importance
Because it protects the metal from the rust and corrosion and give it a shiny appearance

18-carbon electrodes must be replaced from time to time when extraction of aluminum metal
Because rising **oxygen reacts with the carbon electrodes** and gives carbon mono oxide and carbon dioxide

$$^{3}/_{2}\,O_2 + 2C \longrightarrow CO + CO_2$$

Causing erosion of carbon electrodes

19-Recently we use a mixture of salts of aluminum sodium, calcium, fluorides, rather than carylite when extracting aluminum metal?
B. it **reduces melting point and has lower density** than of the molten which facilitates the separation of aluminum, in the bottom of the electric cell

20-Copper (99%) not prefer to use

Because copper (99%) contains the impurities of **iron, zinc and gold**, which reduces the ability of copper conductivity

21-Scientists care much attention by electrolysis and the development of research

Because it is used in electroplating and prepare some of the material in the industry and metal purification also source of electricity batteries

22) Addition Fluorspar in extracting aluminum from bauxite .

To decrease its melting point from 2045^0c to 950^0c

23- Salt bridge is important in Denial cell

It prevents the formation of excess of(Zn^{2+}) in the Zinc half cell and excess of$(SO_4)^{-2}$ ions in the copper half cell so the current will continuously flow

24-The standard hydrogen potential is not equal zero in some cases.

Due to **changing the hydrogen ion concentration** in solution or changing the **potential pressure** of the hydrogen gas or both .

25-Both of magnesium and iron replace hydrogen of the diluted acids but the reaction is faster in case of magnesium.

B .each of them is **more active than hydrogen** of acid and magnesium is more active than iron

26-The density of the sulphuric acid in the battery can identify the car battery condition.

B. when the battery is completely charged the density of acid equal from 1.28 to 1.30 gm/cm^3 **but if the acid density decreased to less than 1.2 gm/cm^3**, the battery needs to recharging and increasing its acid concentration

27-Lithium is used in making mobile battery .

B. It is the **lightest known metal** and it has the **lowest standard reduction potential** relative to all metals (- 3.04v)

28-The total e.m.f of the car battery is 12 volts although each lead cell forming it is 2 volts only.

It consists of six cells are connected in series. Each cell produces 2 volt and the emf of battery = 2 x 6 = 12 volts

6-Choose the correct answer

1-To deposit one gram atom of a trivalent metal it is required to pass a quantity of electricity of.....