

# Final full mark Revision

ملزمة الدرجات النهائية

## King of Excellence

تشمل على

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مع الكينج التفوق حليفك



## Full mark revision مع الكينج التفوق حليفك Chemical formula Radicals

(1) Monovalent radicals		(2) Divalent radical	
cyanate	$\text{CNO}^-$	Sulphate	$\text{SO}_4^{2-}$
Hydroxide	$\text{OH}^-$	Sulphite	$\text{SO}_3^{2-}$
Bicarbonate	$\text{HCO}_3^-$	thiosulphate	$\text{S}_2\text{O}_3^{2-}$
Nitrate	$\text{NO}_3^-$	Carbonate	$\text{CO}_3^{2-}$
Nitrite	$\text{NO}_2^-$	Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Acetate	$\text{CH}_3\text{COO}^-$	(3) Trivalent radicals	
Thio cyanate	$\text{SCN}^-$		
permanganate	$\text{MnO}_4^-$		
ammonium	$\text{NH}_4^+$		
		Phosphate	$\text{PO}_4^{3-}$

## Symbols of important elements and its general valency

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

When Alone

Do not forget the diatomic molecules of element are



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 **مذلع** Carbide carbon



Organic compoundsهام جدا جدا

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 $\begin{array}{c} H \\   \\ C=O \end{array}$	Alkanal	ethanal Acetaldehyde $CH_3CHO$
Carboxylic acids	$\begin{array}{c} O \\    \\ R - C - OH \end{array}$	carboxylic - COOH	alkanoic	Ethanoic acid Acetic acid $CH_3COOH$
Esters	$\begin{array}{c} O \\    \\ R - C - OR \end{array}$	ester -COO-	Alkyl alkanoate	ethyl ethanoate Ethyl acetate

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





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

## 2-iron ores

### 3- Blast furnace and Medrix furnace according to:-

P.O.C	Blast furnace	Medrix furnace
iron ore	$\text{Fe}_2\text{O}_3$	$\text{Fe}_2\text{O}_3$
Source of reducing agent	from coke coal [ C ]	from natural gas
Reducing agent	CO	CO + H <sub>2</sub>
equation in Blast furnace	$\text{Fe}_2\text{O}_{3(s)} + 3\text{CO}_{(g)} \xrightarrow{\Delta} 2\text{Fe}_{(s)} + 3\text{CO}_{2(g)}$	
equation in Medrix furnace	$\text{Fe}_2\text{O}_{3(s)} + 2\text{CO}_{(g)} + \text{H}_{2(g)} \xrightarrow{\Delta} 2\text{Fe}_{(s)} + 2\text{CO}_{2(g)} + \text{H}_2\text{O}_{(g)}$	

## 4- Types of alloys

Interstitial alloy	Substitutional 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 <b>some atom</b> of pure metal is replaced by the atoms of other metal atoms have same size & chemical activity	It is formed when <b>two metals</b> or more <b>combine chemically</b> form new compounds with new properties <b>as alloy of</b>

Name	Chemical Formula	Chemical name	Colour
Magnetite	$\text{Fe}_3\text{O}_4$ Mixed oxide	Magnetic iron oxide	Black Has Magnetic property
Haematite	$\text{Fe}_2\text{O}_3$	Iron III oxide	Blood red Easy reduced
Limonite	$2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$	Hydrate iron III oxide	Yellow Easy reduced
Siderite	$\text{FeCO}_3$	Iron II carbonate	Yellowish grey



as <b>steel iron</b> alloy ( <b>carbon &amp; iron</b> )	as 1- <b>iron ,chromium</b> alloy 2- <b>copper , gold</b> alloy	1-Aluminum nickel alloy & Aluminum copper alloy Which named <b>Dior Alumin</b> lead gold alloy( <b>Au<sub>2</sub>Pb</b> ) 2-cementite <b>Fe<sub>3</sub>C</b>
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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 2-Titanium-aluminum alloy 3-Vanadium steel alloy 4-iron manganese alloy (ferromanganese) 5-Manganese aluminum alloys 6-Nickel steel alloy 7-Nickel chromium alloy 8-nickel- cadmium 9-Copper tin alloy (Cu -Sn) 10-(Cu -Zn) brass alloy	1-MIG fighter planes, 2-planes and space crafts, 3-car springs 4-railways industry 5-drinks cans 6-hard , resistance rust and acid (keep acids) 7-heating coils and electrical ovens 8-rechargeable batteries 9- Bronze 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 <b>large size</b> of the iron ore to <b>small size</b> to be easily reduced .	Process of converted the <b>fine particles</b> of the iron ore to <b>large particles</b> to be easily reduced .	Process of <b>removing</b> of <b>impurities</b> which mix or combine chemically with ore by <b>surface tension or electrical or magnetic separation</b>	Process of <b>heating the iron ores</b> in air strongly to expel humidity

### 7-Paramagnetic & diamagnetic substances

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



Its magnetic moment is equal to the **number of unpaired electrons in ( d )** sublevel as  $\text{Cu}^{++}$ , Fe, Ni, Mn, Co, Sc

its magnetic moment is equal **zero** because electrons are paired in d orbitals or empty such as  $\text{Zn}^{+2}$ ,  $\text{sc}^{+++}$

### 3-Mention the use of the following element

element or Substance	Use or Economic importance
1-Scandium 2-Titanium 3-Chromium 4-Iron	1-mercury vapour lamps 2-dental implant and replacement joints 3-plating metals& leather industry 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 ( $\text{CO} + \text{H}_2$ ) 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 7-Copper 8-Zinc	6-catalyst in hydrogenation of oil - painting metals 7-electrical wires or cables 8- galvanizing of metals

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

Compound or Substance	Use or Economic importance
-----------------------	----------------------------



1-titanium dioxide - $\text{TiO}_2$ 

2-vanadium pentoxide

 $\text{V}_2\text{O}_5$ 3- chromium oxide  $\text{Cr}_2\text{O}_3$ 4- $\text{K}_2\text{Cr}_2\text{O}_7$ 5- $\text{KMnO}_4$ 6-Manganese dioxide  $\text{MnO}_2$ 

7- manganese II sulphate

 $\text{MnSO}_4$ 

8-Copper II sulphate

 $\text{CuSO}_4$ 

9-Fehleing solution

10-zinc oxide  $\text{ZnO}$ 11- zinc sulfide  $\text{ZnS}$ 

1-in sunscreens or sun cream

2-Pigment in ceramic and glass industry

catalyst in production of sulphuric acid by contact method

catalyst in magnets industry of super conducting

3-making pigments

4-oxidizing agent

5-strong oxidizing agent and disinfectant

6-oxidizing agent - dry cell

7-fungicide

8- Insecticide -Fungicide -purification of drinking water

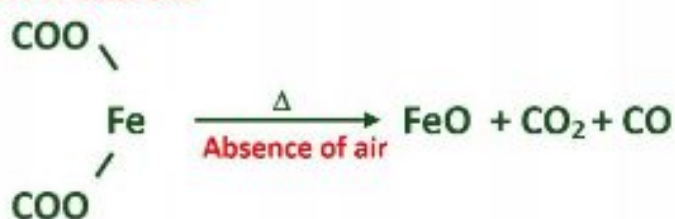
9- it is used in the detection of glucose

10-paints, rubber and cosmetics industry

11-bright coatings &amp; X-ray screens industry

### 5-What is the effect of heat on

1- Iron II oxalate



2- Iron II carbonates (siderite)



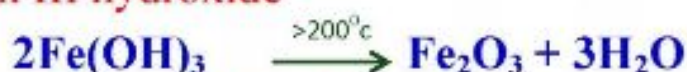
3- Limonite



4- Iron II sulphate



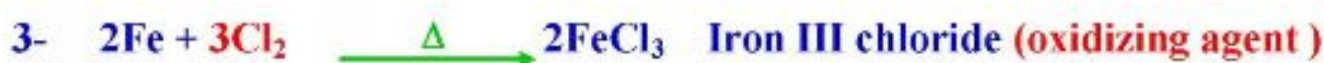
5- Iron III hydroxide



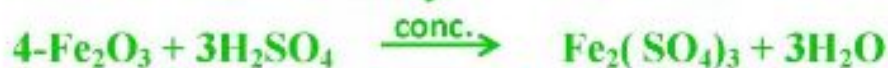
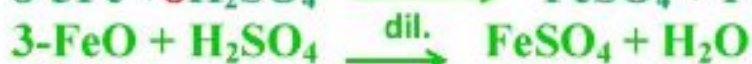
### 6-Reactions of iron







### 7-Reactions of sulphuric acid



### 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 pentaoxide  $V_2O_5$

6-Chromium

7- Fischer-Tropsch

8-water gas

9- Fehling 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

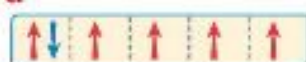
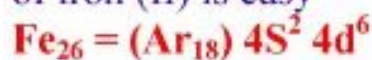
6) Electronic configuration of Chromium and Copper are abnormal .

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

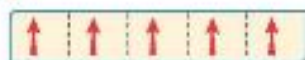




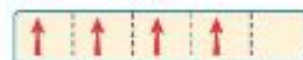
less stable

more stable

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



Oxidation  
Not easy



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.

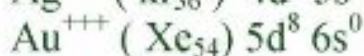
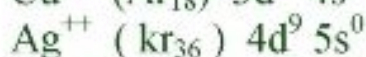
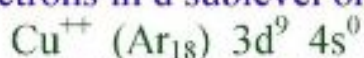
- 11) Scandium cannot give oxidation state (+4) ?

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

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

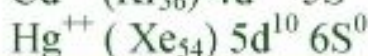
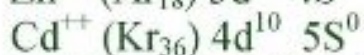
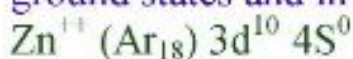
- 12) The coinage metals which are ( $\text{Cu}_{29}$  -  $\text{Ag}_{47}$  -  $\text{Au}_{79}$ ) are considered as transition elements, although the orbitals of (d) sublevel are completely filled with electron

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



- 13)  $\text{Zn}_{30}$ ,  $\text{Cd}_{48}$ ,  $\text{Hg}_{80}$ , 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 .



- 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)  $\text{Cu}^{++} (\text{Ar}_{18}) 4\text{S}^0 3\text{d}^9$  has blue colour**

when the light falls on the  $\text{Cu}^{++}$  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)  $\text{Cr}^{+++}$  ions has red colour Or compounds of chromium III are coloured by red**

due to the presence of **unpaired electrons** in the orbitals of ( $\text{d}^3$ ) sublevel when the light falls on the  $\text{Cr}^{+++}$  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)  $\text{Cu}^+ (\text{Ar}_{18}) 3\text{d}^{10}$  and  $\text{Zn}^{2+} (3\text{d}^{10})$  are colourless**

Due to absence of unpaired electrons in 3d sublevel which is completely full by electrons

**23) Ions of non – transition elements are colourless**

Or ( **representative elements** ) are colourless



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

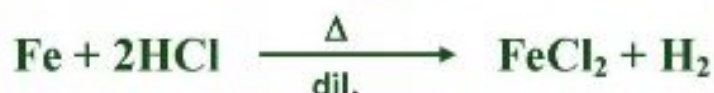
## 24) Reaction of iron with chlorine form iron III chloride

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



## 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



## 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  $\text{Fe}_2\text{O}_3$  ,  $\text{FeO}$**



## Different questions

1 -Which of the following elements paramagnetic and which is diamagnetic  $\text{Zn}$  ,  $\text{Cu}^{++}$  ,  $\text{TiO}_2$  , Write the value of their magnetic moment



Number of unpaired electrons =0

Magnetic moment = 0

Diamagnetic



Number of unpaired electrons 1

Magnetic moment = 1

Paramagnetic



Number of unpaired electrons 0

Magnetic moment = 0

dimagnetic

## 2-How can you get

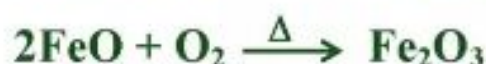
### 1- The three iron oxides from iron



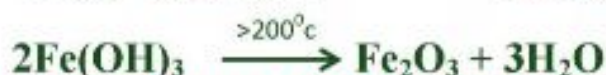
$\Delta$

400;700°C

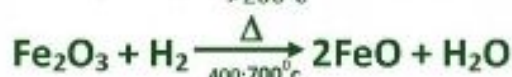
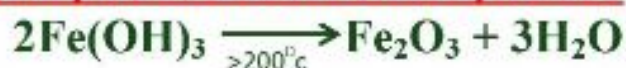




### 2-Iron III oxide from iron III chloride

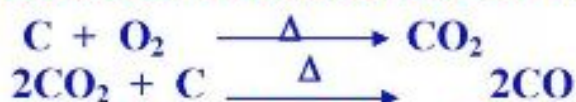


### 3-Iron II hydroxide from iron III hydroxide

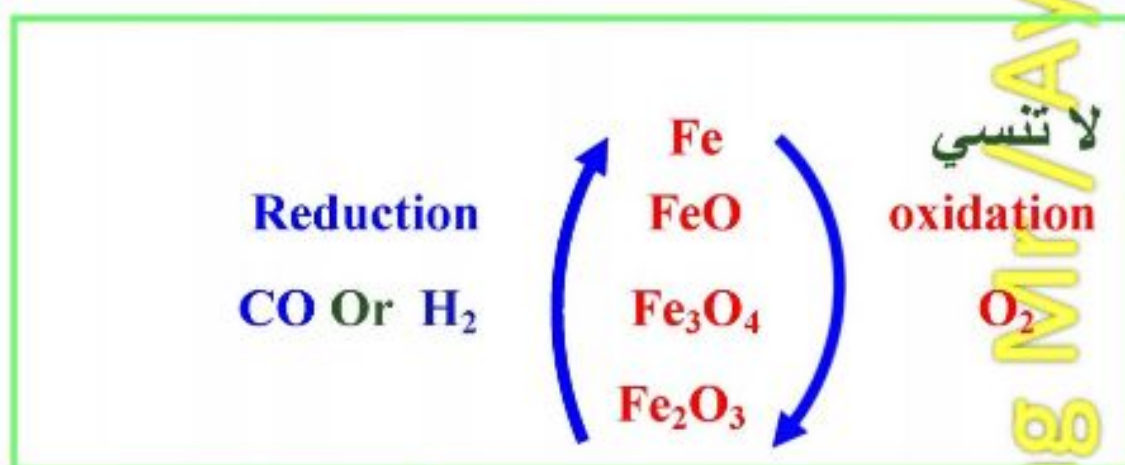


### 3-What is the rule of

**a-coke coal in blast furnace? Producing CO**



**b. Natural gas in Midrex furnace Producing water gas**



**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- $\text{Fe}_2(\text{SO}_4)_3$     b- $\text{FeSO}_4$     c- $\text{Fe}_2\text{O}_3$     d- $\text{FeS}$

**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<sub>2</sub>O<sub>3</sub>      d-FeSO<sub>4</sub>

**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<sub>2</sub> is.....**

a) Paramagnetic and colorured.      b) Diamagnetic and colourless  
c) Diamagnetic and colorured.      d) Paramagnetic and colourless

**11- Transition element with electronic configuration [ 18Ar] 4s<sup>1</sup> , 3d<sup>10</sup> is**

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

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

a) Schiff's 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.

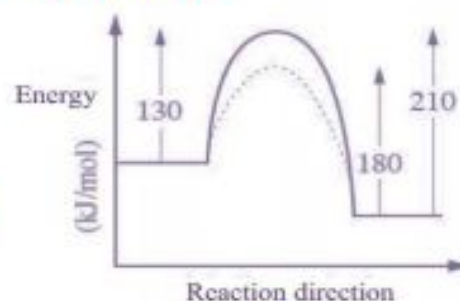
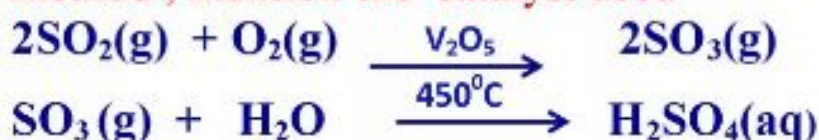
b) What is the value of the activation energy after using a catalyst?

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



7) How can you differentiate between:

Dilute and conc.  $\text{H}_2\text{SO}_4$

EXP.	Dilute. $\text{H}_2\text{SO}_4$	conc. $\text{H}_2\text{SO}_4$
By using iron Filling	It gives pop sound of hydrogen gas	It gives gas $\text{SO}_2$ has irritating smell

## CH(2) 1 - Comparison

### 1-types of chemical analysis

#### Qualitative analysis

Analysis that aims to identify the **constituents or components** of the substance if it is pure ( simple salt ) or mixture from different substances.

#### Quantitative analysis

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

Identification of the elements and the **functional groups** composing the compound to identify it.

#### qualitative inorganic analysis

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
<b>diagnose and treatment of diseases depends on it to</b> 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.	<b>Improving soil properties and its crops depends on it to</b> 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 <sub>2</sub> SO <sub>4</sub>	Barium chloride BaCl <sub>2</sub>
Carbonate CO <sub>3</sub> <sup>2-</sup>	<b>Chloride</b> Cl <sup>1-</sup> <b>Bromide</b> Br <sup>1-</sup> <b>Iodide</b> I <sup>1-</sup> <b>Nitrate</b> NO <sub>3</sub> <sup>1-</sup>	<b>Phosphate</b> PO <sub>4</sub> <sup>3-</sup> <b>Sulphate</b> SO <sub>4</sub> <sup>2-</sup>
Bicarbonate HCO <sub>3</sub> <sup>1-</sup>		
<b>sulphite</b> SO <sub>3</sub> <sup>2-</sup>		
<b>Thiosulphate</b> S <sub>2</sub> O <sub>3</sub> <sup>2-</sup>		
<b>Sulphide</b> S <sup>2-</sup>		
<b>nitrite</b> NO <sub>2</sub> <sup>1-</sup>		

#### 5-Analytical groups and their reagent

Analytical group	Example	Group reagent	precipitated as
<b>1<sup>st</sup> Analytical group</b>	silver( I) <b>Ag</b> mercury (I) <b>Hg</b> lead (II) <b>Pb</b>	<b>HCl</b>	<b>chloride</b>
<b>2<sup>nd</sup> Analytical group</b>	copper II <b>Cu</b>	H <sub>2</sub> S + HCl Or H <sub>2</sub> S in acidic medium	<b>sulphide</b>
<b>3<sup>rd</sup> Analytical group</b>	Aluminum <b>Al</b> iron(II) iron(III)	Ammonium hydroxide <b>NH<sub>4</sub>OH</b>	<b>hydroxides.</b>
<b>5<sup>th</sup> Analytical group</b>	Calcium	ammonium carbonate	<b>carbonates</b>



	<b>Ca</b>	<b>(NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub></b>	
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## 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-methyl 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
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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 $\text{SO}_2$ gas which has irritating smell and yellow ppt of colloidal sulphur is formed
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## 5- Sodium sulphide &amp; 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 &amp; Sodium Nitrate salt

Experiment	Nitrite salt	Nitrate salt
1-By using dilute hydrochloric acid	Colourless gas evolves ( $\text{NO}$ ) which turns reddish brown at the mouth of the test tube ( $\text{NO}_2$ )	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 $\text{H}_2\text{SO}_4$	No reaction	A brown ring appears of $\text{FeSO}_4 \cdot \text{NO}$ disappears by heat or shaking

## 7- barium phosphate &amp; barium sulphate

Exp.	barium phosphate	barium sulphate
By using $\text{HCl}$	soluble in dil $\text{HCl}$	insoluble in Dil $\text{HCl}$

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

Exp.	Hydrochloric acid	sulphuric acid
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By using sodium chloride	No reaction	HCl gas is evolved , which is colourless . it gives white fumes with glass rod wet with ammonia solution .
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### 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 insoluble in water	.it forms potassium carbonate soluble in water

### 14 -Nitric and nitrous acid

Exp.	nitrous acid	Nitric acid
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<b>By heating</b>	<p>Colourless Nitric oxide (NO) is gas evolves which turns reddish brown at the mouth of the test tube</p> $3\text{HNO}_2(\text{aq}) \longrightarrow \text{HNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) + 2\text{NO}(\text{g})$	<p>, reddish brown nitrogen-dioxide evolves</p> $4\text{HNO}_3(\text{l}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$
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### 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  
 $\text{SO}_2$

2-gas has **bad smell** turns a paper wet with lead acetate to black

2- Hydrogen sulphide  
 $\text{H}_2\text{S}$

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 ( $\text{PO}_4^{3-}$ ), and sulphate ( $\text{SO}_4^{2-}$ )

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-magnesium sulphate

13- **Formula** of brown ring appears by anions of nitrate disappears by heat or shaking

13-  $\text{FeSO}_4 \cdot \text{NO}$

14- Cation-group precipitated as **sulphides** in acidic

14- second analytical



medium

15 it gives red brick colour by flame test

16-It is the **positive radical** of the salt

17-it is **formed when  $\text{CO}_2$  passes in lime water** for short time

18- Acids have **high boiling point and less volatile**; decompose at high temperature

19- The **number of atoms or molecules** or ions or electrons or concentration of various substances .

20- Dissolving **1 mole of a substance in water** and completing the solution to **1 liter**.

21- Identification the **constituents** of the substance.

22-Determination of the the **constituents** of the substance **and their concentration** or quantity of the constituents of the sample

23- The reactions which are used for **determination concentration of acids or bases**.

24- The reactions which are used for determination of substances that form **sparingly soluble products**.

25-Substance is used to detect the **end point** at which complete reaction takes place.

26-The indicator that its colour in the acidic medium is red and basic is yellow.

27-It is number of **moles of solute which dissolve in one liter of solvent**.

28-It is a solution of **known concentration** used to measure concentration of another analysts

29-**It is the point** at which quantity of the acid is completely equivalent to the quantity of the base added

30-It is a kind of filter paper **doesn't leave ash** on burning

group

15- Calcium

16- cation

17-calcium carbonate

18- stable acids

19- Avogadro number

20- molar solution

21-Qualitative analysis

22- chemical analysis

23- neutralization reactions

24- precipitation reaction

25- Indicator

26- methyl orange

27-Concentration (Molarity)

28- Standard solution

29- End point

30-Ash less filter paper

## 2-Give reasons for

1- **2 grams of  $\text{H}_2$  occupies the same volume of 28 grams of  $\text{N}_2$  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  $\text{CO}_2$  gas is more than that of  $\text{O}_2$**

Because molar mass of  $\text{CO}_2$  is more than that of  $\text{O}_2$

**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 ( $Cl^{-}$ ) , Bromides( $Br^{-}$ ) , Iodides ( $I^{-}$ ) , Nitrates ( $NO_3^{-}$ ).**

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.**

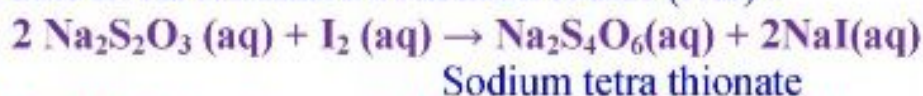
To avoid the conversion of calcium carbonate of white p.pt to soluble calcium bicarbonate so the p.pt disappear.

**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) .

**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 1<sup>st</sup> case due to the formation of **magnesium carbonate** . While in the 2<sup>nd</sup> 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 .... <u>CO<sub>2</sub></u> .. 2. The anion is .. <u>carbonate</u> ... or .. <u>bicarbonate</u> .. 3. To differentiate between them :salt solution + <u>magnesium sulphate</u> -
2-Colourless gas is evolved which turned at the mouth of the test tube to reddish-brown fumes.	1. The gas is ... <u>NO</u> .. and the reddish-brown fumes are ... <u>NO<sub>2</sub></u> ... 2-The anion is ... <u>Nitrite</u> ..
3-Colourless gas is evolved which has irritating smell and turns an acidified potassium dichromate paper into green.	1. The gas is .... <u>SO<sub>2</sub></u> .. and the green colour is <u>chromium sulphate</u> The anion is ... <u>Sulphite</u> ..
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 .... <u>SO<sub>2</sub></u> .. the p.pt. is ... <u>colloidal sulphur</u> ... and the green colour is <u>chromium sulphate</u> . 2. The anion is .. <u>thiosulphate</u> .
5-Colourless gas is evolved which is characterized by its bad odour and turns lead acetate paper black	The gas is .. <u>H<sub>2</sub>S</u> .. and the black P.Pt is .. <u>PbS</u> .. The anion is ..... <u>Sulphide</u> ...
6-Colourless gas is evolved which forms white fumes with a glass rod wetted with ammonia solution.	1. The gas is .. <u>HCl</u> .. and the white fumes are ..... <u>NH<sub>4</sub>Cl</u> ... 2. The anion is ... <u>Chloride or Cl<sup>-</sup></u> ...
7-Colourless gas is evolved which is oxidized by H <sub>2</sub> SO <sub>4</sub> forming reddish-orange fumes which turns a paper wetted by starch solution yellow.	The gas is .... <u>HBr</u> ... and the fumes are ... <u>Br<sub>2</sub></u> ..  The anion is .... <u>Bromide or Br<sup>-</sup></u> .
8-Colourless gas is evolved which is oxidized by H <sub>2</sub> SO <sub>4</sub> forming violet	1. The gas is .... <u>HI</u> ... and the fumes



fumes after heat which turns a paper wetted by starch solution blue.

9-Brown vapour is evolved and its density increases by adding copper felling.

2. are ...I<sub>2</sub>...

3. The anion is ...iodine or I<sup>-</sup>

4. The gas is ....NO<sub>2</sub>..

The anion is ....Nitrate or NO<sub>3</sub><sup>-</sup>..

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

(1) Passing carbon dioxide in limewater.



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



(3) Decomposing magnesium bicarbonate.



(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



(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



(6) Adding iodine solution to sodium thiosulphate.



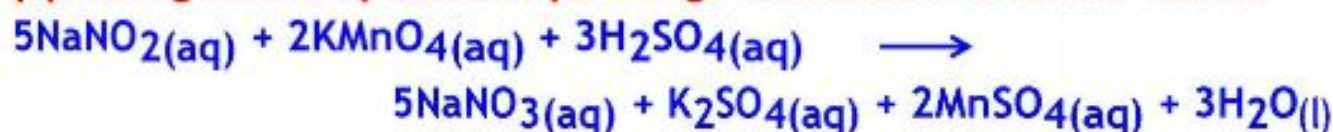
(7) Decomposing isolated acid from the reaction of sodium nitrite with dil. HCl



(8) Exposing nitric oxide to the oxygen.



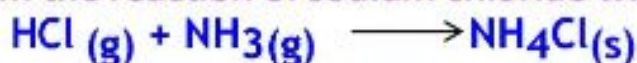
(9) Adding acidified potassium permanganate solution to sodium nitrite.



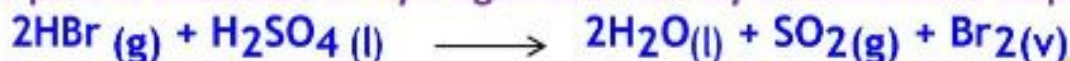


6- Show by balanced chemical reactions what happens in each of the following :

(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.



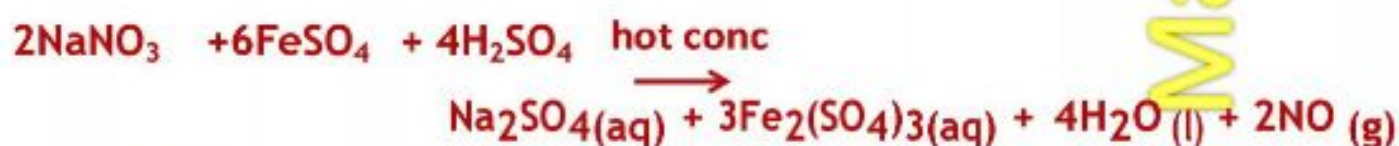
(2) The partial oxidation of hydrogen bromide by concentrated sulphuric acid.



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



(4) Mixing sodium nitrate with freshly prepared iron (II) sulphate and adding conc. H<sub>2</sub>SO<sub>4</sub> to them.



(5) Adding barium chloride to sodium phosphate.



(6) Adding lead acetate solution to sodium sulphate.



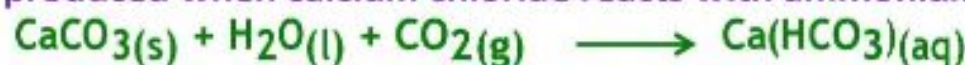
(7) Adding sodium hydroxide solution to iron (II) sulphate.



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



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



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

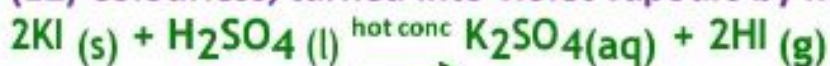




(11) Colourless, gives white fumes with glass rod moistened with ammonia solution.



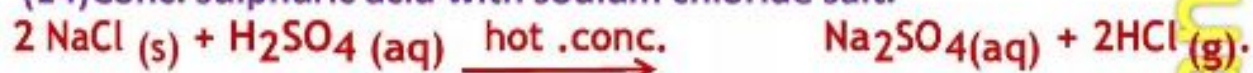
(12) Colourless, turned into violet vapours by heating.



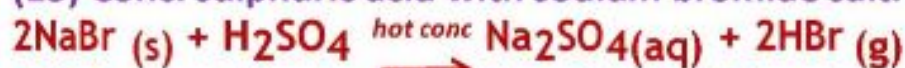
(13) Brown vapour turned into dense vapour when copper felling is added



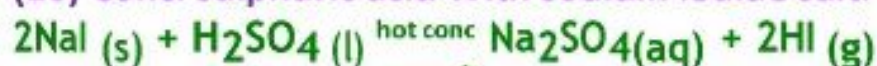
(14) Conc. sulphuric acid with sodium chloride salt.



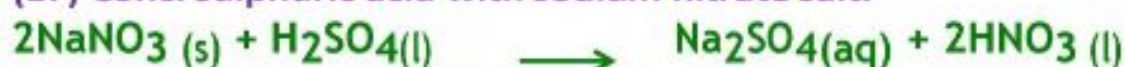
(15) Conc. sulphuric acid with sodium bromide salt.



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



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

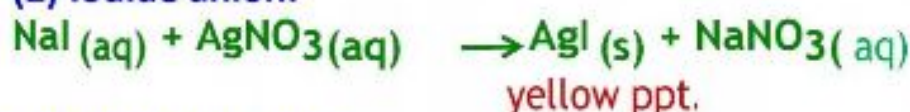


### 8-Mention one confirmatory test for each of the following

(1) Chloride anion.



(2) Iodide anion.



(3) Phosphate anion.



(4) Thiosulphate anion.

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



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

(1) Colourless, turns the limewater milky.





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



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



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



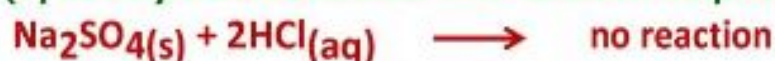
(5) Dil. hydrochloric acid with sodium carbonate salt.



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



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



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



نحن لا نعدك بالنجاح لكن نعدك  
بالتفوق

مراجعة ال Full mark

King Mr/ Ayman Mansour

Mr/ Ayman Mansour

CH(3)

1-comperision

1-Compare between chemical and ionic equilibrium

Chemical Equilibrium

Ionic Equilibrium



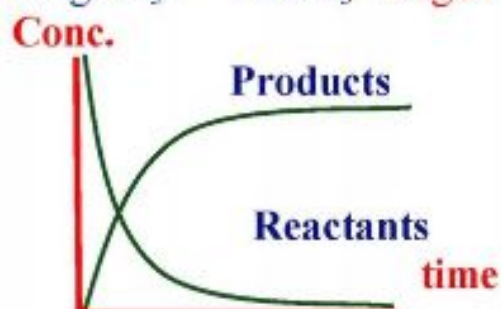
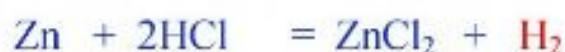
it is a dynamic system in which the **rate of forward reaction equals the rate of backward reaction**, and concentration of reactants and products are still found in medium of reaction,

It is equilibrium of weak electrolytes, between its non ionized molecules, and formed ions.  
non ionized molecules  $\rightleftharpoons$  Dissociated ions

## 2-Compare between Complete reaction and Reversible reaction

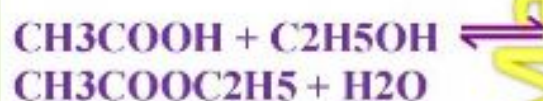
### Complete reaction

Reaction takes place in **forward direction only**, gas or precipitate is formed.



### Reversible reaction

Reaction takes place in both **forward, and backward directions** so that both reactants and products are found in reaction medium



### 2-Write the scientific term of the following phrases

- (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

### What is meant by

- 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

(8) Particles with a kinetic energy equal to or exceed the activation energy.

(9) The negative logarithm of the hydrogen ion concentration.

(10) The maximum pressure of water vapour can be present in the air at a given temperature

(11) The reactions which proceed in both forward and backward directions and the reactants and products are continuously exist in the reaction medium.

(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

(13) A stationary system apparently but a dynamic system reality

(14) A dynamic state reached when the rate of forward reaction equal to the rate of backward reaction.

(15) Reactions proceed in one direction only (forward direction) due to escaping one of the products from the system

(16) A process in which unionized molecules are changed into ions

(17) The positive ion which is formed when water molecule combine with the hydrogen ion (proton) and has an acidic effect on litmus

(18) A state of equilibrium arising between molecules of a weak electrolyte and ions resulting from it.

(19) A solution has (pH) value more than (7)

(20) A solution has (POH) value more than (7)

(21) It is the pressure of water vapour at certain temperature

(22) They are biological catalyst, are protein of high molecular mass

(23) At constant temperature, the degree of ionization increases by dilution.

7-Catalyst

8- activated molecules

9- PH value (hydrogen exponent)

10- Saturated vapour pressure

11- Reversible reaction

12- Le Chatelier's principle states

13- Dynamic equilibrium

14- Chemical equilibrium

15- Complete reaction

16- Ionization

17- Hydronium ion or  $\text{H}_3\text{O}^+$

18- Ionic equilibrium

19- Basic or alkaline solution

20- Acidic solution

21- Water vapour pressure:

22- Enzymes

23- Ostwald law

24- Solubility product  $K_{sp}$



(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 .

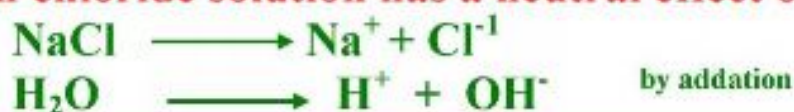
**5 - Raising the temperature, increases the rate of the reaction**

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.**

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

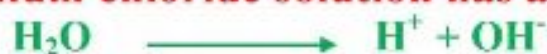
Because, catalyst increases the rate of reaction instead of raising the temp. which saves a lot of money.

**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.**





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

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



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



**4- Arranged the following solutions in ascending order according to PH value**  
 $\text{Na}_2\text{CO}_3 - \text{H}_2\text{O} - \text{NH}_4\text{Cl}$

**Solution**

$\text{Na}_2\text{CO}_3$  is basic its PH more 7

$\text{H}_2\text{O}$  is neutral its PH= 7

$\text{NH}_4\text{Cl}$  is acidic its PH less 7



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



**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.

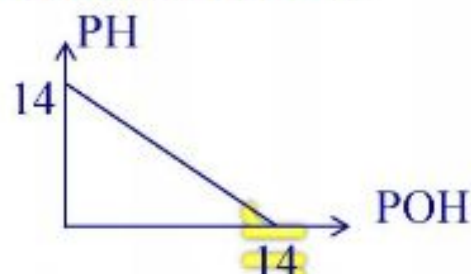


b) What is the type of equilibrium of water ionization?



**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<sub>3</sub> - (CH<sub>3</sub>COO)<sub>2</sub>Ca

NaCl neutral salt PH = 7

FeCl<sub>3</sub> acidic salt PH < 7

(CH<sub>3</sub>COO)<sub>2</sub>Ca basic salt PH > 7

**FeCl<sub>3</sub> < NaCl < (CH<sub>3</sub>COO)<sub>2</sub>Ca**

8- Complete the following table

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

(1)- **Cations & Anions**

Cations	Anions
---------	--------



is a particle that's **poor in electrons** & moves in solution towards the **-ve pole**



is a particle that's **rich in electrons** & moves in solution towards the **+ve pole**



## (2) – Oxidation and reduction

Oxidation	Reduction
Process of <b>losing electrons</b> or <b>increasing positive charge</b> or <b>decreasing negative charge</b> $\text{Zn}^0 \longrightarrow \text{Zn}^{2+} + 2\text{e}^-$ <b>or</b> $2\text{Cl}^- \longrightarrow \text{Cl}_2 + 2\text{e}^-$	Process of <b>gaining electrons</b> or <b>decreasing positive charge</b> or <b>increasing negative charge</b> $\text{Pb}^{+4} + 2\text{e}^- \longrightarrow \text{Pb}^{2+}$ <b>or</b> $\text{Cu}^0 + 2\text{e}^- \longrightarrow \text{Cu}^{2+}$

## 3-Electronic connectors and electrolytic connectors

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

## (4)-Electrolytic cell and Galvanic cell

Electrolytic cell	galvanic cell
1-it changes <b>electrical</b> energy into <b>chemical</b> energy. 2- <b>Anode</b> is the electrode connected	1- It changes <b>chemical</b> energy into <b>Electrical</b> energy. 2- <b>Anode</b> 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 <b>irreversible</b> cell	It is galvanic <b>reversible</b> cell.
<b>Can not</b> be recharged	<b>Can be</b> recharged
<b>As 1</b> – Mercury cell	<b>As 1</b> -car battery
2- fuel cell      3-Daniel cell	2-Lithium ion dry battery

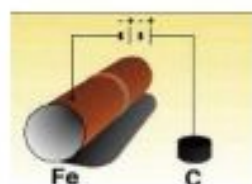
### (6) Purification of metals & Electroplating

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

### (7) Anodic protection and Cathodic protection

More active metal (1) Anodic protection	Less active metal (2) Cathodic protection
covering iron with <b>more active metal</b> than iron as <b>zinc</b> (called galvanizing) <b>iron will be cathode</b> and zinc will anode so when scratch happens <b>zinc will corrode first</b> <b>High oxidation potential</b>	covering iron with <b>less active metal</b> than iron as <b>tin (Sn)</b> scratching takes place <b>iron is the anode</b> and corrode first <b>Low oxidation potential</b>





O.P R.P

	+	-
H	0	0
	-	+

	A	B
Oxi. Pot.		
Red. Pot.		

## 2-Write the scientific expression for each of the following:

- 1-Systems in which the chemical energy in an oxidation reduction processes is converted spontaneously to an electric energy
- 2-Systems in which electrical energy is converted to oxidation reduction processes but not spontaneously.
- 3-Materials that conduct the electric current through the migration of its ions.
- 4-Materials that conduct the electric current through the migration of its electrons.
- 5-The electrode at which reduction processes takes places
- 6-The electrode of electrolytic cells at which oxidation processes takes place
- 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 .
- 8- Particles which move in the electrolyte and carry negative charge.
- 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.
- 10-The quantity of electricity needed to precipitate or dissolve or evolve the equivalent gram of matter by electrolysis.
- 11 -The process of losing electrons associated with

## What is meant by

- 1-Galvanic cells
- 2-electrolytic cells
- 3-electrolytic conductors
- 4- electronic conductors
- 5-Cathode
- 6-anode –positive pole
- 7-coloumb
- 8- anions or negative ions
- 9-Faraday second law
- 10-faraday
- 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.

13-It is electrochemical process in which metals oxidize or lose electrons

14-Process of covering iron with metal more reactive than iron as zinc

15- The reactions in which the electrons are transferred between reactant substances.

16- The electrode at which the oxidation reactions take place in the galvanic cell.

17- U shaped glass tube filled with an electrolyte solution and connects the solutions of the two half cells without allowing a direct contact.

18-The cells in which the oxidation - reduction reaction is a spontaneous irreversible reaction.

19-The cells which are characterized by their reversible chemical reactions and store electric energy in the form of chemical energy.

20-It is used in measuring the density of the acid solution in car battery

21- Electrolyte in the mercury cell.

22- the resultant water in it evaporates and can be condensed as drinking water for astronauts

23- Organic compound is used in making container of car battery which does not affect by acids

24-the active metal electrode which is connected with the positive source in covering metals and will corrode first

25- He deduced the relationship between the quantity of electricity which flows in a solution and the quantity of material liberated at electrodes.

26-It is the emf of galvanic cell consisting of S.H.E. acting as cathode and the element as anode.

12-electro chemical series

13-Corrosion

14- galvanization

15-Redox reactions

16- anode – negative pole

17-salt bridge

18-Primary galvanic cells

19-secondary galvanic cells

20- hydrometer

21 –potassium hydroxide

22- fuel cell

23-poly styrene

24-sacrificial electrode

25-Faraday

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



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



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



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



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



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

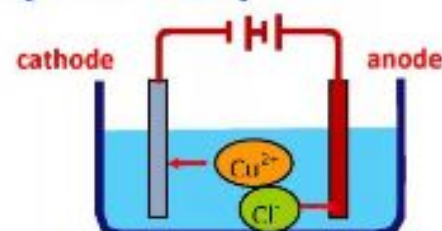
Oxidation & reduction reaction take place non spontaneously

**a-at the cathode:**



**b - at the anode**  $2\text{Cl}^- \rightarrow \text{Cl}_2\uparrow + 2\text{e}^-$

**Total reaction**







## 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 .



### 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



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  $2045^{\circ}\text{C}$  to  $950^{\circ}\text{C}$

**23- Salt bridge is important in Denial cell**

It prevents the formation of excess of  $(\text{Zn}^{2+})$  in the Zinc half cell and excess of  $(\text{SO}_4)^{-2}$  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.**

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  $1.30 \text{ gm/cm}^3$  **but if the acid density decreased to less than  $1.2 \text{ gm/cm}^3$** , 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 (  $-3.04\text{V}$  )

**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 =  $2 \times 6 = 12 \text{ volts}$

**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.....



a ) 189000 coulomb ( **b ) 289500 coulomb**

c) 96500 coulomb (d ) 9650 c

2-The quantity of electricity needed to precipitate 1/10 equivalent of silver from silver nitrate solution is..... [Ag=108]

a) Faraday ( **b) 1/10 Faraday**

c ) 1/5 Faraday ( d ) Faraday

3-The positive pole in the mercury cell consists of.....

a) graphite (b) copper c) aluminum ( **d) Zinc**

4-The anode in the car's battery is made of.....

a) Copper ( b ) aluminum ( **c ) lead** ( d ) iron

5-To precipitate 32.5 gram of zinc [Zn= 65 ] by electrolysis equals.....

a) 2 Faradays ( **b) 1 Faraday** c ) 0.5 Faraday ( d ) 0.2 Faraday

6-The anode in the galvanic cell is.....

a) The positive pole where oxidation process takes place

( **b) The negative pole where oxidation process takes place**

c) The positive pole where reduction process takes place

d) The negative pole where reduction process takes place

7-Each half cell in the galvanic cell is called a ..... electrode.

( **a) standard** (b) reducible c) non - reversible ( d ) reversible

8-The cathode in the galvanic cell is considered as.....

a) the negative pole at which oxidation process takes place

b) the negative pole at which reduction process takes place

c) the positive pole at which oxidation process takes place

( **d) the positive pole at which reduction process takes -place**

9-The neutralization of ions in the two half's of the galvanic cell takes place at.....

a) Introducing electrons in the oxidation half cell

( **b) Salt bridge.**

c ) getting electrons out in the reduction half cell.

d) getting electrons out in the oxidation half cell.

10-Mass of gold precipitated by passing one Faraday in a solution of gold III chloride is.....

a) 1 mole b) 3/2mole ( **c ) 1/3 moles** ( d ) 2 moles

11-To recharge the lead cell an outside source of electricity is connected to the cell which have potential.....

( **a ) slightly higher than the potential of the cell**

b ) lower than the potential of the cell

c) Much higher than potential of the cell

d) equal to the potential.

12-In the car battery the cathode is.....

( **a) lead dioxide** (b ) lead oxide c ) lead ( d ) iron

13-In the car battery the electrolyte is.....



- a ) dilute hydrochloric acid . **b ) dilute sulphuric acid.**  
 c ) Concentrated hydrochloric acid .d ) Concentrated sulphuric acid.

13-Mass of copper. precipitated by passing 965coulomb in a solution of copper sulphate is.....  $cu=63.5$

- a) 0 . 31754 grams** ( b ) 0 .635 grams c) 6.35 grams ( d)31. 75 grams

14-Electroplating is used for the following purposes.....

- a) protection of metals from nitrogen  
 b) protection of metals from reduction  
 c ) protection of metals from corrosion and decreasing the value of metals  
**d) protection of metals from corrosion and increasing the value of metals.**

15- .Lead storage cells are.....

- a) dry cells (b ) gas cells  
**c) liquid cells** (d) alkaline cells

16-The law which states that the weights of substances precipitated or consumed by the same amount of electricity are directly proportional to their equivalent weight's is.....

- a) Faraday's first law **(b) Faraday's second law**  
 c) Ohm's law (d) Vandar Waal's law

17- If you are provided with the following metals:

Iron - copper - zinc - gold.

you can determine their locations in the electrochemical series by one of the following.....

- a) Its malleability and ductility .  
 b ) addition of water to each metal.  
**c ) addition of each one to a solution of the other metal**  
 d) addition of hydrochloric acid to each metal

18-The apparatus used to measure the electric potential difference for a half cell [ i.e. oxidation or reduction ].....

- a) voltmeter** (b) galvanoscope c ) voltammeter ( d ) ammeter

19- During purification of copper the impure copper is used as ..... pole

- a) positive** (b) negative c ) standard ( d ) magnetic

20-Mass of magnesium precipitated by passing 2 Faraday in solution of magnesium sulphate is.....  $Mg=24$

- a) 48 grams ( b ) 12 grams  
 c ) 36 grams **( d ) 24 grams**

(21) X, Y, Z and W are four metals, on heating



So, the metals are arranged according to their chemical activity as :





(c)  $X < Y < Z < W$

(d)  $X < Y < W < Z$

King Mr / Ayman Mansour

CH(5)

1-Write the expression for each phrase:

What is meant  
by



<p>1- It shows the number and kind of atoms inside the molecule.</p> <p>2-It shows the arrangement of the atoms inside the molecule and its bonds.</p> <p>3- More than one Organic compound has the same molecular formula but differs in their structural formula and also <b>differs</b> in physical and chemical properties.</p> <p>4-It is a series of organic compounds have the <b>same</b> general formula and chemical properties but <b>graduated</b> physical properties</p>	<p>1-Molecular formula</p> <p>2-structural formula</p> <p>3-Isomer</p> <p>4-homologues series</p>
<p>5-They are characterized by the presence of single bond between two carbon atoms.</p> <p>6-They are characterized by the presence of a double or triple bond between two carbon atoms .</p> <p>7- It is the breakdown of large hydrocarbons into other small ones using a catalyst.</p> <p>8-It is derived from alkane chain by removing one of the hydrogen atoms from a carbon atom in the chain and cannot be found alone.</p> <p>9-it is derived from aromatic hydrocarbons by removing one hydrogen atom from benzene <math>C_6H_6</math> and cannot be found alone.</p> <p>10-It is a process where simple molecules are combined together to form giant molecules with big molecular mass.</p> <p>11-It is a mixture of caustic soda and calcium oxide .</p> <p>12-It is addition reaction forming unstable compound which loses a water molecule, and a stable compound is formed.</p> <p>13- It is derived from the corresponding alkane by removing one hydrogen atom its general formula</p>	<p>5-saturated hydrocarbons</p> <p>6- unsaturated hydrocarbons</p> <p>7-thermal catalytic cracking</p> <p>8- alkyl group</p> <p>9-aryl group</p> <p>10-polymerization</p> <p>11-soda lime</p> <p>12- Catalytic hydration</p> <p>13- Alkyl group</p>





14- Process of heating the heavy petroleum products under high pressure and in the presence of catalyst to give short chain products.

15-On adding an **asymmetric reagent to an asymmetric alkene**, the positive part is added to carbon atom which has large number of hydrogen and the negative part is added to the carbon atom which has less number of hydrogen atoms

16-It is the reaction of ethylene with potassium permanganate in a basic medium

17-**Flame** is used for welding and cutting metals.

18-Reaction of acetylene with water in the presence of a catalyst

19-Organic compounds derived from fatty acids which contain a big ratio of hydrogen

20-It is composed of two parts, tail is a long carbon chain which is hydrophobic and head is an ionic group which is hydrophilic.

21-They are aliphatic compounds characterized by the presence of a double or triple bond between two carbon atoms have the formula  $C_nH_{2n-2}$

22-it takes place between two different monomers and accompanied by losing a simple molecule such as water.

**14-thermal catalytic cracking**

**15-Markownikof rule**

**16- Bayer reaction**

**17- Oxy acetylene flame**

**18- Catalytic hydration**

**19-ali phatic hydrocarbons**

**20- Detergent**

**21- Alkynes**

**22- condensation polymerization**

### 3-Give reasons for

(1) **The failure of vital force theory.**

Because the scientist **Wohler destroyed** it when he prepared urea by heating of two inorganic compounds (ammonium chloride and silver cyanate).

(2) **The great number and variety of organic compounds.**

Due to the ability of **carbon atoms** to combine with themselves or with other atoms by different types of bonds & carbon is tetravalent

(3) **Both of ethyl alcohol and dimethyl ether have the same molecular formula**



( $C_2H_6O$ ), but they have different properties.

Because they **have different structural formula or isomers**

**(4) Methane is a saturated compound, but ethene is not.**

Because the bonds in methane molecule are **single sigma** bonds, but ethene molecule has a **double bond** between the two carbon atoms one sigma and one pi bond.

**(5) Alkanes are chemically inactive chemically.**

Because the carbon atoms are combined together by a **single sigma bond** which is strong and cannot broken easily.

**(6) Alkanes, alkenes or alkynes are homologous series.**

Because each compound **exceeds the previous** one by ( $-CH_2$ ) group.

**(7) According to (IUPAC) system,  $\begin{array}{c} CH_2-CH_3 \\ | \\ CH_3-CH_2-CH_3 \end{array}$  is not named 2-ethyl propane.**

Because the **longest carbon chain** contains **four carbon** atoms so, it is named 2-methyl butane.

**8- Soda lime is used instead of NaOH in preparation of methane.**

Because Soda lime is a **mixture of NaOH and CaO**, CaO is used to decrease melting point of the mixture.

**9 - Alkenes are more active than alkanes .**

Because of the **presence of weak pi bonds** in alkenes which is easily broken but alkanes have **strong sigma bonds** which cannot broken easily

**10 -The colour of bromine water disappears when it is added to ethylene, while it remains on adding to methane.**

Because bromine reacts with **ethylene by addition** forming di bromo ethane which is colourless, whereas **methane does not react** with bromine.

**11 - Baeyer's reaction is considered an addition reaction.**

Because it is **easy breaks weak pi bond** in the ethylene.

**12- Catalytic cracking is used in petroleum industry .**

To **change hydrocarbons of large molecules to small** one to improve economics value of petroleum.

**13- Catalytic hydration of alkynes is not used to prepare formaldehyde.**

Because **formaldehyde contains only one carbon atom** while simplest alkyne (acetylene) **contains two carbon** atoms at least.

**14-The reaction of alkenes with water needs acidic medium**



To **produce positive hydrogen ion** because water is a weak electrolyte so the concentration of positive **hydrogen ion increases** and break the double bond

**15-Black carbon is important**

It is used in the making of **car tiers, black painting, polishes and printing ink**

**16-Alkenes are characterized by their ability to undergo addition reaction with other substances**

B. the **weak Pi bond** is broken down and saturated compounds are formed.

**17-Methane is collected by downward displacement of water**

Because it is **slightly soluble in water**.

**18-Alkanes do not react by addition**

Because they are **saturated hydrocarbons contain single sigma** bond only. which only react by substitution

**19-Using chloroform as anesthetic is stopped**

Because the **inaccurate estimation of the dose** causes the death of patient

**20-Freon's are harmful**

B. they causes the **decay of ozone layer** which protect the earth from harmful effect of ultra violet rays.

**21-The use of ethylene glycol as antifreeze substance**

Because it forms **hydrogen bonds** with water molecules and it prevents their combination with each other to form ice crystals

**22-Bromine dissolved in carbon tetrachloride solution, is not used to differentiate between ethene and ethyne.**

Because **both of them reacts with bromine** and its red colour discharged.

**23-Active metals like sodium are covered by heavy alkanes.**

To protect them from **rust, corrosion** and reaction because alkanes are non-polar compounds insoluble in water.

**24-Freons are used in air conditions and fridges.**

Due to its **cheap price, easy to be liquefied, non poisonous, odourless and nonflammable non corrosive for metals,**

**25-On reacting ethene with potassium permanganate in alkaline medium, the colour of potassium permanganate is discharged.**

Because it reacts with ethene by addition and **pi bond** is broken.



**26-On adding hydrogen bromide to propene, 1-bromo propane is not formed.**

According to **Markownikof's rule**, if the alkene is asymmetrical the **hydrogen** atom is added to the carbon atom which is **rich in hydrogen** atoms, and the halogen atom is added to other carbon atom which is poor in hydrogen.

**27-Before collection, Ethyne gas is passed through copper sulphate solution in dil. sulphuric acid.**

To remove **phosphine gas ( $\text{PH}_3$ )** and **hydrogen sulphide ( $\text{H}_2\text{S}$ )** which are impurities in calcium carbide.

**28-Ethyne sometimes burns with a smoky flame.**

Because in a **limited amount of oxygen** and carbon is not completely burnt.

**29-Oxyacetylene flame is used for welding and cutting metals.**

Because the temperature of reaction reaches **more  $3000^\circ\text{C}$** .

**30-Ethyne reacts by addition in two steps while ethene reacts in one step.**

Because ethyne **contains two ( $\pi$ ) bonds** while ethene contains **one only**.

**3-Choose the correct answer for each of the following :-**

1 - Catalytic cracking of octane ( $\text{C}_8\text{H}_{18}$ ), ..... is produced.

a) heptane and methane    **b) butane and butylene**    c) ethane, hexane

2 - Catalytic hydration of acetylene produces.....

a) ethylene    **b) acetaldehyde**    c) acetone

3 - Heating of anhydrous sodium acetate with soda lime produces .....

a) ethane    **b) methane**    c) propane

4 - Oxidation of ethylene by potassium permanganate in alkaline medium is called ..... reaction .

a) Haber    **b) Baeyer**    c) FrideI-Craft

5-reaction of methane with chlorine at ultra violet rays is called ..... reaction

a. oxidation,    b. addition,    **c. substitution**,    d. elimination

6-The molecule of detergent is composed of **two** parts tail is a long carbon chain and the **head** is an ionic group which is .....

**a)hydrophilic**    b)hydrophobic    C) bydrophobic    d)tydrophobic

7-The alkane which contains more than 17 carbon atoms, is a ..... alkane .

**a) Solid**    b) Liquid    c) Gaseous    d) Vapour



8 - The reaction between ethanol and acetic acid is called .....

- a) oxidation      b) esterification      c) neutralization

9- Catalytic hydration of acetylene and oxidizing the product produce .....

- a) ethylene      b) acetic acid      c) acetaldehyde

10- Adding HCl to vinyl chloride produces .....

- a- 2, chloro propane    b- ethyl chloride    c- 1,2 dichloroethane    d- 1,1dichloroethane

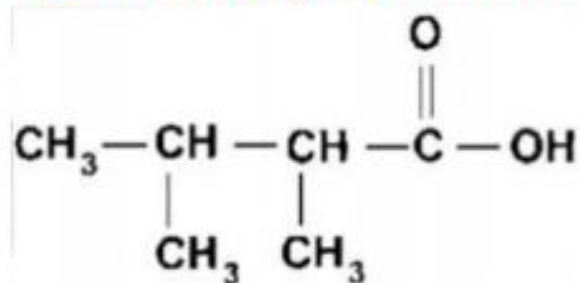
4- Write the structural formula for each of the following: -

- 1) 3 - methyl 2 -butanol .  
2) 4 - chloro 1 - hexene .

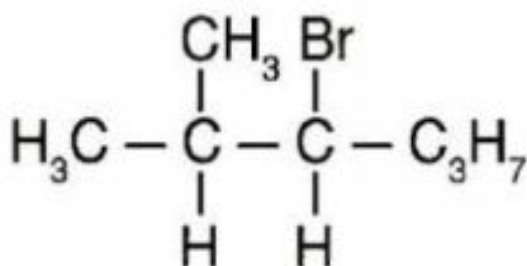
Write down the name of the following compound according to IUPAC system:



**2,3 dimethyl butanoic acid**



**3bromo,2methyl hexane**



The molecular formula  $\text{C}_3\text{H}_6\text{O}$

represents a ketone.

The molecular formula  $\text{C}_2\text{H}_4\text{O}_2$  represents an ester



Monomer المونومر	Commercial name الاسم التجاري	Type of polymerization نوع البلمرة	One property أحد خواص البوليمر	one use أحد استخدامات البوليمر
Formaldehyde + phenol فورمالدهيد + فينول	<b>Bakelite</b>	<b>condensation polymerization</b>	<b>thermo resistance &amp; electric insulator</b>	<b>Ash trays &amp; electric insulator</b>

Write the IUPAC name of

35-



36-





# كل العلماء 1- Scientists

What is the rule or effort of the following scientists in chemistry?

## 1-Fischer-Tropsch

Conversion of water gas (a mixture of hydrogen and carbon monoxide) to liquid fuel in presence of iron as catalyst

## 2-Haber- Bush

Preparation of ammonia gas in presence of iron as catalyst

## 3- Goldberg –Wage put Law of mass action :-

At a constant temperature, the rate of a chemical reaction is directly proportional to the product of multiplication of the reactant concentrations

## 4-Ostwald put Ostwald law:-

It is a quantitative relationship between the degree of ionization ( $\alpha$ ) and dilution  
degree of ionization ( $\alpha$ ) is directly proportional to dilution

$$K_a = \alpha^2 \times C$$

## 5-Le Chatelier put Le Chatelier principle

Any change in the conditions of equilibrium such as pressure, concentration or temperature will shift the equilibrium in the direction which will oppose the change

## 6- Faraday

Put faraday laws of electricity for the relation between the amount of substance precipitated or evolves at any electrode and quantity of electricity passes in solution

## 7-Daniel made Daniel cell which is galvanic cell of emf =1.1 volt

Which changes chemical energy to electric energy spontaneously.

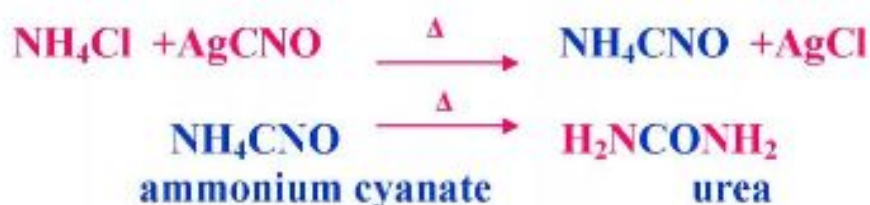
## 8- Berzelius He put (vital force theory)

Organic compounds are formed only under the effect of a vital force which is found in living cells as animal & plants

## 9- Wohler he made Objection of vital theory



Wohler **prepared urea** (an organic compound in urine of mammals) by evaporating ammonium cyanate solution (inorganic compound)



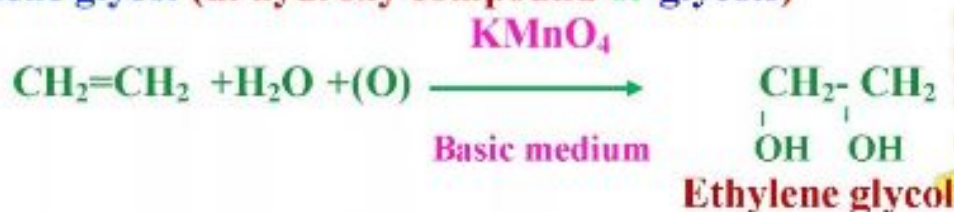
### 10- Markownikoff put Markownikoff's rule

"On adding an asymmetric reagent to an asymmetric alkene, the positive part of the reagent is added to carbon atom which is rich in hydrogen atoms and the negative part is added to the carbon atom which is poor in hydrogen atoms"



### 11-Bayer made Bayer's reaction

It is the reaction of ethylene with potassium permanganate in a basic medium. To get ethylene glycol (di hydroxy compound or glycols)



It is used to test unsaturation of alkene or alkynes  
toluene or methyl benzene

Write the molecular formula & structural formula of the following

Name	Structural formula	Molecular formula
1-Urea	$\begin{array}{c} \text{O} \\    \\ \text{H}-\text{N}-\text{C}-\text{N}-\text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$	$\text{H}_4\text{N}_2\text{CO}$
3-Ethylene glycol 1,2 di hydroxy ethane	$\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{H} \\   \quad   \\ \text{OH} \quad \text{OH} \end{array}$	$\text{C}_2\text{H}_6\text{O}_2$



## Uses

4-Mention the use of the following or importance or rule of

Name	Use or importance
1-Qualitative Analysis	1-determination components or constituents of substance
2-Quantitative Analysis	2-determination the ratio or amount or concentration of each component in substance.
3-organic analysis	3-Determination of the elements and the functional groups of compound.
4-Volumetric analysis	4-It is used to measure unknown concentration of reacting solutions by known concentration solution called standard solution.
5-Titration	5- <b>volumetric process</b> used to determine concentration of solution using <b>standard solution</b>
6-chemical analysis In medical field	6- Determine the concentration of sugar, urea, & active elements in drugs.
7- chemical analysis In agricultural field	7-Determine the <b>soil properties</b> as acidity or alkalinity, type and <b>ratio of elements</b> in soil .
8- chemical analysis In industrial field	8-Determines the concentration of components of industrial products.
9- chemical analysis In environmental field	9-Determine the <b>harmful environmental pollutants</b> in <b>water</b> and <b>food</b> . and amount of carbon monoxide, sulphur dioxide and nitrogen oxides in <b>air</b> pollutant gases.
10-Indicators	10- determination the <b>end point</b> of the reaction by change their colour with changing the medium of reaction
11-burette& conical flask	11-Tools of titration process
12-Ash less filter paper:	12-kind of filter paper doesn't leave ash on burning.
13-Catalysts in catalytic converters	13-It converts the gaseous combustion products, which cause air pollution, into safe products.
14-Enzymes	14-Catalysts for many biological and industrial processes.
15-salt bridge	15-It prevents <b>saturation</b> of excess of (+ve) zinc ions or (-ve) sulphate ions in the two half cells so current will <b>continuously flow</b> .



**16-standard hydrogen electrode.**

**17-Mercury cell**

**18- fuel cell**

**19-Lithium ion dry battery**

**20- poly styrene**

**21-sacrificial electrode**

**22-hydrometer**

**23- cryolite - $\text{Na}_3\text{AlF}_6$**

**24-fluorspar- $\text{CaF}_2$**

**25-fluoride salts of Aluminum, Sodium and Calcium**

**27-Silver bromide**

**28-Black carbon**

**29-Water gas**

**30-Ethylene glycol**

**16- Its potential equals zero , used for measuring the electric potentials of unknown electrodes**

**17-It is used in ear phones, clocks and cameras**

**18-It is used in spacecraft and shuttles** and produce water used for drinking astronauts.

**19-It is used in mobile and laptop computers. & some of recent cars instead**

**20- making Container of car battery**

**21-it** protects iron pipes and ships in salty water

**22-measuring the density** of the acid solution in car battery

**23-dissolving or solvent** of bauxite

**24-it decreases the bauxite melting point from  $2045^\circ\text{C}$  to  $950^\circ\text{C}$**

**25-They have low melting point and a lower density are used in Extraction of Aluminum by electrolysis of bauxite ( $\text{Al}_2\text{O}_3$ ) instead of fluorspar**

**27-Making Photographic films**

**28-making car tiers, black painting, polishes and printing ink**

**29- fuel and reducing agent in Medrix furnace.**

**30-antifreeze** substance in car radiators in cold countries. ,the **hydraulic brake** ,printing ink, **polyethylene glycol (PEG)** is used in the manufacture of **Dacron fibers**, photographic films and cassette tapes

### 5-Write the structural formula and one use of the following

	Compound name	Structural Formula	uses
1	<b>Chloroform</b>	$  \begin{array}{c}  \text{Cl} \\    \\  \text{H} - \text{C} - \text{Cl} \\    \\  \text{Cl}  \end{array}  $	It was used as <b>anesthetic</b> substance



2	<b>Halothane</b> <b>Or</b> 2-bromo 2-chloro - 1,1,1 trifluoro ethane	$  \begin{array}{c}  \text{Br} \quad \text{F} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{F} \\    \quad   \\  \text{Cl} \quad \text{F}  \end{array}  $	<b>anesthetic substance</b> <b>instead of chloroform</b>
3	<b>1,1,1 trichloro ethane</b>	$  \begin{array}{c}  \text{Cl} \quad \text{H} \\    \quad   \\  \text{Cl}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{Cl} \quad \text{H}  \end{array}  $	<b>Dry cleaning</b>
4	<b>Freons as</b> tetra fluoro methane $\text{CF}_4$ famous one is dichloro , difluoro methane $\text{CF}_2\text{Cl}_2$	$  \begin{array}{c}  \text{Cl} \\    \\  \text{F}-\text{C}-\text{Cl} \\    \\  \text{F}  \end{array}  $	<b>Air conditions, fridges,</b> <b>rushed substance to liquid</b> <b>and perfumes , cleaner of</b> <b>electronic sets.</b>
5	<b>anhydrous white copper sulphate</b>	<b><math>\text{CuSO}_4</math></b>	<b>Test the presence of</b> <b>hydrogen in organic</b> <b>substance by absorbing</b> <b>water its colour turns blue</b>
6	<b>Soda lime</b>	<b>It is a mixture of</b> <b><math>\text{NaOH}</math> and calcium</b> <b>oxide <math>\text{CaO}</math></b>	<b>preparation of methane</b> <b>or benzene in lab. <math>\text{CaO}</math>(</b> <b><u>quick lime</u> ) reducing the</b> <b>M.P.of the mixture</b>



## CH(2)

## Laws &amp; problems

<b>1-</b> Number of moles =	$\frac{\text{Mass of substance (g)}}{\text{Molar mass (gram/mole)}}$	Mole
<b>2-</b> Number of moles =	$\frac{\text{Number of particles or molecules}}{\text{Avogadro's number (} 6.02 \times 10^{23} \text{)}}$	Mole
<b>3-</b> Number of moles =	$\frac{\text{Volume of gas (L)}}{22.4}$	Mole
<b>4-</b> The density of gas =	$\frac{22.4}{\text{molar mass}}$	gram / liter
<b>5-</b> Concentration (M) = (Molarity)	$\frac{\text{Number of moles}}{\text{Volume [liter]}}$	mole / liter or molar Or M
<b>6-</b> W% of compound in impure sample =	$\frac{\text{Mass of compound in the sample}}{\text{Mass of impure sample}} \times 100$	
<b>7-</b> The W % of element in a compound =	$\frac{\text{Mass of element in compound}}{\text{Molar mass of compound}} \times 100$	

**8- Titration**

$$\frac{M_1 V_1}{M_a} = \frac{M_2 V_2}{M_b}$$

$M_1$  = concentration of the **acid** (mole/liter).

$M_2$  = concentration of the **alkali** (mole/liter).

$V_1$  = volume of **acid** ml or L.       $V_2$  = volume of the **alkali** ml Or L

$M_a$  = number of moles of the **acid** from **balanced chemical equation**.

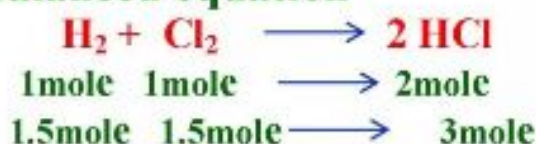
$M_b$  = number of moles of **alkali** from **balanced chemical equation**.

Number of moles	Mass	No. of molecules	Volume (L)	Conc. x V(L)
	Molar mass	$6.02 \times 10^{23}$	22.4	



1) What is the number of moles of HCl formed and number of moles of hydrogen remained without reaction, on adding 2 mol of  $H_2$  to 1.5 mol of  $Cl_2$

Write the balanced equation



number of moles of HCl formed = 3 mole

number of moles of hydrogen remained without reaction =  $2 - 1/3 = 0.5 \text{ mol}$

Substances react  
with each other by  
fixed ratio

2) How many liters of oxygen gas at (stp) can be released from thermal dissociation of 42.6 grams of sodium chlorate ( $NaClO_3$ ) into sodium chloride and oxygen ?  
[O=16, Cl=35.5, Na=23]

Solution

Write the balanced equation



$$\text{Volume of oxygen} = 42.6 \times \frac{67.2}{213} = 13.44 \text{ liters}$$

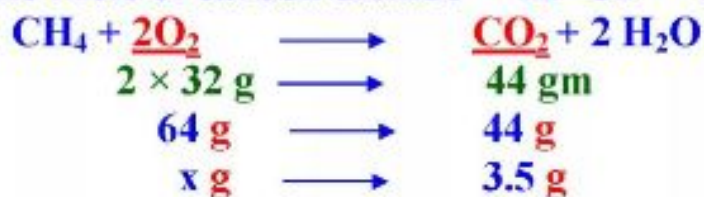
3-Methane  $CH_4$  is the main component of natural gas and burns, according to the equation



Calculate the mass of oxygen required to produce 3.5 grams of carbon dioxide. [O=16, C=12]

Solution

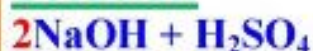
The Mole of carbon dioxide =  $12 + 32 = 44 \text{ gm}$



$$x = \frac{64 \times 3.5}{44} = 5.09 \text{ gm}$$

4-In titration of 25 ml sodium hydroxide solution with sulfuric acid 0.1 Molar the volume of the acid consumed at the point of neutralization is 8 ml. Calculate the concentration of sodium hydroxide solution



**Solution**

$M_1$	0.1	$M_2$	x
$V_1$	8	$V_2$	25
$M_a$	1	$M_b$	2

$$\frac{M_1 \times V_1}{M_a} = \frac{M_2 \times V_2}{M_b}$$

$$\frac{8 \times 0.1}{1} = \frac{25 M_2}{2} \quad M_2 = 0.064 \text{ mole / L}$$

5 - Calculate the volume of hydrochloric acid (0.1 Molar ) necessary to calibrate 20 milliliters of a solution of sodium carbonate (0.5 Molar ) until complete reaction.

**Solution**

Acid		Base	
$M_1$	0.1	$M_2$	0.5M
$V_1$	X	$V_2$	20ml
$M_a$	2	$M_b$	1

$$\frac{V_1 \times M_1}{M_a} = \frac{V_2 \times M_2}{M_b}$$

$$\frac{V_1 \times 0.1}{2} = \frac{20 \times 0.5}{1}$$

$$V_1 = \frac{20 \times 2 \times 0.5}{0.1 \times 1} = 200 \text{ ml}$$

Acid volume  $V_1 =$

6) 20 mL of 0.5 M sodium hydroxide solution is neutralized completely with 0.45 g of unknown acid whose molar mass equals 90 g/mol. Calculate no. of moles of NaOH required to neutralize 1 mol of that acid.

Acid		Base	
$M_1$	40.5	$M_2$	0.5M
$V_1$		$V_2$	20ml
$M_a$	1	$M_b$	x

Number of moles = mass x molar mass  
 $= 0.45 \times 90 = 40.5 \text{ mole}$   
 Number of moles =  $M \times V$

$$\frac{V_1 \times M_1}{M_a} = \frac{V_2 \times M_2}{M_b} \quad \frac{40.5}{1} = \frac{0.5 \times 20 \times 10^{-3}}{x}$$

$$X = 2.4 \times 10^{-3} \text{ mol}$$



7)-A 1.023 grams of hydrated cobalt (II) sulphate ( $\text{CoSO}_4 \cdot x \text{H}_2\text{O}$ ) was strongly heated until a constant mass 0.603 grams. Calculate the percentage of water of crystallization of the hydrated cobalt (II) sulphate, then calculate the number of water molecules of crystallization and write the molecular formula of the hydrated salt.

(Co=59, S=32, O=16, H=1)

### Solution

	Mass of water in	Mass of anhydrous
substance	X g	155 g
sample	0.42 g	0.603 g

Mass of water of crystallization =  $1.023 - 0.603 = 0.42 \text{ g}$

$$\% \text{ of water of crystallization} = \frac{\text{mass of water}}{\text{mass of hydrated salt}} \times 100$$

$$= (0.42/1.023) \times 100 = 41.1\%$$

Molecular mass of  $\text{CoSO}_4 = 59 + 32 + (4 \times 16) = 155 \text{ g}$

155 g of  $\text{CoSO}_4$  combines with x g of  $\text{H}_2\text{O}$   
 0.603 g of  $\text{CoSO}_4$  combines with 0.42 g of  $\text{H}_2\text{O}$

Mass of water of crystallization in the molecular formula  
 $= (155 \times 0.42) / 0.603 = 107.9 = 108 \text{ g}$

Molar mass of water = 18g

$$x \text{ mole water} = 108 \div 18 = 6 \text{ mole}$$

Or  $\frac{\text{Mass of water in sub.}}{\text{Mass of water in sample}} = \frac{\text{mass of anhydrous sub.}}{\text{mass of anhydrous sample}}$

$$\frac{x \text{ g of H}_2\text{O}}{0.42 \text{ g}} = \frac{155 \text{ g}}{0.603}$$

$$x \text{ gm} = (155 \times 0.42) / 0.603 = 107.9 = 108 \text{ g}$$

Molar mass of water = 18g

$$x \text{ mole water} = 108 \div 18 = 6 \text{ mole}$$

The molecular formula  $\text{CoSO}_4 \cdot 6\text{H}_2\text{O}$

8- 2gm of impure sodium chloride dissolves in water and added to the abundance of silver nitrate 4.628 g of silver chloride precipitated. Calculate the percentage of chlorine in the sample.

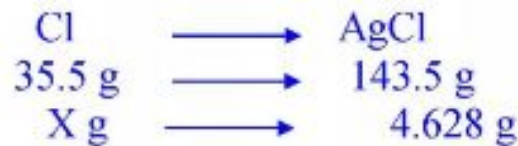
Solution [Ag=108, Cl=35.5]





The Mole of chloride  $\text{Cl}^- = 35.5 \text{ gm}$

The Mole of  $\text{AgCl} = 108 + 35.5 = 143.5 \text{ g}$



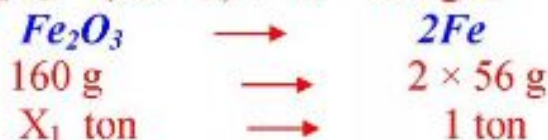
$$\text{Mass of chlorine} = \frac{35.5 \times 4.628}{143.5} = 1.14 \text{ g}$$

$$\text{Percentage of chlorine in the sample} = \frac{1.14 \times 100}{2} = 57\%$$

**9-Iron ore Contains 30% of the iron III oxide  $\text{Fe}_2\text{O}_3$  how many tons of crude needed to produce one ton of iron. [Fe=56 , O= 16]**



The Mole of  $\text{Fe}_2\text{O}_3 = (56 \times 2) + 48 = 160 \text{ gm}$



$$\text{X}_1 \text{ (the amount of iron oxide for the production } \frac{160 \times 1}{112} \text{ of iron)} = 1.43 \text{ tons}$$

**Iron crude**

100  
 $\text{X}_2 \text{ ton}$

contains  
 $\longrightarrow$

**iron III oxide**

30  
1.43 ton

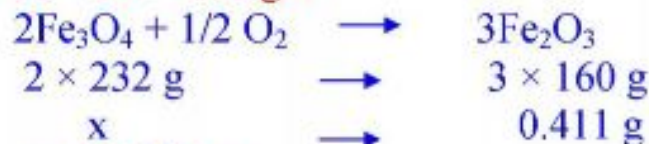
$$\text{Iron ore to get one ton iron} = \frac{143 \times 100}{30} = 4.766 \text{ tons}$$

**10-When oxidation of half grams of ore of magnetite  $\text{Fe}_3\text{O}_4$  it turns into iron III oxide resulted in 0.411 g of  $\text{Fe}_2\text{O}_3$ . Calculate the percentage of black oxide in the raw. [Fe=56 , O= 16]**

**Solution:**

The Mole of  $\text{Fe}_3\text{O}_4 = 3 \times 56 + 64 = 232 \text{ gm}$

The Mole of  $\text{Fe}_2\text{O}_3 = 2 \times 56 + 48 = 160 \text{ gm}$



$$\text{x} = \frac{232 \times 2 \times 0.411}{160 \times 3} = 0.3973 \text{ gm}$$

$$\text{Percentage} = \frac{0.3973 \times 100}{0.5} = 79.46\%$$

King Mr / Aymman Mansour

Mr.-Aymman Mansour



**CH(3)**

$$K_a = \alpha^2 \times C$$

$$\alpha = \sqrt{\frac{K_a}{C}}$$

**For acids**

$$[H_3O^+] = \sqrt{K_a C}$$

$$pH = -\log [H^+]$$

$$POH = 14 - PH$$

**For base**

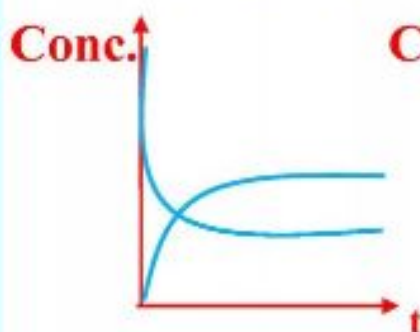
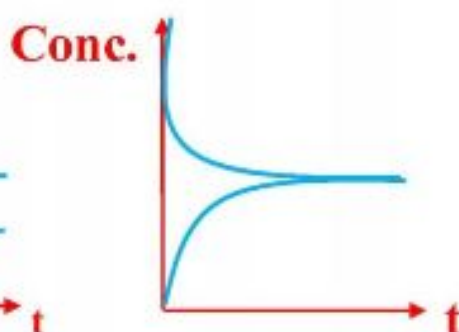
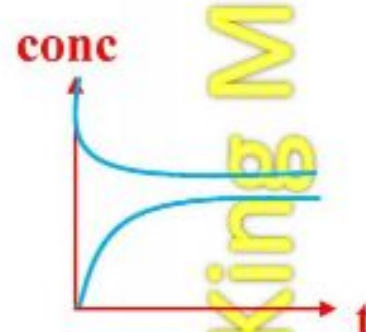
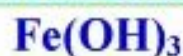
$$[OH^-] = \sqrt{K_b C}$$

$$pOH = -\log [OH^-]$$

$$PH = 14 - POH$$

**Ionic product of water**

$$K_w = [H^+][OH^-] = 10^{-14}$$

 $K_c > 1$  $K_c = 1$  $K_c < 1$ **Weak base****Weak acids**

$$K_c = \frac{[\text{Products}]^a}{[\text{Reactants}]^b}$$

$$K_p = \frac{P^a (\text{Products})}{P^b (\text{Reactants})}$$

**a, b number of moles****1- Calculate the equilibrium constant of the reaction:**

Provided that the concentrations of I<sub>2</sub>, H<sub>2</sub> and HI at equilibrium are 0.221, 0.221 and 1.563 mole/liter, respectively and comment on the result.



Solution

$$K_c = \frac{[HI]^2}{[H_2][I_2]} \quad K_c = \frac{(1.563)^2}{(0.221)(0.221)} \quad K_c = 50$$

$K_c$  is more than one the forward reaction is the predominant reaction,

2-If the number of moles of nitrogen, hydrogen and ammonia in the container of volume 10 liters at equilibrium is equal to 27, 2.5, 0.5 Mole Calculate the value of the equilibrium constant  $K_c$  of reaction to form ammonia

Solution

Concentration = number of moles ÷ volume in liters

The concentration of nitrogen  $N_2 = 27 \div 10 = 2.7 \text{ mol / L}$

The concentration of hydrogen  $H_2 = 2.5 \div 10 = 0.25 \text{ mol / L}$

The concentration of ammonia  $NH_3 = 0.5 \div 10 = 0.05 \text{ mol / L}$

$$K_c = \frac{[NH_3]^2}{[H_2]^3 [N_2]} \quad K_c = \frac{(0.05)^2}{(0.25)^3 (2.7)} = 0.059$$

3-Calculate the equilibrium constant ( $K_p$ ) of the reaction :



When the pressures are 2 , 1 and 0.2 atmosphere for the gases  $NO_2$  ,  $O_2$  and  $N_2$ , respectively .

$$\text{Solution } K_p = \frac{P^2(NO_2)}{P(N_2) P^2(O_2)} \quad K_p = \frac{2^2}{1^2 \times 0.2} = 20$$

**4 - In the balanced reaction**

Explain the factors that decrease the amount of ammonia formed

Solution

We can decrease formation of ammonia by (reaction moves back ward)

- 1- By heating or increasing temp. (reaction is exothermic)
- 2- By decreasing concentration of hydrogen or nitrogen gas
- 3- By decreasing pressure or increasing volume



5 - In the balanced reaction



Explain how each change affects the following changes on the concentration of hydrogen

A - add more of  $\text{CO}_2$

b - add more water vapor

c - Adding a catalyst

d - increase the temperature

e - reduce the size of the pot

### Solution

A - add more of  $\text{CO}_2$  concentration of hydrogen decreases

b - add more water vapor concentration of hydrogen increases

c - Adding a catalyst concentration of hydrogen does not change

d - increase the temperature concentration of hydrogen increases

e - reduce the size of the pot concentration of hydrogen does not change

bec. number of moles of reactants equal number of moles of products

6- Calculate the value of pH in 0.1 molar acetic acid solution at  $25^\circ\text{C}$ , provided that the equilibrium constant of the acid is  $1.8 \times 10^{-5}$

### Solution

$$[\text{H}_3\text{O}^+] = \sqrt{C_a K_a}$$

$$[\text{H}_3\text{O}^+] = \sqrt{0.1 \times 1.8 \times 10^{-5}} = 1.342 \times 10^{-3} \text{ molar}$$

$$\text{PH} = -\log [\text{H}_3\text{O}^+]$$

$$\text{PH} = -\log 1.342 \times 10^{-3} = 2.87$$

$$\text{POH} = 14 - 2.87 = 11.13$$

7- Calculate the value of pH of the solution of 0.01 mol / l of sodium hydroxide

### Solution

Sodium hydroxide strong alkali monohydroxyl fully ionized, so the concentration of  $[\text{OH}^-]$  is equal to the concentration of alkaline solution itself = 0.01

$$\text{POH} = -\log [\text{OH}^-] = -\log 0.01 = 2$$

$$\text{PH} = 14 - 2 = 12$$

8- Calculate  $K_{\text{SP}}$  for silver chromate  $\text{Ag}_2 \text{CrO}_4$  If you know that the 8-concentration of  $[\text{CrO}_4^{2-}]$  equal to  $7.8 \times 10^{-5}$  mole / L and the concentration of  $[\text{Ag}^+]$  equal to  $1.56 \times 10^{-4}$  mole / L



**Solution**

$$K_{SP} = [\text{Ag}^+]^2 [\text{CrO}_4^{2-}]$$

$$K_{SP} = [1.56 \times 10^{-4}]^2 [7.8 \times 10^{-5}]$$

$$K_{SP} = 1.9 \times 10^{-12}$$

**9- Calculate  $K_{SP}$  for silver sulphate  $\text{Ag}_2\text{SO}_4$  If you know that its degree of solubility equal to  $1.4 \times 10^{-2}$  mole / L**

**conc = number of mols x degree of solubility**

**Solution**

$$K_{SP} = [2\text{Ag}^+]^2 [\text{SO}_4^{2-}]$$

$$K_{SP} = (2\alpha)^2 \times \alpha$$

$$K_{SP} = (2 \times 1.4 \times 10^{-2})^2 (1 \times 1.4 \times 10^{-2})$$

$$K_{SP} = 10.976 \times 10^{-6}$$

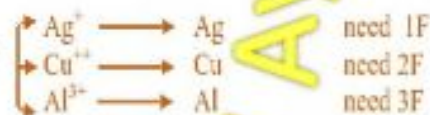
**CH(4)**

(1)  $q = It$

(2)  $1 F = 96500 C$

(3)  $\text{eq.wt} = \frac{\text{at. wt}}{\text{valency}}$

To despile one gm / atom of



(4)

96500c	eq.Wt (gm)
q (c)	m (gm)

$$\frac{M_1}{M_2} = \frac{\text{eq wt}_1}{\text{eq wt}_2}$$

**5- The amount of electricity for gram /atom or mole**

**= number of atoms in moles x 1F x valency**

**1-A-Arrange the following electrodes in descending order according to the strength of the reducing agents.**

1-  $\text{Zn}^{+2} / \text{Zn}$  [ -0.76 volts ]      2-  $\text{Mg} / \text{Mg}^{+2}$  [2.375 volts ]

3-  $2\text{Cl} / \text{Cl}_2$  [-1.36 volts ]      4-  $\text{K}^+ / \text{K}$  [-2.924 volts ]

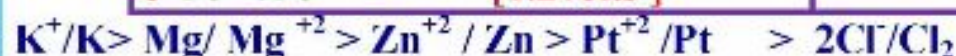
5-  $\text{Pt}^{+2} / \text{Pt}$  [1.2volts ]



Descending order according to the strength of the reducing agents.

= descending order according to oxidation potential

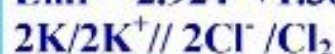
Symbol process	oxidation potential
1- $Zn^{+2} / Zn$ [ -0.76 volts ]	0.76 volts
2- $Mg / Mg^{+2}$ [ 2.375 volts ]	2.375 volts
3- $2Cl / Cl_2$ [ -1.36 volts ]	-1.36 volts
4- $K^+ / K$ [ -2.924 volts ]	2.924 volts
5- $Pt^{+2} / Pt$ [ 1.2volts ]	-1.2volts



2)-Write the symbolic diagram of the galvanic cell which consists of two electrodes from the previous electrodes which give the maximum electromotive force with writing the e.m.f. and determine the direction of the electric current .

Maximum emf between K and Cl

$$Emf = 2.924 + 1.36 = 4.284 \text{ V}$$

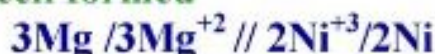


	anode	cathode
	K	Cl
Oxi. Pot.	2.924	-1.36
Red. Pot.	-2.924	1.36

3-If the reduction potentials of Magnesium and nickel is (-2.4 , -0.23 )volts respectively , answer the following ;

A- which is anode. Magnesium

B-Write the symbolic diagram of the galvanic cell formed



C-calculate the electromotive force.

$$Emf = 2.4 + (0.23) = 2.17 \text{ v}$$

4-write the symbol of the following galvanic cell work indicating oxidized reducing agent and the value of the electromotive force of the cell



Note that the oxidation potential of copper = -0.34 V (spontaneous or not)

Solution

From the equation



oxidizing agent) cathode



	anode	cathode
	H2	Cu
Oxi. Pot.	0	- 0.34
Red. Pot.	0	0.34

$$e.m.f \text{ of cell} = \text{zero} + 0.34 = 0.34 \text{ volt}$$

Spontaneous because value of emf is +ve



5. If 19300 coulomb of electricity is required to precipitate 6.5 gm of metal from an electrolyte containing its ions. Calculate the gram equivalent weight for each metal.

$$\begin{array}{lcl} 96500 \text{ C} & \longrightarrow & \text{eq wt gm} \\ 19300 \text{ c} & \longrightarrow & 6.5 \text{ gm} \\ \text{eq wt} & = & \frac{96500 \times 6.5}{19300} = 32.5 \text{ gm} \end{array}$$

6- Find amount of electricity which needed to precipitate 5.9 gm of nickel from (NiCl<sub>2</sub>) solution

Given that  $\text{Ni}^{2+} + 2e \longrightarrow \text{Ni}$  [At.wt of (Ni) = 59]

$$\text{eq. wt} = \frac{\text{at. wt}}{\text{Valency}} = \frac{59}{2} = 29.5 \text{ gm}$$

$$\begin{array}{lcl} 96500 \text{ C} & \longrightarrow & 29.5 \text{ gm} \\ x \text{ c} & \longrightarrow & 5.9 \text{ gm} \end{array}$$

$$\text{Amount of electricity} = \frac{96500 \times 5.9}{29.5} = 19300 \text{ c}$$

7- In an electroplating process taking place to plate copper by gold, by passing 0.5 faraday in an aqueous solution of gold (III) chloride.

Calculate the volume of the precipitated gold layer Given that the atomic mass of gold = 196.98 and the density of gold = 13.2 gm / cm<sup>3</sup>. Write the cathodic reaction.

$$\text{eq. wt} = \frac{\text{at. wt}}{\text{Valency}} = \frac{196.98}{3} = 65.66 \text{ gm} \quad q = 0.5 \text{ F}$$

$$\begin{array}{lcl} 1 \text{ F} & \longrightarrow & 65.66 \text{ gm} \\ 0.5 \text{ F} & \longrightarrow & m \text{ gm} \end{array}$$

$$m = 0.5 \times 65.66 \div 1 = 32.83 \text{ gm}$$

density = mass ÷ volume

$$\text{volume} = \text{mass} \div \text{density} = 32.83 \div 13.2 = 2.487 \text{ cm}^3$$



8- A quantity of electricity is passed through two electrolytic cells connected in series. the 1st cell contains copper (II) chloride solution While the 2nd cell contains copper (I) solution. If the increase in the mass of the cathode in the 1st cell was 0.073 gm (Cu=63.5)

Find the increase in the mass of the cathode in the 2nd cell

in 1<sup>st</sup> cell

$$\text{eq. wt} = \frac{\text{at. wt}}{\text{Valency}} = \frac{63.5}{2} = 31.75 \text{ gm} \quad m_1 = 0.073 \text{ gm}$$



**in 2<sup>nd</sup> cell**

$$\text{eq. wt} = \frac{\text{at. wt}}{\text{Valency}} = \frac{63.5}{1} = 63.5 \text{ gm}$$

$$\frac{m_1}{m_2} = \frac{\text{eq. wt}_1}{\text{eq. wt}_2} \quad \frac{0.073}{m_2} = \frac{31.75}{63.5} \quad m_2 = 0.146 \text{ gm}$$

9) Passing a quantity of electricity in molten aluminum III oxide atomic mass of aluminum precipitate at the cathode Find

A - The amount of electricity passing through the molten

b - Mass of oxygen at the anode

C - the number of moles of oxygen resulting note that (Al = 27, O = 16)

$$\text{eq. wt} = \frac{\text{at. wt}}{\text{Valency}} = \frac{27}{3} = 9 \text{ gm}$$

$$\begin{array}{lcl} 1\text{F} & \longrightarrow & 9 \text{ gm} \\ q\text{F} & \longrightarrow & 27 \text{ gm} \end{array}$$

$$q = 1 \times 27 \div 9 = 3 \text{ F}$$

$$\text{eq. wt} = \frac{\text{at. wt}}{\text{Valency}} = \frac{16}{2} = 8 \text{ gm}$$

$$\begin{array}{lcl} 1\text{F} & \longrightarrow & 8 \text{ gm} \\ 3\text{F} & \longrightarrow & m \text{ gm} \end{array}$$

$$m = 3 \times 8 / 1 = 24 \text{ gm}$$

$$\text{no. of moles} = \text{mas} / \text{molar mass} = 24 / 32 = 0.75 \text{ mole}$$

10) Passing a quantity of electricity of one Faraday in acidified water Find the rising volume of hydrogen at the cathode and volume of oxygen at the anode note that, (O = 16, H = 1)

For hydrogen

$$\text{eq. wt} = \frac{\text{at. wt}}{\text{Valency}} = \frac{1}{1} = 1 \text{ gm}$$

$$1\text{F} \longrightarrow 1 \text{ gm}$$

$$\text{no. of moles} = \text{mas} / \text{molar mass} = 1 / 2 = 0.5 \text{ mole}$$

$$V = \text{no. of moles} \times 22.4 = 0.5 \times 22.4 = 11.2 \text{ L}$$

For oxygen

$$\text{eq. wt} = \frac{\text{at. wt}}{\text{Valency}} = \frac{16}{2} = 8 \text{ gm}$$

$$1\text{F} \longrightarrow 8 \text{ gm}$$

$$\text{no. of moles} = \text{mas} / \text{molar mass} = 8 / 32 = 0.25 \text{ mole}$$

$$V = \text{no. of moles} \times 22.4 = 0.25 \times 22.4 = 5.6 \text{ L}$$



## Choose the correct answer for each of the following:

1) (Amount of electricity required to precipitate 1 mole of copper, equals ..... according to the following reaction  $\text{Cu}^{+2}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Cu}(\text{s})$ )

- a) 1F      b) 0.5 F      c) 2 F      d) 4 F

2) The number of moles in 72 litres of ammonia gas ( $\text{NH}_3$ ) at (S.T.P) is ..... moles. (a) 2.3      (b) 3.2      (c) 23      (d) 32

3) Which of the following, increases on diluting hydrochloric acid with water?....

- (a) The rate of its reaction with magnesium .  
 (b) The concentration of  $\text{H}^+$  ions.  
 (c) Its electric conductivity.  
 (d) Its pH value.

4) On mixing an equal volumes of 0.5 molar solution of HCl and 0.5 molar solution of NaOH the resultant solution is.....

- (a) neutral.      (b) basic.      (c) acidic.      (d) alkaline.

5) On mixing 100 ml of 0.5 molar solution of HCl and 200 ml of 0.5 molar solution of NaOH the resultant solution is.....

- (a) neutral.      (b) basic.      (c) acidic.

5) Hydrochloric acid is one of the strongest acids. The pH value of its solution of 1 molar concentration is .....

- (a) zero      (b) 7      (c) 13      (d) 14

6) 0.001 molar solution of hydrochloric acid has a pH value equals.....

- (a) 3      (b) 1      (c) zero.      (d) 11

7) To precipitate 1 mol of tri-valent element, it's required to pass an amount of electricity equals ....., to one of its salt solution.

- (a) 9650 C      (b) 96500 C      (c) 189000 C      (d) 289500 C

8) The particle which contains 36 electron , 49 neutron and 38 proton, it is a / an .....



- a) ion whose charge is -2      b) atom whose atomic no. is 87  
c) ion whose charge is +2      d) atom whose atomic no. is 49

9) The quantity of electricity required to precipitate  $\frac{1}{2}$  mol of aluminum, equals ..... according to the following reaction :



- (a) 0.5 F      (b) 1 F      (c) 3 F      (d) 1.5 F

10) When 22.4 litres of oxygen gas were reacted with 70 litres of hydrogen gas to produce water vapor, the remaining hydrogen gas at (S.T.P) was found to be .....

- (a) 47.6 litres.      (b) 23.8 litres.      (c) 25.2 litres.      (d) 50.4 litres.

a) 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.

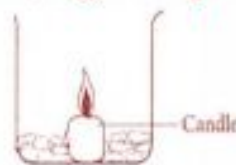
.....

.....

.....

b) On the opposite figure, the candle is surrounded with a substance (X) and on adding dil. hydrochloric acid to this substance, a gas is produced and causes putting off the flame of the candle.

a-Suggest two names of this substance (X),



.....

.....

c- Writing the chemical equation expressing the reaction of one of them with hydrochloric acid

.....

.....

d) How many methylene groups ( $\text{CH}_2$ ) in a molecule of aromatic benzene and cyclohexane ?

.....

.....

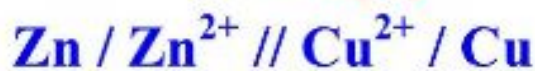
نحن لا نعدك بالنجاح لكن نعدك بالتفوق

مراجعة ال Full mark

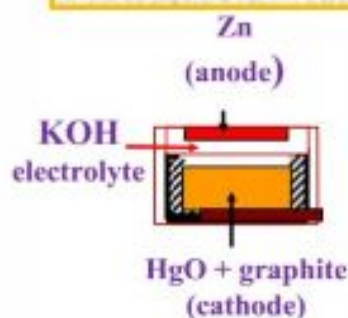


# Drawing

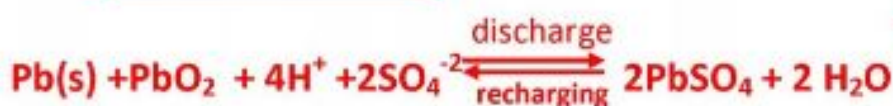
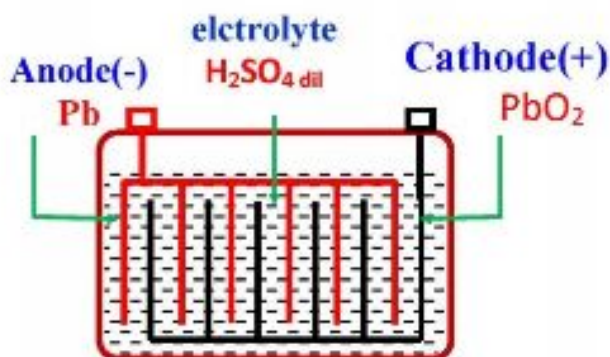
## Daniel cell



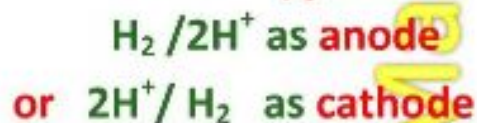
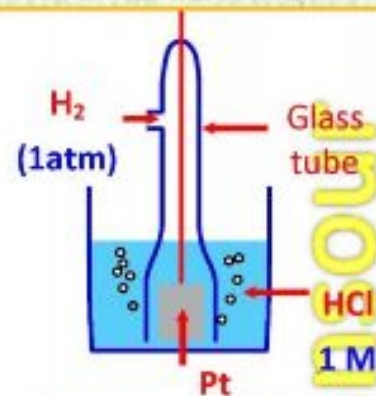
## Mercury cell



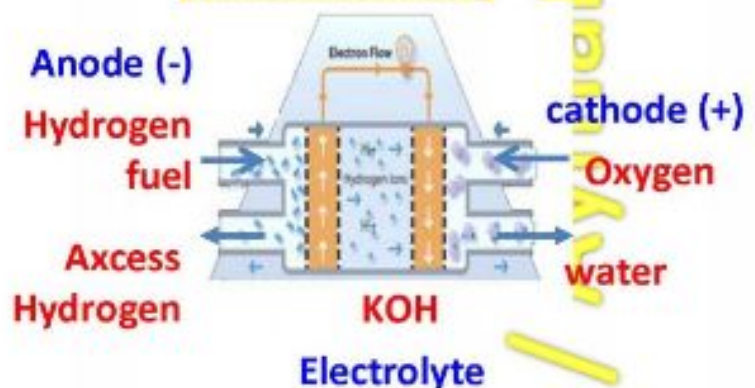
## Car battery



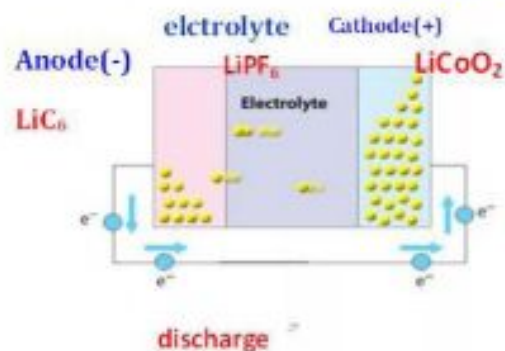
## Standard hydrogen electrode



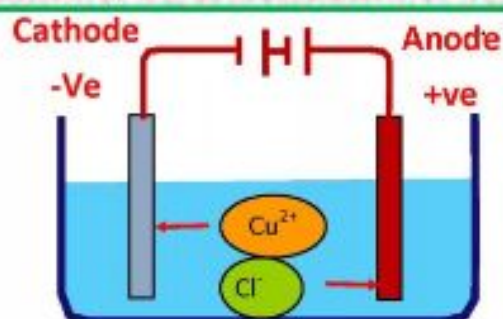
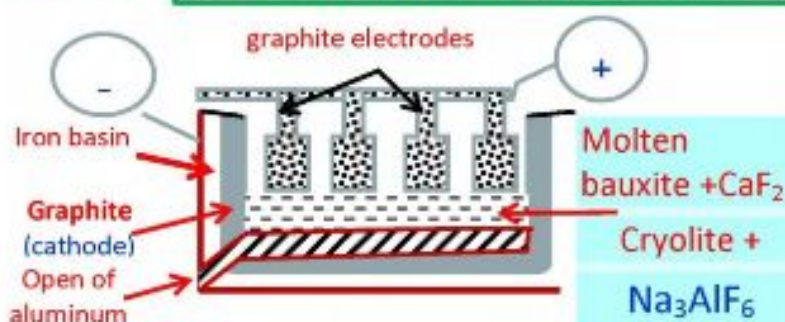
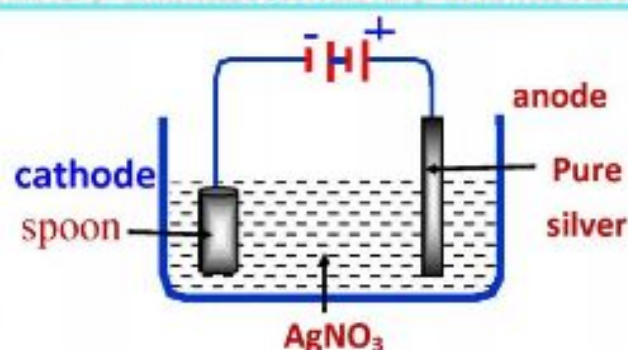
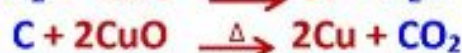
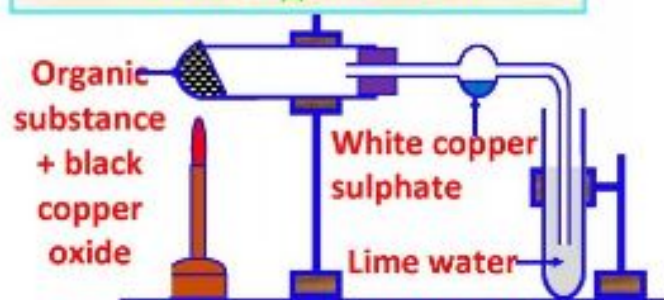
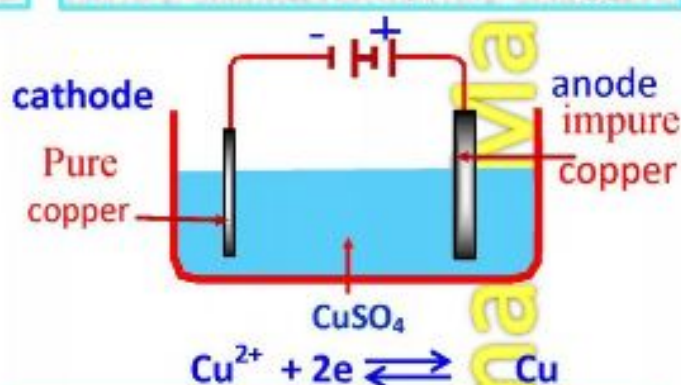
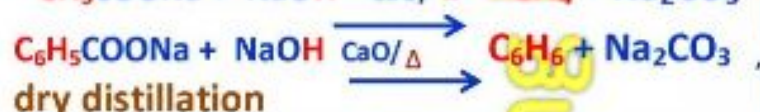
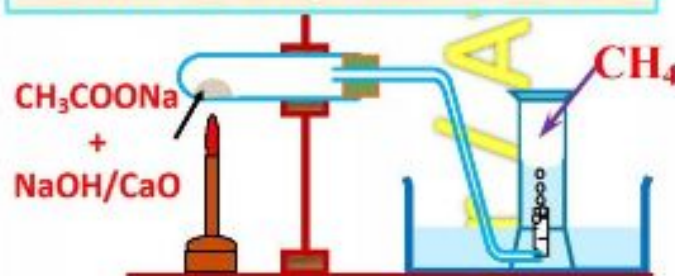
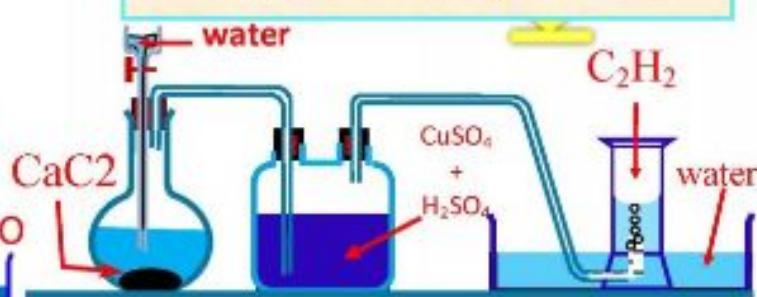
## Fuel cell



## Lithium ion battery





**Electrolysis of copper chloride****Extraction of aluminum****Electroplating the spoon with silver****Test organic sub.****ethylene or ethene in lab****Purification of impure copper****Methane in lab or benzene****acetylene or ethyne in lab**



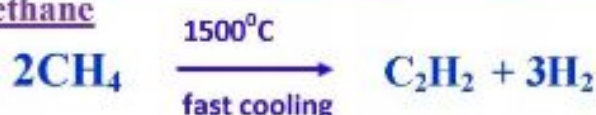
## How can you differentiate between?

1-methane and ethylene اهم حاجة في التفريق ركز في نوع المادة مش اسمها بس

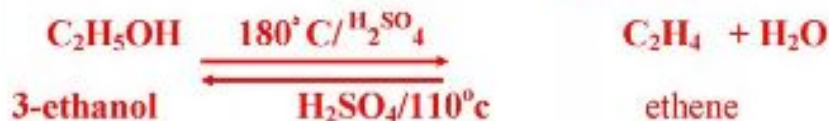
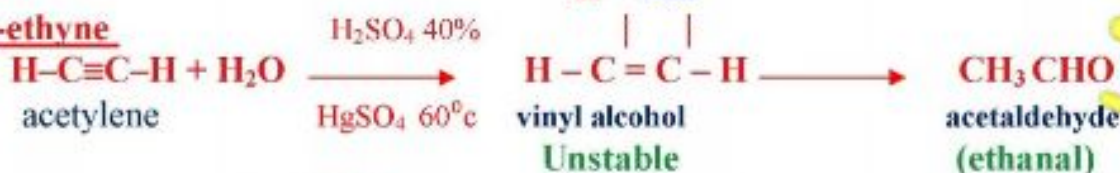
2-ethane and acetylene

Exp.	Methane	Ethylene or ethene	Acetylene or ethyne
1-Bromine water dissolves in $\text{CCl}_4$	No reaction	The <b>Red colour</b> of bromine disappears	The <b>Red colour</b> of bromine disappears
2-By adding $\text{KMnO}_4$	No reaction	The <b>violet colour</b> of $\text{KMnO}_4$ disappears	The <b>violet colour</b> of $\text{KMnO}_4$ disappears

### 1-methane



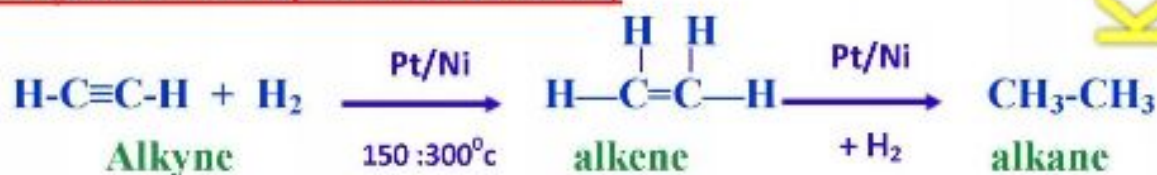
### 2-ethyne



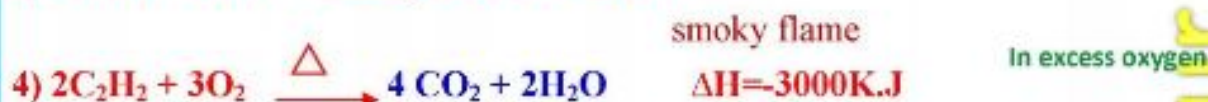
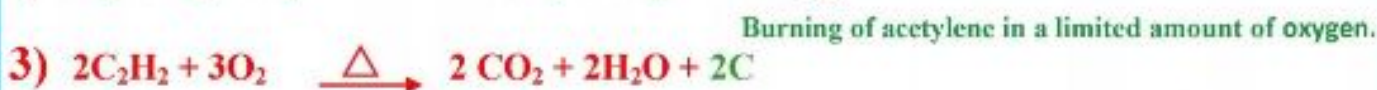
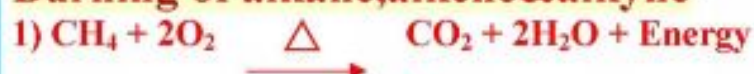
Ethyl hydrogen sulphate

### Hydrogenation (reaction with hydrogen)

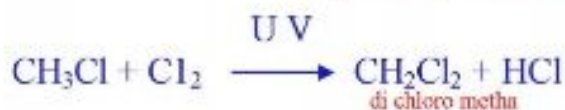
#### 1- alkyne & alkene (addition reaction)



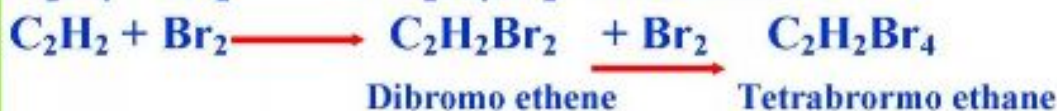


**Burning of alkane, alkene & alkyne**

Oxy acetylene flame is used for welding and cutting metals.

**21-Halogenation (reaction with halogen  $\text{Cl}_2, \text{Br}_2, \dots$ )****a- Halogenation of alkanes (substitution reaction)**

(stop use as anesthetic substance)

**b-Halogenation of alkyne & alkene (addition reaction)**

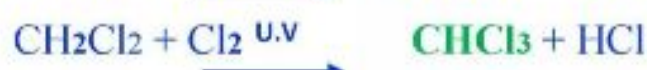


## Organic conversions

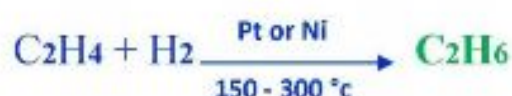
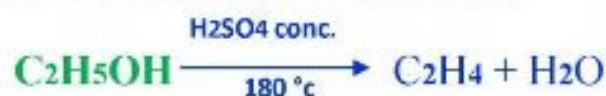
### 1-Black carbon from acetic acid



### 2-Chloroform from methane

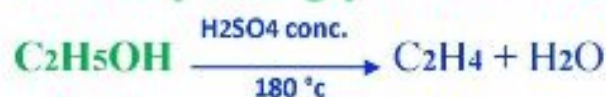


### 3-Ethane from ethanol



### 4-dihydric alcohol from mono hydric alcohol

#### or ethylene glycol from ethanol



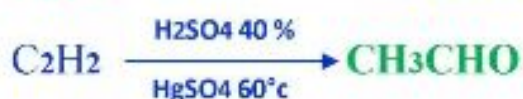
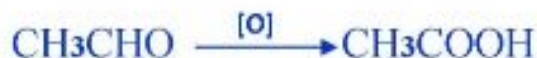
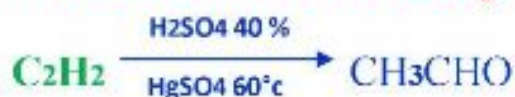
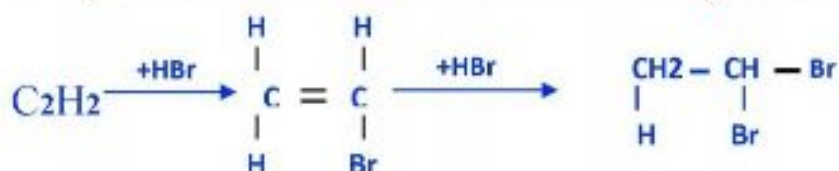
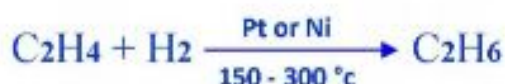
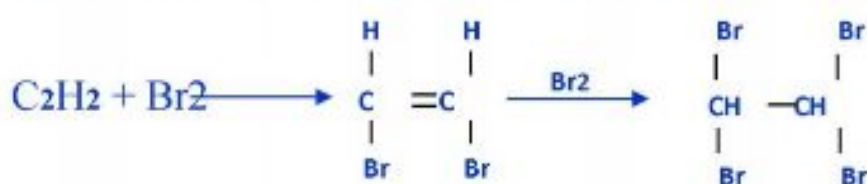
### 5-P.V.C from acetylene



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**6-Acetalhyde (ethanal) from calcium carbide****7-Methane from acetylene****8-1,1dibromo ethane from acetylene****9-Ethane from ethanol****10-Acetic acid from acetylene****11-butane from octane****12-1,1,2,2Tetra bromo ethane from acetylene**

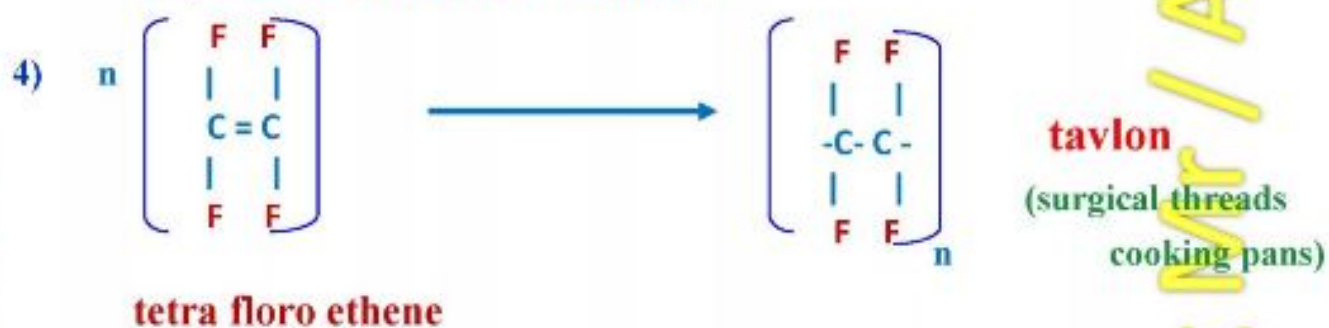
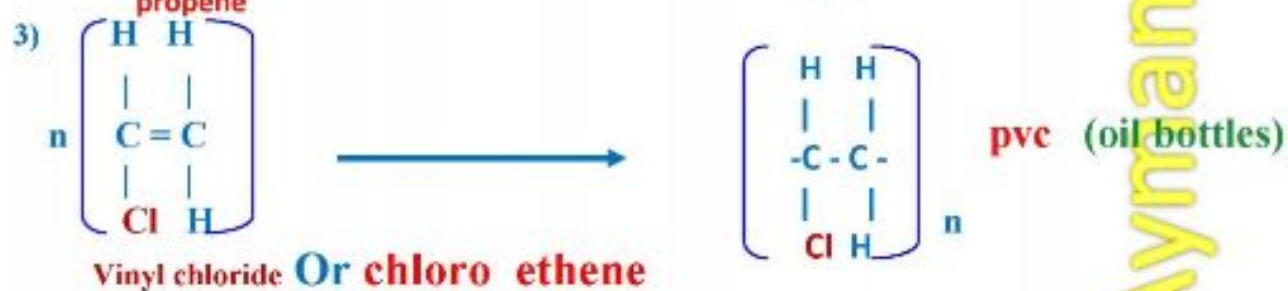
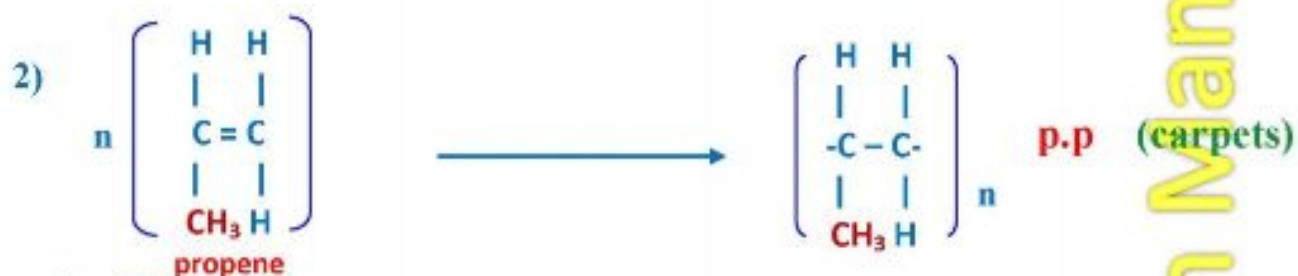
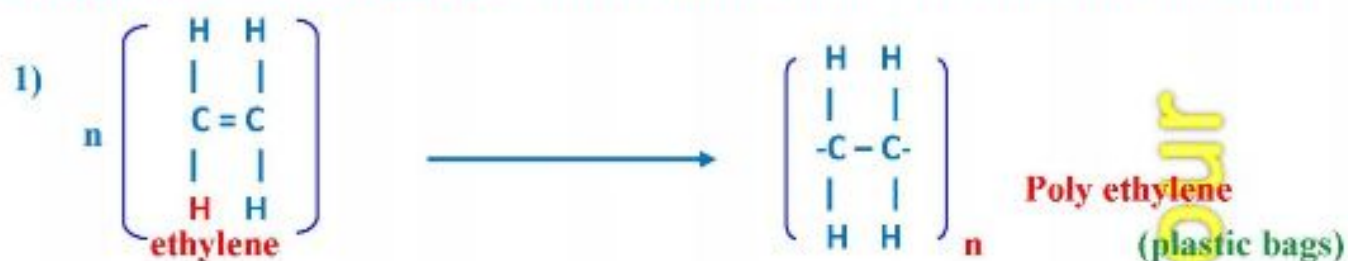
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## Polymerization

**a- addition polymerization** (between similar monomers to form polymer)





# Experiments

**1-Explain experiment for the effect of dilution on both solutions of ethanoic acid (acetic acid), and of hydrogen chloride gas**

## Steps

**Dilute each** solution to 0.01 molar and test the electrical conductivity, then dilute each solution to 0.001 molar and test the conductivity of each solution again.

## Obs.

Illumination of **the lamp is not affected in** the case of dilution of **hydrochloric acid**, but the **illumination increases** in the case of the dilution of **acetic acid**.

## Conc.

Ionization of hydrogen chloride is complete, **but that of acetic acid is partially** so ionization of **hydrochloric acid** is not affected by dilution, but the ionization of **ethnic acid** increases by dilution



**2-Explain an experiment for effect of concentration on the equilpruim state ? Or To clarify the law of mass action ,**

## Steps

Add iron III chloride of **faint yellow colour** to **colourless** ammonium thio cyanate solution

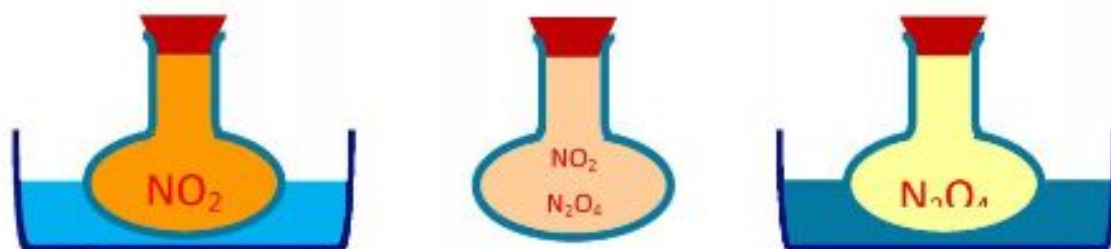
Reaction mixture **becomes blood red** due to the formation **iron thiocyanate**



By adding more ammonium thio cyanate the reaction moves forward and **red colour become more dense**

**3- Experiment to illustrate the effect of temperature on a reaction at equilibrium:**



**Hot water****Room temp.****Cold water**

Dark reddish brown

reddish brown

colourless

Heating

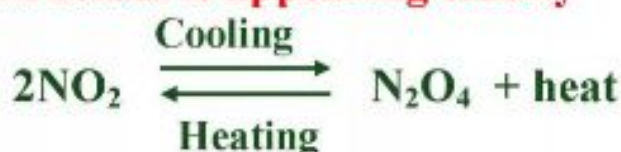
Cooling

Get a flask contain nitrogen dioxide

By cooling a flask containing nitrogen dioxide ( $\text{NO}_2$ ) Has a reddish brown color the colour of ( $\text{NO}_2$ ) gradually decreases until **disappears completely**

By putting flask puts in hot water we find that

The reddish brown colour is **appearing clearly**



#### 4- Explain an experiment for electrolysis of copper chloride solution

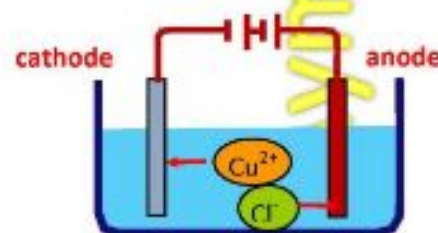
Oxidation & reduction reaction take place spontaneously

a-at the cathode:



b - at the anode  $2\text{Cl}^- \rightarrow \text{Cl}_2 \uparrow + 2\text{e}$

**Total reaction**



#### 5-Explain exp. for electroplating the spoon or jug with a layer of silver

##### Steps:

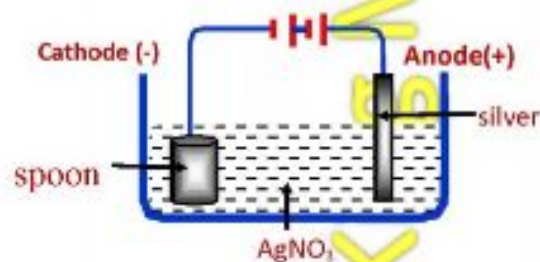
1- Clean the spoon or jug well then connects it with the (-ve) pole of battery

**acts as cathode**

2- Connect a **pure silver** rod to the (+ve) pole of battery **acts as anode**.

3- put the spoon and the silver rod in ( $\text{AgNO}_3$ ) solution

4- passing a suitable current for a time ,the spoon will plated with layer of silver



**Reactions At anode :- (silver rod)  $\text{Ag} \longrightarrow \text{Ag}^+ + \text{e}$  (oxidation)**

**At Cathode :- (spoon)  $\text{Ag}^+ + \text{e} \longrightarrow \text{Ag}$  (redaction)**

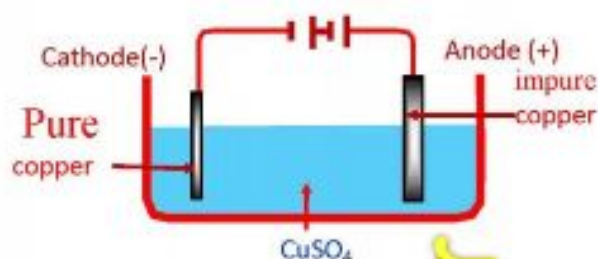


**6- explain exp. for -Purification of copper metals****steps**

1 - Connect a **impure copper** rod to (+ve) pole of battery **acts as anode**

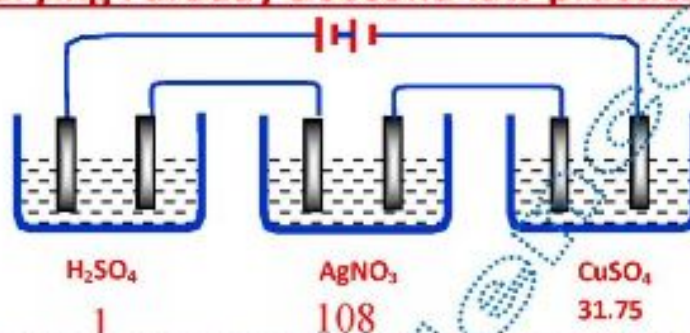
2 - Connect thin plate of **pure metal** rod to (-ve) pole of battery **acts as cathode**

3 - Put them in electrolytic solution of metal salts wants to be purified



\* **at the anode:**  $\text{Cu} \longrightarrow \text{Cu}^{2+} + 2e^-$  (oxidation)

\* **at the cathode**  $\text{Cu}^{2+} + 2e^- \longrightarrow \text{Cu} \downarrow$  (reduction)

**7-Experiment varying Faraday's second law practically**

1 - Pass **same electric current** in solutions of silver nitrate and copper sulfate and diluted sulfuric acid connected together in a row

2 - We note that mass formed at the cathode materials are silver and copper and hydrogen **directly proportional** to equivalent mass



## 3-galvanic cells

P. O .C	Mercury cell	fuel cell	lithium ion cell	Lead storage cell
1- Type of cell	Primary	Primary	Secondary	Secondary
2- E.M.F	1.35 volt	1.23 volt	3 volt	12 volt or more
3- Anode	Zinc	hydrogen	lithium graphite $\text{LiC}_6$	Lead covered with spongy lead
4-Cathode	Mercury Oxide	Oxygen	lithium cobalt oxide $\text{LiCoO}_2$	lead dioxide
5- Electrolyte	Potassium hydroxide $\text{KOH}$	Potassium hydroxide $\text{KOH}$	Lithium phosphorus fluoride $\text{LiPF}_6$	Dilute sulphuric acid $\text{H}_2\text{SO}_4$
6-Anodic reaction	$\text{Zn} \rightarrow \text{Zn}^{+2} + 2\text{e}$	$2\text{H}_2 + 4\text{OH}^- \rightarrow 4\text{H}_2\text{O} + 4\text{e}$	$\text{LiC}_6 \rightarrow \text{C}_6 + \text{Li}^+ + \text{e}$	$\text{Pb} + \text{SO}_4^{2-} \rightarrow \text{PbSO}_4 + 2\text{e}$
7-Cathodic reaction	$\text{Hg}^{2+} + 2\text{e} \xrightarrow{\text{Hg}}$	$\text{O}_2 + 2\text{H}_2\text{O} + 4\text{e} \rightarrow 4\text{OH}^-$	$\text{CoO}_2 + \text{Li}^+ + \text{e} = \text{LiCoO}_2$	$\text{PbO} + 4\text{H}^+ + \text{SO}_4^{2-} = \text{PbSO}_4 + 2\text{H}_2\text{O}$
8- total reaction	$\text{Zn} + \text{HgO} \rightarrow \text{ZnO} + \text{Hg}$	$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$	$\text{LiC}_6 + \text{CoO}_2 \rightarrow \text{C}_6 + \text{LiCoO}_2$	$\text{Pb} + \text{PbO} + 4\text{H}^+ + 2\text{SO}_4^{2-} \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$
9-Symbol of cell	$\text{Zn} / \text{Zn}^{+2} // \text{Hg}^{+2} / \text{Hg}$	$2\text{H}_2 / 4\text{H}^+ // \text{O}_2 / 2\text{O}^{2-}$	$\text{C}_6^- / \text{C}_6 // \text{Co}^{+4} / \text{Co}^{+3}$	$\text{Pb} / \text{Pb}^{2+} // \text{Pb}^{+4} / \text{Pb}^{2+}$