

UNIT-1

Periodic Table and Electronic Configuration

According to Bhor model there are various shell around the nucleus and each shell contains small shells known as subshells.

- Electrons are filled in the increasing order of energy of the subshell.

Shells	Subshell	No: of Electrons	Total No: Electrons in each shell.
1(K)	1 s	2	2
2(L)	 2 s 2 p	2 6	8
3(M)	 3 s 3 p 3 d	2 6 10	18
4(N)	 4 s 4 p 4 d 4 f	2 6 10 14	32

- Increasing order of energy of subshells.
 $1s < 2s < 2p < 3s < 3p < 4s < 3d < 4p$
- Maximum number of electrons that can be accommodate in each subshell is.
s-2, p-6, d-10, f-14
- Completely filled 'd' subshell (d^{10}) or half filled d subshell (d^5) are more stable.
- While writing subshell electronic configuration using the symbol of noble gas.
Upto $2p^6$ use the symbol [Ne]
Upto $3p^6$ use the symbol [Ar]
Upto $4p^6$ use the symbol [Kr]

Block, Period, group.

- The block to which the element belongs will be the same as the subshell to which the last electron is added.
- Largest shell number will be the period of the element.
- **Group number.**

For 's' block elements : No: of electrons in the outermost 's' subshell will be the group number
For 'p' block elements : Add 12 to the no: electrons in the outermost 'p' subshell
For 'd' block elements : No: of electrons in the outermost 's' subshell +No: of electrons in the penultimate subshell.

● Characteristics of 's' block elements:

- More metallic character
- Less ionisation energy
- Less electronegativity
- Their oxides and hydroxides are basic in nature

● Characteristics of 'p' block elements:

- Elements in solid liquid and gaseous states are included in this block.
- High ionisation energy
- High electronegativity

● Characteristics of 'd' block elements:

- They are metals.
- Form coloured compounds.
- Show various oxidation state.
- Last electron is filled in the penultimate shell.

Activity 1:

Find out the odd one and give reason.
2s, 3s, 2f, 1p

Activity 2:

Complete the table

shell	K	L	M	N
Subshell	1s,	2s----	----, 3p, ----	4s, ---, ----, ----

Activity 3:

- Find out the maximum number of electrons that can be accommodated in 'N' shell.
- Name the subshell which can accommodate a maximum of 10 electrons.

Activity 4:

Chlorine has 17 electrons

- What is the atomic number of chlorine?
- Write the subshell electronic configuration.
- How many shells are there in a chlorine atom?
- Which is the subshell common to all the shells?

Activity 5:

Complete the table

Element	Subshell Electronic Configuration	Subshell Electronic Configuration using the symbol of noble gas
$_{12}\text{Mg}$
$_{20}\text{Ca}$	[Ar] $3d^3 4s^2$
... V
$_{21}\text{Sc}$

Activity 6:

Subshell electronic configuration of element X is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4s^2$

- What is the atomic number of the element X?
- Find out whether the electronic configuration given is correct or not. If not, correct it.
- Give reason.

Activity 7:

Complete the table

Element	Subshell Electronic Configuration	Period	Block	Group
$_{19}\text{K}$				
$_{10}\text{Ne}$				
$_{27}\text{Co}$				
$_{13}\text{Al}$				
$_{22}\text{Ti}$				

Activity 8:

Outermost Subshell Electronic Configuration of the element 'Y' is $3s^2 3p^4$

- i) Write the complete Subshell Electronic Configuration.
- ii) Find out the period, group and block of this element.
- iii) Write 2 characteristics of the block of this element.

Activity 9:

Atomic number of Mn is 25

- i) Write the Subshell Electronic Configuration.
- ii) Find the oxidation state of Mn in Mn_2O_7 and write the subshell electronic configuration of manganese ion. (oxidation state of O is -2)

Activity 10:

Find out the wrong subshell electronic configuration from the following.

- a. $1s^2 2s^2 2p^3$
- b. $1s^2 2s^2 2p^6 3s^1$
- c. $1s^2 2s^2 2p^6 2d^7$
- d. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$

Activity 11:

Subshell electronic configuration of some elements are given (Symbols are not real)

P- $1s^2 2s^2 2p^3$

Q- $[Ar] 3d^3 4s^2$

R- $1s^2 2s^2 2p^6$

S- $1s^2 2s^2 2p^6 3s^1$

- i) Which elements formed coloured compounds?
- ii) Which elements are in same block?

Activity 12:

Subshell electronic configuration of an elements is $[Ar] 3d^5 4s^1$

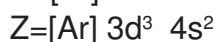
- i) Find the atomic number of this element.
- ii) In which subshell the last electron enters.

Activity 13:

- a) Find the oxidation state of Mn in the following compounds.
i. MnCl_2 ii. MnO_2
(Hint: oxidation state of Cl is -1, and O is -2)
- b) Why 'd' block elements shows variable oxidation state?

Activity 14:

Subshell electronic configuration of some elements are given (Symbols are not real)



- a) Write the complete subshell electronic configuration of 'Y'
b) Which element shows variable oxidation state?
c) Find out the group number, period of the elements 'Z'

Activity 15:

Two compounds of iron are FeCl_2 and FeCl_3 (oxidation state of Cl is -1)

- a) In which compound Fe has +2 oxidation state?
b) Write the subshell electronic configuration of Fe^{3+} ion.
c) Why transition elements show variable oxidation state?

Activity 16:

Some characteristics of 'f' block elements are given below. Identify the correct one.

- a) They are natural elements.
b) Uranium, Thorium are 'f' block elements.
c) The last electrons in 'f' block elements are filled up in the antepenultimate shell.
d) Some elements are Radio active
e) Many of the elements in 'f' block are used as catalysts in the petroleum industry.

Activity 17:

Match the following

Block	Outermost electronic configuration	Peculiarities
s	$3p^5$	Most of the compounds are coloured
p	$3d^4 4s^2$	They belong to lanthanoids (6 th period)
d	$4f^1 5d^1 6s^2$	Highest atomic size in the period
f	$3s^1$	High Electronegativity

UNIT-2

Gas Laws and Mole Concept

Solid, liquid and gas are the three prominent physical states of matter. A solid has definite shape and volume under normal condition. It can resist to an extent, the forces which try to change its shape and volume. Liquid has definite volume but it acquires shape of the container. Gas has no definite shape and volume it gets the shape and volume of the container. In this unit we discuss the effect of temperature and pressure on the volume of a gas. The gas laws and their practical applications. The variation of energy of particles with temperature is all so discussed.

In a chemical reaction atoms and molecules react together in the ratio of their numbers. The number of atoms participating in a chemical reaction should be definite in order to complete the reaction without wasting any reactants. But we can't count the minute particles. In such situation we convert the masses of substances into number of minute particles. We can use a new unit mole here. If we weigh an element equal to its atomic mass expressed in grams, then it contains 6.022×10^{23} atoms of the element. The number of particles 1 GAM, 1GMM (Gram molecular mass) etc.. 6.022×10^{23} , which is known as Avogadro number. At STP the volume of one mole of any gas is 22.4.L. The mole concept is applicable in all chemical reactions and equations that we come across in our life situations. In this unit we discuss the concept mole and solve simple numerical problems which relate the mass of substances with number of particles and volume of particles.

The properties of gas molecules

Volume of a gas

Pressure of a gas

Temperature

Pressure volume relations (Boyle's law)

Temperature and volume relations (Charles's law)

The relation between number of moles and volume (Avogadro's law)

Gram atomic mass (GAM)

Gram molecular mass (GMM)

Simple Arithmetic problems in mole concept.

Relationship between volume of a gas and mole.

The volume of a gas is the volume of the container which it occupies. As a result of the random motion of gas molecules, they collide with each other and also collide with the walls of the container in which it is kept. This collision accounts for the pressure of a gas.

Temperature is the average kinetic energy of molecules in a substance.

The volume and pressure of a gas is related. When volume increases pressure decreases. When volume increases the distance between the gas molecules increases and number of collisions decreases hence pressure also decreases. The volume and pressure is inversely proportional. At a constant temperature, volume of a definite mass of gas is inversely proportional to its pressure. If P is the pressure and V the volume $P \times V = \text{Constant}$

$$P_1 V_1 = P_2 V_2 \text{ Boyle's law}$$

When Temperature increases, the volume of the gas increases.

At constant pressure, the volume of a definite mass of gas is directly proportional to the temperature in Kelvin scale.

The relation is called Charles's law.

$$\frac{V}{T} = \text{a constant}$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

At constant Temperature and pressure, the volume of a gas is directly proportional to the number of molecules. This relationship is known as Avogadro's law.

In a chemical reaction, when atoms and molecules combine they keep a proportion by their number. If the particles having the same mass, even though they are in crores, we can determine accurate number on the basis of mass.

For determining the actual number of atoms or molecules, mole concept can be used.

1. Mole atom means 6.022×10^{23} atoms.

The mass of an element in grams equal to its atomic mass is called 1 gram atomic mass of the element. (GAM)

1 GAM of an element contains 6.022×10^{23} atoms.

Likewise the mass in grams equal to the molecular mass of the substance is called gram molecular mass (GMM) of that substance.

1GMM contains 6.022×10^{23} molecules.

At STP (Temperature 273 K, Pressure 1 atm) One mole of any gas will occupy a volume of 22.4L.

One mole of any gas under the same conditions of temperature and pressure will contain the same number of molecules and hence their volume will also be the same. This is called molar volume of the gas.

1. From the following statements choose the correct statement which shows the property of a gas.

- The distance between the molecules is less.
- Volume of a gas is the volume of the container which it occupies.
- The energy of the gas molecules are very high.
- The attractive force between gas molecules is very high.

2. When the temperature of gas kept in a closed container increases. How does the following variables change?

- Kinetic energy
- Pressure.

3. The data of an experiment with a fixed mass of gas at constant temperature is given

pressure P(atm)	volume V(L)	PV
1	10	.....(a).....
2	.....(b).....	10
.....(c).....	2.5	10

- (i) Complete the table, what is the particularity for PV.
 - (ii) Find the relationship between pressure and volume.
 - (iii) This experiment demonstrate which gas law.
4. a. How does the size of an air bubbles rising from the bottom of a water body chnges. Give reason.
- b. Which gas law explains this.
5. The relationship between tempatature and volume of a gas kept at constant pressur is given in the table.

volume V(L)	Tempatature T (K)	V/T
600	300	2
800	.....(a).....	2
.....(b).....	450	2

- (i) Find the value of a, b
 - (ii) State the gas law related to this
 - (iii) Write an example related to our daily life that demonstrate this gas law
6. Analyse the statement below and find the gas law related to this.
- a) The size of a balloon increases when air is being filled.
 - b) If an inflated balloon is kept in sunlight, it will burst .
 - c) The distribution of cooking gas can be done by filling it in cylinders.
7. What is the molar volume of a gas that is kept at STP.
8. Find the number of mol of atoms and arrange them in the increasing order.
(Hmt : H = 1, C = 12 O = 16 Ca = 40)
- a) 10 g Hydrogen b) 100 g Calcium c) 64 g Oxygen
9. Find the number of molecules in 85 g NH₃ What is the mass of CO₂ molecules.
(Hmt : C = 12 O = 16, N = 14, H = 1)
10. Find the GMM of the following
- a) CaCO₃ b) (NH₄)₂SO₄ c) Na₂CO₃ d) Ca(OH)₂
[Atomic Mass : H - 1, C - 12, N - 14, O - 16, Na - 23, S - 32, Ca - 40]

11. 44g of CO₂ at STP is given.

Find a) Volume

b) Number of molecules

12. Complete the table. [Hint : He : 4, N : 14, O - 16, P - 31]

Substance	Atomic mass	Given mass	Number of Molecules	Number of atoms
He	4	10	(a)	(b)
N ₂	14	(c)	6.022 x 10 ²³	(d)
Cl ₂	35.5	(e)	(f)	10 x 6.022 x 10 ²³
O ₂	(g)	80	(h)	5 x 6.022 x 10 ²³

13. Arrange the following in these increasing order of number of mole.

a. 90g H₂O

b. 48g CH₄

c. 100g CaCO₃

a. 96g SO₂

14. Match the following

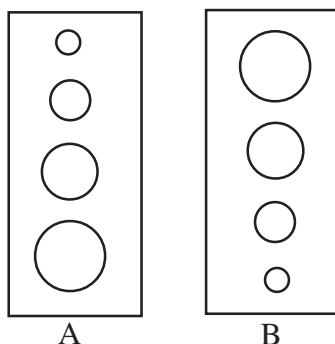
A	B	C
10g H ₂	3 x 6.022 x 10 ²³	2 mole atoms
54g H ₂ O	2GAM	112 L at STP
32g O ₂	5 x 6.022 x 10 ²³	3 GMM

15. From the given samples find which contains equal number of molecules.

a. 88g CO₂ b. 54g H₂O c. 4g H₂ d. 17g NH₃

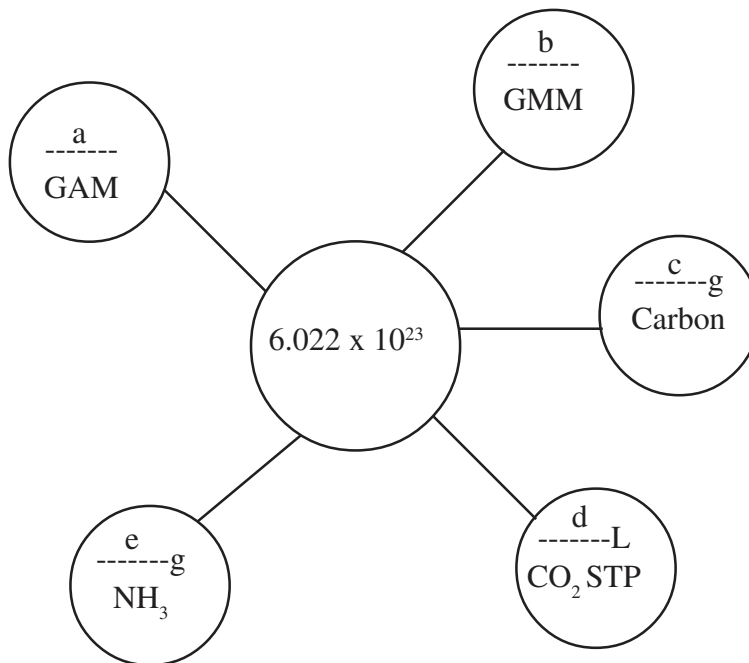
Atomic mass : C = 12, O = 16, H = 1, N = 14

16. The figure shown the bubbles produced in an aquarium. Choose the correct figure. Explain the reason. Give the name of the gas law used to explain this



17. Which gas law explain the relation between volume and temperature of a gas? How volume and temperature of a gas is related?
 A gas is kept in a cylinder of volume 10 L and 300 K. Keeping the pressure constant if temperature is decreased to 150 K find its new volume.

18.



Answer Key

1. a) The volume of a gas is the volume of the container which of occupres.
 c) The energy of the gas molecules are very high
2. a) Kinetic energy increases
 b) Pressure increases
3. i) $a = 10$, $b = 5L$, $C = 4atm$, $P \times V$ is a constant
 ii) Pressure and volume is inversily prepotional Boyle's law.
4. a) Size increases
 At the bottom pressure is high. When moving up wards pressure gradually increases and volume increases.
 b) Boyle's law
5. i) $a = 400$, $b = 900$
 ii) At constant pressure the volume of a fixed mass of gas is directly prepotional to the temperature in kelvin scale.
 iii) Write a suitable occasion

6. a) Avogadro's law
 b) Charle's law
 c) Boyle's law

7. 22.4L

8. a) $10/1=10$ mol H
 b) $100/40=2.5$ mol Ca
 c) $64/16 = 4$ mol O
 $100\text{g Ca} < 64\text{g O} < 10\text{gH}$

9. a) NH_3 molecular mass = 17
 NH_3 GMM = 17g
 Number of moles $85/17 = 5$ mole
 Number of molecules $5 \times 6.022 \times 10^{23}$
 b) Molecular mass of $\text{CO}_2 = 44$
 5 moles $\text{CO}_2 = 5 \times 44 = 220$ g

10. a) $\text{CaCO}_3 = 40 + 12 + 3 \times 16 = 100$ g
 b) $(\text{NH}_4)_2 \text{SO}_4 = 18 \times 2 + 32 + 4 \times 16 = 36 + 32 + 64 = 132\text{g}$
 c) $\text{Na}_2 \text{CO}_3 = 2 \times 23 + 12 + 3 \times 16 = 46 + 12 + 48 = 106\text{g}$
 d) $\text{Ca}(\text{OH})_2 = 40 + 2 \times 17 = 40 + 34 = 74\text{g}$

11. a) GMM of $\text{CO}_2 = 44$ g
 Number of moles = 1 mol
 Volume = 22.4 L
 b) Number of molecules 6.022×10^{23}

12. a = $2.5 \times 6.022 \times 10^{23}$ b = $2.5 \times 6.022 \times 10^{23}$
 c = 28g d = $2 \times 6.022 \times 10^{23}$
 e = 355g f = $5 \times 6.022 \times 10^{23}$
 g = 16 h = $2.5 \times 6.022 \times 10^{23}$

13. a = 5, b = 35, c = 1, d = 1.5
 $c < d < b < a$

14.	A	B	C
	10g H_2	$5 \times 6.022 \times 10^{23}$	STP 112 L
	54g H_2O	$3 \times 6.022 \times 10^{23}$	3 GMM
	32g O_2	2GAM	2 Mol atom

15. a, c

16. Figure B
Pressure at the bottom is high moving up gradually decreases and volume increases.
Boyle's law.

17. Charles's law
Volume is directly proportional of temperature in the Kelvin Scale.

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \frac{10}{300} = \frac{x}{150}$$

$$10 \times 150 = x \times 300$$

$$x = \frac{1500}{300} = 5L$$

18. a) 1 GAM b) 1GMM c) 12g d) 22.4 L e) 17g NH₃

UNIT-3

Reactivity Series and Electro Chemistry

Reactivity of all metals are not same. some metals vigorously react with water, atmosphere and acids, where as some metals show less reactivity. Metals have been arranged in the descending order of reactivity in reactivity series.

More reactive metal displaces a less reactive metal from its metallic salt solution. This is called displacement reactions. Displacement reactions are redox reactions. In galvanic cell or voltaic cell, Chemical energy through redox reactions gets converted to electrical energy. Electrolysis is a process where in an electrolyte undergoes chemical change by passing electricity. The practical application of electrolysis are production of metals, production of non metals, production of compounds, purification of metals etc.

Through electrolysis we can coat one metal over another metal. This is called electroplating.

Main points:

- Reaction of metals with water
- Reaction of metals with air
- Reaction of metals with acids
- Reactivity series
- Displacement reaction
- Galvanic cell or voltaic cell
- Electrolysis
- Electrolysis of molten sodium chloride
- Electrolysis of sodium chloride solution
- Applications of electrolysis
- Electroplating

Reactivity of metals with water, atmosphere and acids are different for different metals.

1. Among the following metals which reacts vigorously with cold water?
(Na, Cu, Mg, Al)
2. The metals which reacts with hot water and liberating hydrogen is.....
(Cu, Ag, Mg, Fe)
3. Complete the chemical equation of reaction of magnesium with atmosphere?
 $2\text{Mg} + \text{O}_2 \rightarrow \dots\dots\dots$
4. Among the following metals which one reacts with atmosphere and loses its lustre easily?
(Al, Cu, Mg, Au)
5. The metal which vigorously reacts with dil. HCl and liberates hydrogen is
(Al, Fe, Mg, Pb)

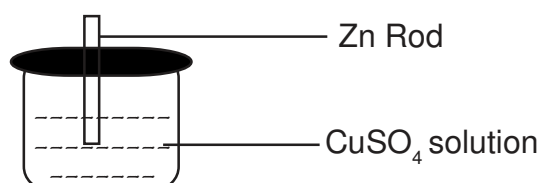
6. Among the following metals, the one which will not react with dil. HCl is.....
(Al, Zn, Cu, Fe)
7. Complete the Table.

Metal	cold water	hot water	Atmosphere	dil.HCl
Sodium	Reacts vigorously	.....	.....	.....
Magnesium	.....	.....	Reacts	.....
Copper	.....	.....	Reacts	.....
Gold	No reaction	.....	.....	.....

Reactivity series and Displacement reaction

In reactivity series metals have been arranged in the descending order of reactivity. Displacement reactions are those in which a more reactive metal displaces a less reactive metal from its salt solution. The reactive metal under goes oxidation and less reactive metal gets reduced here. Displacement reactions are redox reactions.

8. Observe the following figure and answer the questions.



- a) What happens to the blue colour of the solution after some time?
 b) Which metals under goes oxidation here?
 c) Write down the equation of reduction that takes place here?
9. Write down the equation of oxidation that takes place when a Cu strip is dipped in AgNO₃ solution?
10. When Cu striped in AgNO₃ solution, The colour of AgNO₃ solution becomes blue after some times. The Iron responsible for this colour change is?
- 11 Observe the following figure and answer the questions.

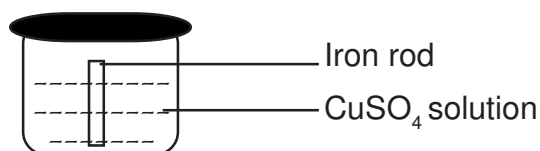


Fig (A)

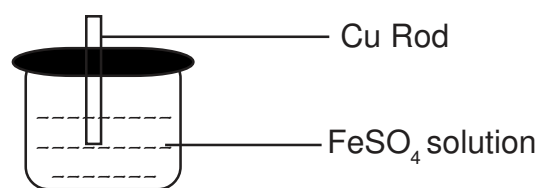


Fig (B)

- a) In which beaker displacement reaction occurs? Explain on the basis of electrochemical series.
- b) Write down the equations of oxidations and reduction take place here.

12. Complete the Table

Metal	Solution	Displacement reactions
Mg	CuSO ₄	Reaction occurs
Cu	MgSO ₄	.....
Zn	MgSO ₄	.....
Fe	ZnSO ₄	.....

Galvanic Cell

In Galvanic cell or voltaic cell, chemical energy is converted to electrical energy through redox reactions. Here the oxidation reaction occurs at anode (Negative Charge) and reduction occurs at cathode (Positive Charge) Electron flow occurs from anode to cathode. Salt bridge is used in galvanic cell to maintain the neutrality of cell by the transfer of ions.

13. In a galvanic cell energy change changes to electrical energy.
14. The charge of anode in galvanic cell is
15. In galvanic cell, the electrode in which reduction takes place is
16. When a galvanic cell is made up of silver and copper, the anode will be
17. Construct a galvanic cell using the chemicals given below.

Zn, Mg, Cu, Fe, CuSO₄, ZnSO₄, CaCO₃, Voltmeter, Saltbridge

Write down the equations of oxidation and reduction reactions that occurs here.

Electrolytic Cell

Electrolytes are substances which under goes chemical change with the passage of electricity. The process where in a substances under goes chemical change with the passage of electricity is called Electrolysis. The Electrode in which oxidation occurs in a electrolytic cell is anode (connected to the positive terminal of the battery) and the one in which reduction occurs is the cathode (connected to the Negative terminal of the battery). During electrolysis, positive ions move towards cathode and under goes reduction. Negative ions are attracted towards anode and under goes oxidation.

- When molten NaCl is electrolysed, chlorine will be obtained at anode and sodium will be obtained at cathod. When NaCl Solution is electrolysed, we will get chlorine at anode and Hydrogen at cathod.

18. When molten NaCl is electrolysed,
- The Ion which gets attracted to anode id
 - Write down the equation of reduction that takes place at cathode?
 - Which metal is obtained at cathode?

19. In the electrolysis of NaCl solution,

Electrode	Products	Reactions	Chemical Equation
Anode	Chlorine	.....	.....
Cathode	.....	Reduction	$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

20. What are the applications of electrolysis ?

Electroplating

Electroplating is a process in which one metal is coated over another metal by Electrolysis. The article to be coated is connected to the negagive terminal of the battery and the metal to be plated is connected to the positive terminal of the battery. A salt solution of the metal to be plated is used as electrolyte.

21. Observe the figure and answer the questions.
(Text Book Page No 59, Fig 3.4)
- Which is cathode here?
 - What happens to Cu^{2+} ions at cathode? Write down the equation
 - Complete the equation
 $Cu \rightarrow \dots + 2e^-$
 - Which is electrolyte here?
 - During electrolysis, how the cocentration of ions in the solution remains constant?
22. If silver is to be plated on another metal, which is the electrolyte to be used?
23. Write down any two examples of electroplating.

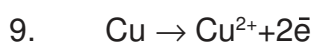
Answer Key

1. Na
2. Mg
3. $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

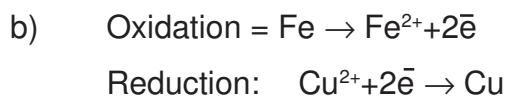
4. Mg
5. Mg
6. Cu

Metal	cold water	hot water	Atmosphere	dil.HCl
Sodium	Reacts vigorously	Reacts	Reacts	Reacts
Magnesium	No Reactions	Reacts	Reacts	Reacts
Copper	No Reactions	No Reactions	Reacts	No Reactions
Gold	No reaction	No reaction	No reaction	No reaction

8. a) Blue Colour of the solution will be lost.
b) Zn
c) $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$



11. Figure A, reactivity of Fe is more than Cu so that Fe under goes oxidation and displaces Cu^{2+} Ions from CuSO_4 solution.

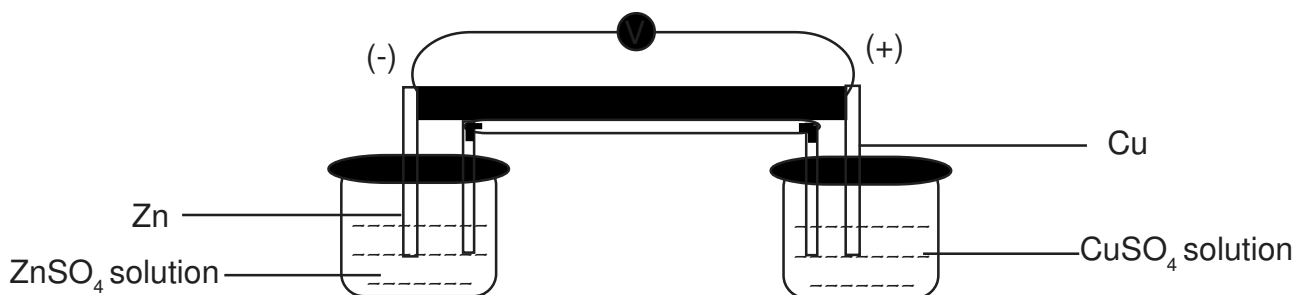


Metal	Solution	Displacement reactions
Mg	CuSO_4	Reaction occurs
Cu	MgSO_4	Reaction doesnt occurs
Zn	MgSO_4	Reaction doesnt occurs
Fc	ZnSO_4	Reaction doesnt occurs

13. Chemical energy

- 14 Negative
 15. Cathode
 16. Copper

17.



18. a) Chloride iron
 b) $\text{Na}^{+1} + 1\bar{e} \rightarrow \text{Na}$
 c) Sodium

19. Electrode	Products	Reactions	Chemical Equation
Anode	Chlorine	Oxidation	$2\text{Cl}^{-1} - 2\bar{e} \rightarrow \text{Cl}_2$
Cathode	Hydrogen	Reduction	$2\text{H}_2\text{O} + 2\bar{e} \rightarrow \text{H}_2 + 2\text{OH}^{-}$

- 20 1) Production of metals
 2) Production of non metals
 3) Production of compounds
 4) Purification of metals

21. a) Iron bangle
 b) Reduction, $\text{Cu}^{2+} + 2\bar{e} \rightarrow \text{Cu}$
 c) $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\bar{e}$
 d) CuSO_4 solution

22. AgNO_3 solution or sodium cyanide + silver cyanide solution

UNIT-4

Extraction of Metals

The discovery of metals has completely changed human life. Today metals find an inevitable role in all area of our life. There are some processes required to make metals in the form in which we experience them. This chapter deals with the chemistry of extraction and purification of metals from their existing condition on earth crust.

Concept:

- Minerals and ores
- Concentration of ores
- Extraction of metals from Concentrated ore
- Refining of metals
- Industrial preparation of Iron
- Extraction of aluminium

Discussions:

Minerals and Ores

- ❖ Minerals are the metallic compounds generally seen in earth crust.
- ❖ A Mineral from which a metal is extracted is called ore.
- ❖ Characteristics of ore are,
 1. Abundance
 2. Easily and cheaply separable
 3. High metal content
 4. Low making cost.

Metal	Ore
Aluminium	Bauxite
Iron	Haematite, Magnetite
Copper	Copper pyrites, Cuprite
Zinc	Zinc blende, Calamine

Concentration of Ores

- ❖ The process of removing the impurities (Gangue) from the ore obtained from earth's crust

Properties of ores	Properties of impurities	Method	Example
High density	Low density	Levigation or hydraulic washing	Oxide ores, ore of gold
Low density	High density	Froth floatation	Sulphide ore Copper pyrates
Magnetic	Non-Magnetic	Magnetic separation	Ore of Iron, Tin stone
Non-Magnetic	Magnetic		
Soluble in the solution	Insoluble in the same solution	Leaching	Ore of aluminium

Extraction of metals from concentrated ore

- ❖ Two stages in the extracton process are,
 1. Conversion of concentrated ore into its oxide.

Method	Process	Example
Calcination	Heating the ore in the absence of air at a temperature below its melting point	Carbonates & Hydroxides decompose to their oxides $ZnCO_3 \rightarrow ZnO$
Roasting	Heating the ore in the current of air at a temperature below its melting point	Sulphde ores are converted in to oxides $Cu_2S \rightarrow Cu_2O$

2. Reduction of the oxide
 - ❖ Extraction of the metal from its oxide is reduction.
 - ❖ Reducing agents like Carbon, Carbon monoxide and electricity are used for the reduction.

Refining of metals

- ❖ The process of removal of impurities to get pure metals is refining

Method	Characteristics	Example
Liquation	Melting point of the metal is less than the impurities	Tin (Sn), Lead (Pb)
Distillation	Boiling Point of the metal is less than the impurities	Zinc (Zn), Cadmium (Cd), Mercury (Hg)
Electrolytic refining	Electrolysis of the salt Solution of the metal	Copper (Cu), Silver (Ag)

Industrial Production of Iron

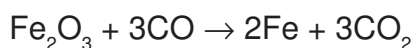
Ore of the Iron	Haematite (Fe_2O_3)
Raw Materials fed into the blast furnace	Haematite, Limestone (CaCO_3), coke
Reducing agent	Carbon Monoxide (CO)
Gangue	Silicon dioxide (SiO_2)
Flux	Calcium Oxide (CaO)
Slag	Calcium silicate (CaSiO_3)

The reactions in the blast furnace are,

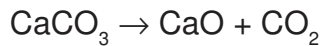
1. Formation of carbon monoxide



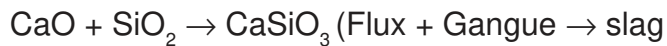
2. Reduction of Haematite into Iron



3. Decomposition of calcium carbonate



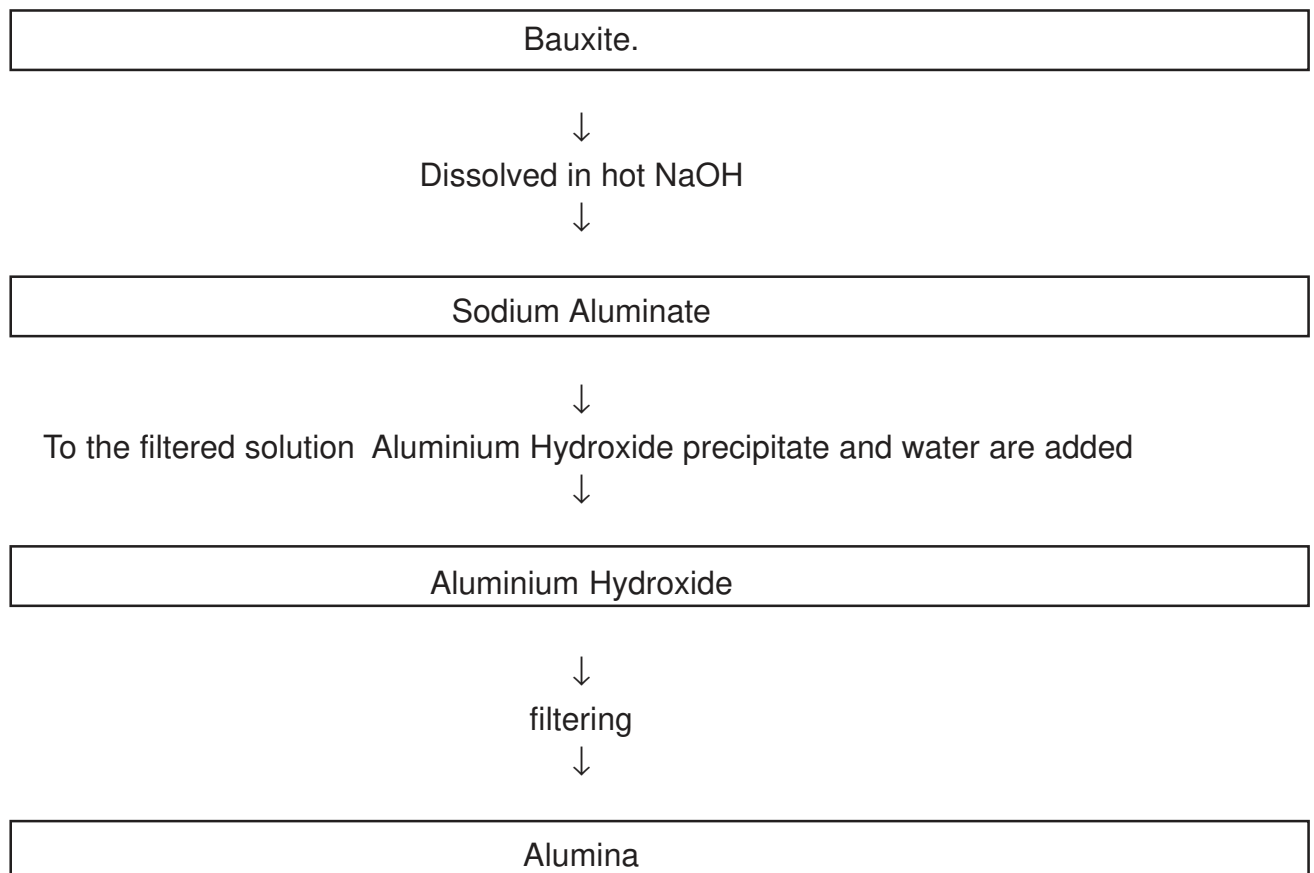
4. Formation of slag



Extraction of Aluminium

- ❖ The ore of aluminium is bauxite.
- ❖ The extraction process of aluminium is called Hall-Heroult process

Concentration of Bauxite



Electrolysis of Alumina

- ❖ Molten cryolite is added to the Alumina to,
 1. Reduce the melting point of Alumina.
 2. Increase the electrical conductivity of Alumina.
- ❖ When electricity is passed through alumina it under goes electrolysis
$$\text{Al}_2\text{O}_3 \rightarrow 2\text{Al}^{3+} + 3\text{O}^{2-}$$

	Anode	Cathode
Reaction	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$	$\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$
product	Oxygen gas	Aluminium

Model Questions

1. Identify the relation and fill up suitably.

Iron : Haematite,

Aluminium :.....

2. Select the appropriate method of concentration of the ores from the bracket.

(Froth floatation, leaching, levigation, magnetic separation)

- a) Ore is lighter
- b) The ore is magnetic in nature and the impurities are non magnetic.
- c) Ore desolves in a solution
- d) Density of the ore is higher.

3. Match the following

Metal	Refining Method
Mercury	Electrolytic Refining
Tin	Distillation
Copper	Liquation

4. The electrolysis of alumina is given below. (Fig : 4.7-TB Page No-71)

- a) Cryolite is added to the alumina. Why?
- b) Anodes are replaced time to time. Why?

5. Calcination and roasting are the two processes involved in the purification of metals.

- a) What is the difference between these two?
- b) What happens to the ore during calcination?

6. Iron is prepared using blast furnace.

- a) Which is the reducing agent?
- b) How the reducing agent is formed in the blast furnace?
- c) Write the reduction reaction taking place in the blast furnace?
- d) Which is the slag formed in the blast furnace?

UNIT-5

COMPOUNDS OF NON-METALS

Non metallic elements have the tendency to accept electrons. These elements combine together to form non metallic compounds. So we shall familiarise ourselves with methods of production of some these non metallic compounds.

Concepts

- Preparation of NH_3 in the class rooms.
- Physical and chemical properties.
- Liquor ammonia & Liquid ammonia
- Solubility of NH_3 in H_2O water fountain experiments

Uses of NH_3

- Reversible reaction chemical equilibrium, properties
- Le-chatelier principle
- Effect of concentration, pressure and temperature in equilibrium.
- Preparation of H_2SO_4 , contact process, physical and chemical properties.
- Dehydrating nature & Drying nature of H_2SO_4
- Reaction of H_2SO_4 with salt, oxidation properties.
- Identification of SO_4^{2-} ion

Preparation of NH_3 in the class rooms.

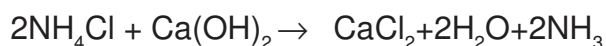
- Heat NH_4Cl & $\text{Ca}(\text{OH})_2$
$$\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O} + 2\text{NH}_3$$
- Produced NH_3 gas is passed through quick lime [CaO] to remove moisture [H_2O]
- Gas jar used for collecting NH_3 is kept inverted position because density is lesser than air.
- NH_3 dissolve in H_2O to produce NH_4OH
$$\text{NH}_3 + \text{H}_2\text{O} \rightarrow \text{NH}_4\text{OH}$$

Properties

- Colourless
- Pungent smell
- Basic character
- Easily dissolve in H_2O to produce NH_4OH
- Density is lesser than air.

Activities

1. a) Choose suitable chemicals used for preparation of NH_3 in the class rooms.
Given below.
 $\text{KNO}_3, \text{BaCl}_2, \text{NH}_4\text{Cl}, \text{NaCl}, \text{Ca}(\text{OH})_2, \text{CaO}$
- b) Complete the chemical equation $\text{NH}_3 + \text{H}_2\text{O} \rightarrow \dots\dots\dots$
- c) Liquor NH_3 concentrated aqueous solution of NH_3
Liquid NH_3 :.....
2. A pungent smell was felt when $\text{Ca}(\text{OH})_2$ and NH_4Cl were mixed in a glass jar the equation is given below



- a) Which gas is formed here.
- b) Write physical properties of NH_3
- d) Write uses of NH_3
3. Analyse the figure and answer the questions. Page 8, figure (5, 2)
- a) Why did water get in to the flask on pressing the piston of syringe.
- b) What property of NH_3 exhibited by the change of colour of water entering the flask in to pink?
- c) Complete the equation
 $\text{NH}_3 + \text{H}_2\text{O} \rightarrow \dots\dots\dots$
4. Figure of preparation of Ammonia in the laboratory is given
- a) Complete the equation
 $2\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O} + \dots\dots\dots$
- b) Why is the gas formed passed through the dring agent.
- c) Can H_2SO_4 be used as the drying agent in ammonia preparation why?
- d) NH_3 is collected in an inverted gas jar why?

Reversible reaction

Reaction takes place in both direction

Forward Reaction- Reactants combine together to form products.

Backward Reaction- Products change in to reactions

Chemical Equilibrium- Stage at which rate of forward and backward reactions become equal $r_f = r_b$

Properties of Equilibrium

- Both reactions and products co-exist
- rate of forward and backward reactions are equal
- Kinetic in molecular level because foward and backward reactions are takes place equal rate in equal time.
- Takes place in closed system.

Le-chatelier principle

When the concentration, pressure or temperature of system at equilibrium is changed. The system will readjust itself so as to nullify the effect of that change and attain a new state of equilibrium

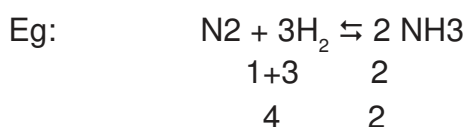
Effects of concentration in equilibrium

- At equilibrium when concentration of reactant increase rate of forward reaction increases.
- Forward reaction increases when remove the product from the system.
- To increase concentration of product increase rate of backward reaction.

Pressure and Chemical equilibrium

Influence in the case of gas only.

- Pressure of the gas increases when number of molecules increases when number of molecules decreases pressure of the gas decreases. When a system attain equilibrium, pressure increases system try to decrease the pressure.



This equilibrium total number of moles of reactant is 4, and product is 2.

When pressure of the system increases system try to decrease the pressure in the direction of number of molecule less [is rate of forward reaction increases]

If the number of gaseous molecules in the reactant and product are equal, pressure will not have any effect on the chemical equilibrium.

Effect of temperature in equilibrium

- On increasing the temperature, the system tries to reduce it by increasing the rate of ***Endothermic*** reaction.
- At low temperature the number of molecules having threshold energy will be less. So the rates of forward and backward reactions get reduced. Hence certain reaction take place at optimum temperature.

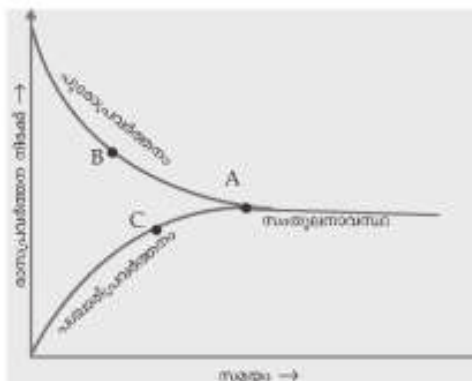
Catalyst and Chemical equilibrium

Catalyst increases the rates of both forward and backward reactions to the equal rates. System reach equilibrium very fastly

Activities

- 5 Two bits of cotton wool dipped separately in conc.HCl and NH_3 solution are placed at the ends of a glass tube as shown in the figure 5.3 Page No 83.
- What is the white fumes by the reaction?
Give reason
 - On heating the glass tube what happened?
 - Write above reactions as reversible reaction.
6. $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$
- Above equilibrium reactions write total number of molecules of products and reactant
 - Write the effect of pressure in this equilibrium. Give reason.
 - State Le-chalelier principle
7. $\text{CaCO}_3 \xrightleftharpoons{\text{endothermic}} \text{CaO} + \text{CO}_2$
- For this equilibrium when temperature increases what happend?
 - Write two method to increase the forward reaction.
 - Write the effect of catalyst in equilibrium
8.
 - Chemical equilibrium dynamic at molecular level gives reason?
 - Write the properties of chemical equilibrium
9. $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3 + \text{heat}$
- For this equilibrium write endothermic reaction.
 - Write above reaction in the forward and backward reactions?
- 10 $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$
consider this equilibrium and complete the table given below
- | Activity | Change in rate of Forward Reaction |
|-------------------------|------------------------------------|
| ● Heats | ● |
| ● Increase the Pressure | ● |
| ● Remove NO_2 | ● |
- 11 Equation of NH_3 manufacture is give
 $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3 + \text{heat}$
- Name the process of manufacture of NH_3 ?
 - What is the effect of pressure in equilibrium?
 - Though the forward reaction is a comparativly high temperature is used here, why?

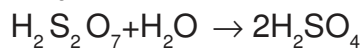
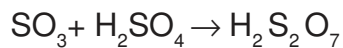
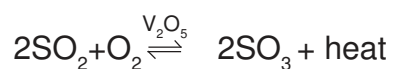
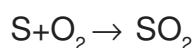
12 The graph representing a reversible reactions given



- Which of the graph represents backward reaction?
- At which point does the system attain equilibrium?
- When a system attain equilibrium, the concentration of reactants and products will not change, why?

H_2SO_4 - Kings of Chemicals

Industrial preparation



Dehydrating nature

Conc: H_2SO_4 has the ability to absorb chemically combine H_2O from substances, so it act as Dehydrating agent.

Drying agent: Capable of absorbing the moisture present in a substance

Oxidising nature

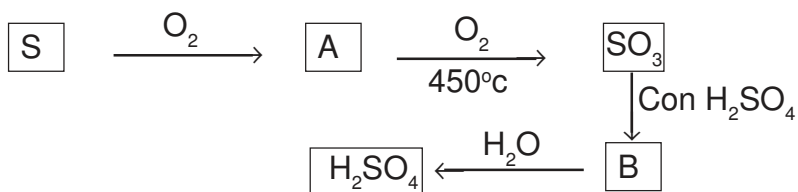
Concentrated H_2SO_4 react with metals and non metals oxidises them.

Identification SO_4^{2-} ion

Sulphate salts react with $BaCl_2$ to form a white precipitate of $BaSO_4$, it is not soluble in dilute HCl.

Activities

13. The flow chart of manufactures of H_2SO_4 is given below.



- What are A and B
 - H_2SO_4 will be formed on dissolution of SO_3 in H_2O . But this is not used in the manufactures process. Why?
 - Write name of manufacture of H_2SO_4 ?
 - Write the procedure to identify sulphate ion?
14. Which property of H_2SO_4 is exhibited in the following reactions.
- $\text{C} + \text{H}_2\text{SO}_4 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{SO}_2$
 - $\text{C}_{12}\text{H}_{22}\text{O}_{11} \xrightarrow{\text{Conc: H}_2\text{SO}_4} 12\text{C} + 11\text{H}_2\text{O}$
15. Equation of the reaction between Cu and H_2SO_4 given below.
- $$\begin{array}{ccccccc} 0 & +1 & +6-2 & +2 & +6-2 & +1 & -2 & +4 & -2 \\ \text{Cu} + 2\text{H}_2\text{SO}_4 & \rightarrow & \text{CuSO}_4 & + & 2\text{H}_2\text{O} & + & 2\text{SO}_2 \end{array}$$
- Which element has under goes oxidise?
 - Which substance gets reduced?
 - Which is the reducing agent?
16. $\text{NaCl} + \text{H}_2\text{SO}_4 \rightarrow \text{NaHSO}_4 + \text{HCl}$
- In the above reaction NaCl react with H_2SO_4 to form HCl . Like wise, if you want to prepare HNO_3 which is the salt to be used?
 - Write the equation of the reaction?
17. A few drops of conc: H_2SO_4 are added to a little sugar crystals taken in a watch glass.
- What will be the observation?
 - Which property of H_2SO_4 is used here?

Answer Key

1.
 - a) NH_4Cl , $\text{Ca}(\text{OH})_2$
 - b) NH_4OH
 - c) Liquid form of NH_3

2.
 - a) NH_3
 - b) See notes
 - c) Manufactures of fertilisers, cleaning window pans and tiles, cooling agents in Iceplant,....

3.
 - a) decreasing the pressure in the flasks.
 - b) Basic nature
 - c) $\text{NH}_3 + \text{H}_2\text{O} \rightarrow \text{NH}_4\text{OH}$

- 4)
 - a) $2\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O} + 2\text{NH}_3$
 - b) To remove the moisture
 - c) NH_3 react with H_2SO_4 to form $(\text{NH}_4)_2\text{SO}_4$
 - d) Density of NH_3 is less than air.

5.
 - a) NH_4Cl
 - b) White fumes disappear
 - c) $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$
 - d) $\text{NH}_3 + \text{HCl} \rightleftharpoons \text{NH}_4\text{Cl}$

6.
 - a) Total number of molecules of reactant and products are 2
 - b) No influence in pressure., no: of molecules of reactant and products are equal.
 - c) See the notes

7.
 - a) Forward reaction increases
 - b)
 1. Increase concentration of CaCO_3
 2. Remove CO_2 or CaO
 3. Increase the temperature
 - c) No influence, reaction attain equilibrium very fastily

8.
 - a) See the note
 - b) ,,

9.
 - a) $2\text{NH}_3 \rightarrow \text{N}_2 + 3\text{H}_2$
 - b) Forward reaction $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$
 - c) backward reaction $2\text{NH}_3 \rightarrow \text{N}_2 + 3\text{H}_2$

10.
 - Heat increase rate of forward reaction increases.
 - increase pressure
$$\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$$

System try to decreases the pressure. On the product side number of molecules less, hence decrease forward reaction.

NO_2 removed in case forward reaction

11. a) Haber process.
b) Pressure increases rate of forward reaction increases.
c) See the notes Page No : 6
12. a) CA / AC
b) A
c) Rate of forward and backward reaction equal.
13. a) A-SO₂
B-H₂S₂O₇
b) Dissolution of SO₃ in H₂O is an exothermic so the droplets of H₂SO₄ formed fog preventing further dissolution
c) Contact process
d) See the notes
14. a) oxidising property
b) Dehydrating agent
15. a) Cu
b) H₂SO₄
c) Cu
16. a) NaNO₃
b) $\text{NaNO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{NaHSO}_4 + \text{HNO}_3$
17. a) Black precipitate is formed
b) Dehydrating nature

UNIT-6

Nomenclature of Organic Compounds and Isomerism

Organic Chemistry is the branch of chemistry that details with the carbon compounds. you have understood the position and importance of the element carbon in the periodic table. Carbon is a component in a variety of compounds. Understanding the topic, you will be able to write The Structural formula and IUPAC name of an Organic compound if its molecular formula is given and viceversa.

After realising the fact that there is a change of forming different types of compounds having the same molecular formula, the concept isomerism can be achieved important points.

- The valency of carbon is 4
 - There are compounds having single bond, double and triple bond between carbon atoms.
 - Hydrocarbons are compounds containing carbon and hydrogen only.
 - The open Chain hydrocarbons having only single bond between the carbon atoms are included in the Alkane Category
 - In alkanes, as all the 4 valencies of each carbon atom are satisfied by single bonds, they are known as saturated hydrocarbons.
 - The general formula of alkanes is $C_n H_{2n+2}$
 - Hydrocarbons having double bond or triple bond between carbon atoms are commonly known as unsaturated hydrocarbons.
 - Hydrocarbons having a double bond between any two carbon atoms are considered as Alkenes.
 - The general formula of Alkyne is $C_n H_{2n-2}$
 - A series of compounds which can be represented by a general formula, having a common difference of $-CH_2-$ group between successive members is called a homologous series.
 - The members of homologous series show similarity in chemical properties. There is a regular gradation in their physical properties.
 - IUPAC has put forward some rules for naming of hydrocarbons.
 - The presence of certain atoms or groups imparts certain characteristic properties to organic compounds. They are called functional groups.
 - Compounds having same molecular formula but different chemical and physical properties are called isomers. The phenomenon is called Isomerism.
1. Some hydrocarbons are given. classify them into Alkane, Alkene, Alkyne.



2. Structural formula of some hydrocarbons are given, complete the table

Structural Formula	Molecular Formula
a. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$	
b. $\text{CH}_2\text{=CH-CH}_3$	
c. $\text{CH}\equiv\text{C-CH}_3$	
d. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$	

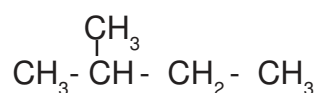
3. Certain hints about an hydrocarbon are given

- The main chain has 5 carbon atoms
 - It has no branches
 - All carbon atoms have single bonds
- a. What is the condensed formula of the compound
 - b. Write the IUPAC name of the compound

4. Complete the Table

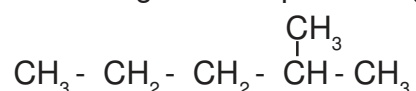
Structural Formula	IUPAC Name
a. CH_4	
b. $\text{CH}_3\text{-CH}_3$	
c. $\text{CH}_3\text{-CH}_2\text{-CH}_3$	
d. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$	
e. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$	
f. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$	

4. The structural formula of an organic compound is given below.



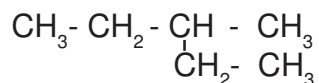
- a. How many atoms are present in the main chain of the compound?
- b. What is the position number of the carbon which contains a branch?
- c. What is the name of the branch?
- d. Write the IUPAC name of the compound.

6. The structural of an organic compound is given.



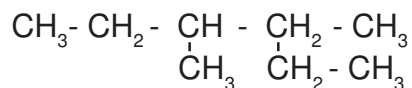
- a. How many carbon atoms are present in the main chain of the compound?
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7. The structural of an organic compound is given.



- a. How many carbon atoms are present in the main chain of the compound?
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8. The structural of an organic compound is given.



- a. How many carbon atoms are present in the main chain of the compound?
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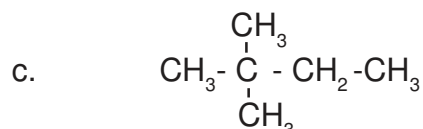
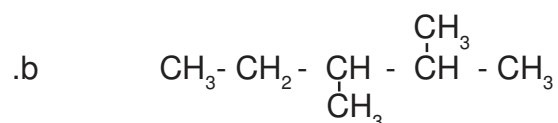
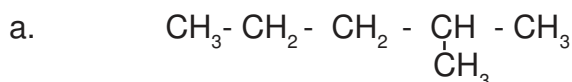
9. Write the structural formula of the hydrocarbons given below

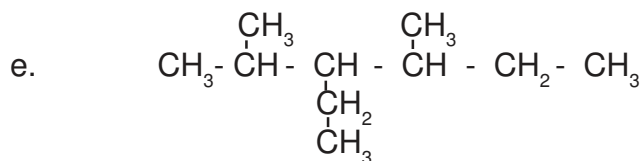
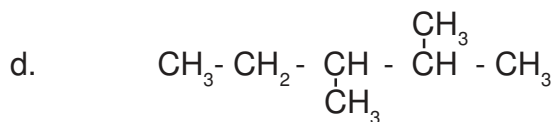
- a. 3-Methylpentane
- b. 2-Methylbutane
- c. 3-Ethylpentane
- d. 3-Ethylhexane

10. Given below are certain hints about a hydrocarbon

- a.
 - The main chain contain 5 carbon atoms
 - Second and Third carbon atoms carrying branches
 - Two branches are Methyl radical
- b. What are the position number of carbon atoms carrying the branches
- c. What are the name of the branches?
- d. Write the IUPAC name of the compound.

13. Write the IUPAC name of the hydrocarbons given below





14. Given below are certain hints about a hydrocarbon.

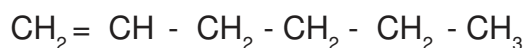
- There are 6 carbon atoms in it.
- The second carbon has a double bond.

- a. To which type of following does it belong? (Alkane, Alkene, Alkyne)
- b. Write the structural formula of the compound
- c. Write the IUPAC name of the compound.

15. Complete the Table

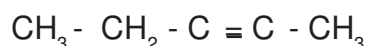
	Structural Formula	IUPAC Name
a.	_____ (a) _____	But-2-ene
b.	$\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 = \text{CH}_2$	_____ (b) _____
c.	_____ (c) _____	Hex-3-ene
d.	_____ (d) _____	Pent-2-ene

16. The Structural formula of a hydrocarbon is given below



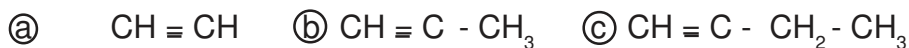
- a. Write the IUPAC name of the compound.
- b. What is the IUPAC name of this hydrocarbon when the double bond changes in to between second and third atom.

17. The Structural formula of a hydrocarbon is given below



- a. To which type of hydrocarbon does it belong? (Alkane, Alkene, Alkyne)
- b. Write the molecular formula of the compound
- c. Write the IUPAC name of the compound.

18. Write the IUPAC name



19. Given below are certain hints about a hydrocarbon.
- There are 5 carbon atoms in it.
 - There is a triple bond at the second carbon atom
- a. To which type of hydrocarbon does it belong? (Alkane, Alkene, Alkyne)
 - b. Write the structural formula of the compound
 - c. Write the IUPAC name of the compound.

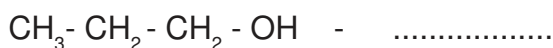
20. Complete the Table

Structural Formula	Number of carbon atom in main chain	Word Root	Position number of branch carrying carbon atom	Number of branch	IUPAC Name
1. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \overset{\text{CH}_3}{\underset{|}{\text{CH}}} - \text{CH}_3$	<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>
2. $\text{CH}_3 - \underset{\text{CH}_2 - \text{CH}_3}{\underset{|}{\text{CH}}} - \text{CH}_2 - \text{CH}_3$	<u>f</u>	<u>g</u>	<u>h</u>	<u>i</u>	<u>j</u>
3. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \underset{\text{CH}_2}{\underset{\text{CH}_3}{\underset{|}{\text{CH}}}} - \text{CH}_2 - \text{CH}_3$	<u>k</u>	<u>l</u>	<u>m</u>	<u>n</u>	<u>o</u>

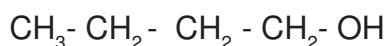
Functional Groups

Carbon and hydrogen are not the only elements present in organic compounds. There are other atoms and groups of atoms present in the place of hydrocarbons. The presence of these atoms or groups imparts certain characteristic properties of organic compounds. They are called functional groups.

21. Fill in the blanks as given in the example.

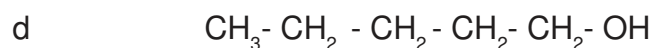
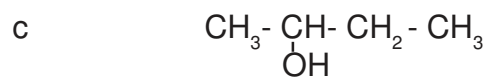
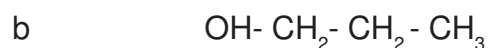
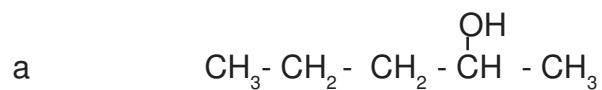


22. The structural formula of an organic compound is given below.

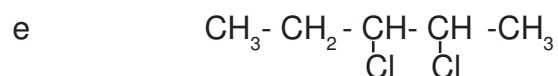
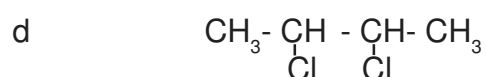
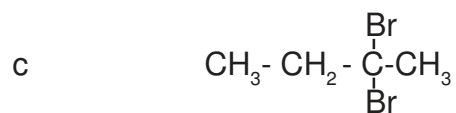
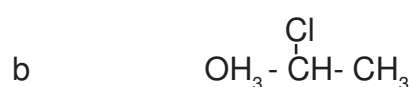
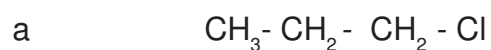


- a. Name of functional group of the compound?
- b. What is the common name of the compounds having this functional group?
- c. Write the IUPAC name of this compound.

23. Write the IUPAC name of the following compounds.



24. Write the IUPAC name of the following compounds.



25. Write the structural formula of the compounds is given below.

a. 2-Bromopentane

b. Dichlorobutane

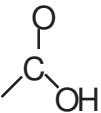
26. Complete the Table

Structural Formula	IUPAC Name
HCOOH	Methanoic Acid
$\text{CH}_3 - \text{COOH}$	<u> Ⓐ </u>
<u> Ⓑ </u>	Propanoic Acid
$\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{COOH}$	<u> Ⓒ </u>

27. Complete the Table

Structural Formula	IUPAC Name
$\text{CH}_3\text{-O-CH}_2\text{-CH}_3$	_____ (a) _____
_____ (b) _____	Ethoxyethane
$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-O-CH}_3$	_____ (c) _____
_____ (d) _____	Ethoxypropane
$\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$	_____ (e) _____

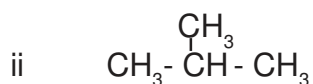
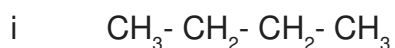
28. Complete the Table

Functional Group	Name of Functional Group
- OH	----- (a)
	----- (b)
- O - R	Alkoxy group

29. Write the structural formula of the compounds CH_4H_8 . Write down the structural formula of one of its isomers which is an alicyclic compound Isomerism.

Compounds having same molecular formula, but different chemical and physical properties are called Isomers. Phenomenon is called Isomers.

30. Examine the two hydrocarbons given below.



- Write the molecular formula of the compound
- Write the IUPAC name of the compound
- What is the difference between these two compounds?
- What is the phenomenon known as?

31. Given below are certain hints about a hydrocarbon.

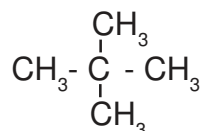
- The molecular formula of the compound is C_5H_{12}
- Has a methyl radical as branch

- a. Write the IUPAC name of the compound
- b. Write the structural formula of two possible Isomers of this compound and write their IUPAC names

32. Given below are certain hints about a organic compound

- The molecular formula of the compound is C_3H_8O
 - Has a hydroxyl (-OH) group
- a. Write the structural formula and IUPAC names of the position Isomers of this compound.

33. The Structural formula of a hydrocarbon is given below.

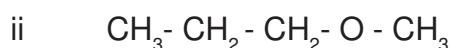
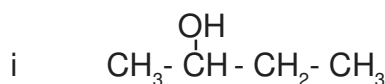


- a. Write the IUPAC name of the compound
- b. Write the structural formula of any one Isomers of the compound.
- c. What type of isomerism is shown by these compounds.

34. Given below are certain hints about an organic compound.

- Molecular formula is C_3H_8O
 - This organic compound is an ether
- Write the structural formula and IUPAC names of functional Isomers of this compound.

35. The Structural formula of two organic compound are given.



- a. Write the IUPAC name of these two compounds.
- b. Write one similarity and one difference between these two compounds.
- c. What is this phenomenon known as.

36. Complete the Table.

Structural Formula	Molecular Formula	Functional Group	Functional Isomer of given Compound
$\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{O} - \text{CH}_3$	<u> a </u>	<u> b </u>	<u> c </u>
$\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH}$	<u> d </u>	<u> e </u>	<u> f </u>

Cyclic or Ring Compound.

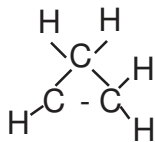
Cyclic and Ring Compounds are classified in to two.

- Alicyclic compounds
- Aromatic compounds

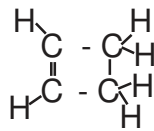
Alicyclic Hydrocarbon

Alicyclic Hydrocarbon are cyclic Hydrocarbon similar to alkane, alkene and alkyne.

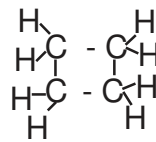
eg:



Cyclopropane



Cyclobutene

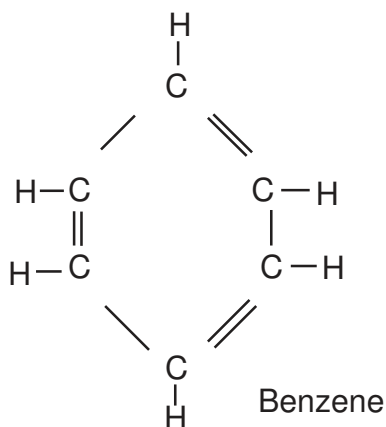


Cyclobutane

Aromatic Hydrocarbon

Aromatic compounds are having their own aroma.

eg:



Benzene

Answer Key

- 1.
- | Alkane | Alkene | Alkyne |
|----------|----------|----------|
| C_2H_6 | C_2H_4 | C_2H_2 |
| C_3H_8 | C_3H_6 | C_3H_4 |
2. a) C_4H_{10} , b) C_3H_6 c) C_3H_4 d) C_5H_{12}
3. a. $CH_3 - CH_2 - CH_2 - CH_2 - CH_3$
b. Pentane
4. a) Methane b) Ethane c) Propane d) Butane
e) Petane f) Hexane
5. a) 4 b) 2 c) Methyl d) 2-Methylbutane
6. a) 5 b) 2 c) Methyl d) 2-Methylpentane
7. a) 5 b) 3 c) Methyl d) 3-Methylpentane
8. a) 6 b) 3 c) Ethyl d) 3-Ethylhexane
- 9.
- a. $CH_3 - CH_2 - \underset{\substack{| \\ CH_3}}{CH} - CH_2 - CH_3$
- b. $CH_3 - \underset{\substack{| \\ CH_3}}{CH} - CH_2 - CH_3$
- c. $CH_3 - CH_2 - \underset{\substack{| \\ CH_2 \\ | \\ CH_3}}{CH} - CH_2 - CH_3$
- d. $CH_3 - CH_2 - \underset{\substack{| \\ CH_2 \\ | \\ CH_3}}{CH} - CH_2 - CH_2 - CH_3$
- 10.
- a. $CH_3 - \underset{\substack{| \\ CH_3}}{CH} - \underset{\substack{| \\ CH_3}}{CH} - CH_2 - CH_3$
- b. 2, 3-Dimethylpentane
11. a. 3, 4
b. 3, 4-Dimethylpentane

- 12 a) 3, b). 2, 2, c) Methyl, d) 2, 2-Dimethylpropane
13. a) 2-Methylpentane
 b) 2, 3-Dimethylpentane
 c) 2, 2-Dimethylbutane
 d) 3-Ethyl-2, 4 - Dimethylhexane
14. a) Alkene
 b) $\text{CH}_3\text{-CH}=\text{CH-CH}_2\text{-CH}_3$
 c) Hex-2-ene
15. a. $\text{CH}_3\text{-CH}=\text{CH-CH}_3$
 b. Pent-1-ene
 c. $\text{CH}_3\text{-CH}_2\text{-CH}=\text{CH-CH}_2\text{-CH}_3$
 c. $\text{CH}_3\text{-CH}=\text{CH-CH}_2\text{-CH}_3$
16. a. Hex-1-ene
 b. Hex-2-ene
17. a. Alkyne
 b. C_5H_8
 c. Pent-2-yne
18. a) Ethyl b) Prop-1-yne c. But-1-yne
 d) But-2-yne e) Hex-2-yne.
19. a) Alkyne b) $\text{CH}_3\text{-C}=\text{C-CH}_2\text{-CH}_3$, c) Pent-2-yne
20. a) 5 b) Pentane c) 2
 d) Methyl e) 2-Methylpentane f) 5
 g) pentane h) 3 i) Methyl
 j) 3-Methylpentane k) 6 l) Hexane
 m) 3 n) Ethyl o) Ethylhexane
- 21 Propan-1-ol
22. a. Hydroxyl
 b. Alcohol
 c. Butan-1-ol
23. a) Pentan-2-ol b) Propan-1-ol
 c) Butan-2-ol d) Pentan-1-ol
24. a. 1-Chloropropane b) 2-Chloropropane
 c. 2, 2-Dibromobutane d) 2, 3-Dichlorobutane
 e. 2, 3-Dichloropentane
25. a. $\text{CH}_3\text{-}\overset{\text{Br}}{\text{CH}}\text{-CH}_2\text{-CH}_2\text{-CH}_3$
 b. $\text{CH}_3\text{-}\underset{\text{Cl}}{\text{CH}}\text{-}\underset{\text{Cl}}{\text{CH}}\text{-CH}_3$

26. a. Ethanoic acid
 b. $\text{CH}_3 - \text{CH}_2 - \text{COOH}$
 c. Butanoic acid
27. a. Methoxyethane
 b. $\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_3$
 c. Methoxypropane
 d. $\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
 e. Ethoxybutane
28. a. Hydroxyl group
 b. Carboxylic group
 c. Alkoxy Group
29. a.
$$\begin{array}{c} \text{H} \quad \text{H} \\ | \quad | \\ \text{H}-\text{C} - \text{C}-\text{H} \\ | \quad | \\ \text{H}-\text{C} - \text{C}-\text{H} \\ | \quad | \\ \text{H} \quad \text{H} \end{array}$$
 Cychlobutane
30. a) C_4H_{10} b) i Butane ii) 2-Methylpropane
 c) Different Structural formulas d) Chain Isomerism
31. a.
$$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_3 \end{array}$$

 b. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$ Pentane
 c.
$$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
 2, 2-Dimethylpropane
32. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH}$ Propan-1-ol

$$\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_3 \\ | \\ \text{OH} \end{array}$$
 Propan-2-ol
33. a. 2, 2-Dimethylpropane
 b. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
 c. Chain Isomerism
34. a. $\text{CH}_3 - \text{O} - \text{CH}_2 - \text{CH}_3$ Methoxyethane
 b. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH} / \begin{array}{c} \text{OH} \\ | \\ \text{CH}_3 - \text{CH} - \text{CH}_3 \end{array}$
 Propan-1-ol / Propan-2-ol
35. a. i Butan-2-Ol ii) Methoxyepropane
 b. Same molecular formula, Different functional group
 c. Functional Isomerism.
36. a. $\text{C}_4\text{H}_{10}\text{O}$ b) Alkoxy c) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{OH}$
 d. $\text{C}_4\text{H}_8\text{O}$ e) Hydroxyl f) $\text{CH}_3 - \text{O} - \text{CH}_2 - \text{CH}_3$

UNIT-7

CHEMICAL REACTIONS OF ORGANIC COMPOUNDS

Substances like plastic, Medicines, Soap, Detergent, Fuels, Alcohol etc. are organic compounds used in our day to day life. These organic compounds are prepared by using different organic reactions. Let us familiarise some of the chemical reactions of organic chemistry in this unit.

Concepts

Different chemical reactions of organic compounds.

- Substitution reactions
- Addition reactions
- Polymerisation
- Combustion
- Thermal cracking

Some Important organic compounds

- Alcohols
 - Methanol
 - Ethanol
- Carboxylic acid
 - Ethanoic acid
- Esters
- Soap and Detergent

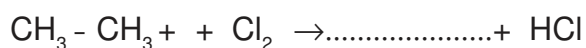
Substitution reactions

An atom or a group in a compound is replaced by another atom or group of atoms are called Substitution reactions.



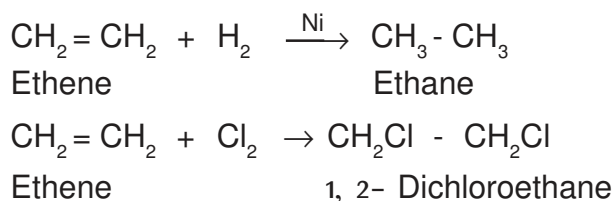
Activity 1

Fill in the blanks



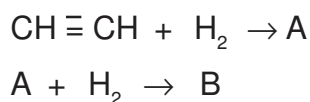
Addition reactions

Unsaturated organic compounds with double bond or tripple bond react with H_2 , Cl_2 , HCl , HBr etc. to form saturated hydrocarbons.



Activity 2

The following equations represent, the addition reaction of ethyne with hydrogen. Identify the products A, B in the equation.



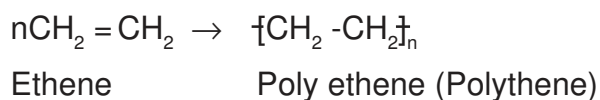
Activity 3

Write the products in the following addition reactions

Addition Reactions	Products
a) $CH_3 - CH = CH_2 + Cl_2$
b) $CH_3 - CH = CH - CH_3 + HCl$

Polymerisation

Large number of simple molecules combine together to form complex molecules.



Monomer	Polymer	Uses
Ethene	Polyethene	Carrybags
Vinyl Chloride	Polyvinyl Chloride (PVC)	Pipes
Tetrafluroethene	Polytetrafluroethene (Teflon)	Non-stic Vesels
Isoprene	Polyisoprene (Natural rubber)	Tyres, Tubes

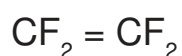
Activity -4

Simple molecules combine to form complex molecules are called polymerisation.

- Name the product obtained when Vinyl Chloride undergoes polymerisation.
- Write the chemical equation for this polymerisation reaction.

Activity -5

Write the structure of the polymer, when the following monomer undergoes polymerisation.



Combustion of Hydrocarbons

Hydrocarbons combine with oxygen to form CO_2 , H_2O and heat.



Methane

Hydrocarbons are used as fuels because of the exothermic nature of the combustion process.

Activity -6

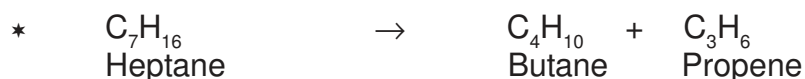
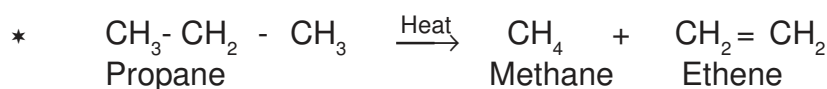
Write the balanced chemical equation for the combustion of butane (C_4H_{10}).

Thermal cracking

Some hydrocarbons with high molecular masses, when heated in the absence of air to form hydrocarbons with lower molecular masses.

❖ Factors that influence the products formed due to Thermal Cracking.

- Nature of the hydrocarbons
- Temperature
- Pressure.



Activity -7

Thermal cracking helps to control pollution. Explain with example.

Some Important Organic Compounds

● Alcohols

Function group is -OH

* Methanol (CH₃OH)

Industrial Preparation: Carbon monoxide treated with hydrogen in the presence of a catalyst at high temperature and pressure.

Uses :

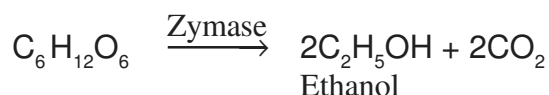
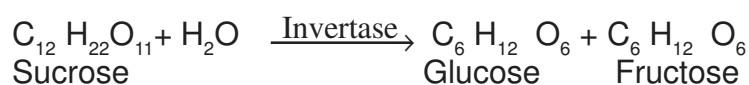
- Solvent in the manufacture of paint.
- manufacture of varnish and formalin

* Ethanol (CH₃-CH₂-OH)

Uses :

- Fuel
- Beverage
- Preservative
- Solvent for medicins.

Industrial Preparation : Fermenting diluted molasses by adding yeast.



Activity -10

Esters have the pleasant smell of fruits and flowers.

- Which are the reactants used for the preparation of propylethanoate ester?
- Write the chemical equation for this esterification reaction.

● Soap

- Fatty acids (palmitic acid, stearic acid, oleic acid) combines with glycerol to form oils and fats.
- Soap is the salt formed when oils and fats react with alkalies (Sodium hydroxide and Potassium hydroxide).

Activity -11

How does soap remove dirt?

● Detergent

- Detergents are salt of sulphonic acid.
- Detergents are made from hydrocarbons obtained from coal and petroleum.

Activity -12

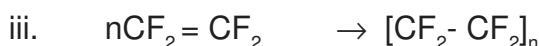
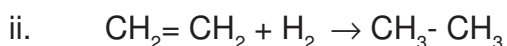
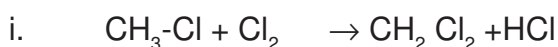
- Write the differences between soap and detergent.

Model Questions

- Match Suitably

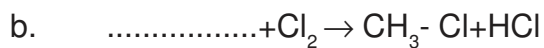
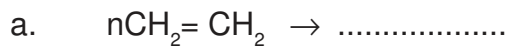
A reactants	B Products	C Name of the reaction
$\text{CH}_3\text{-CH}_2\text{-CH}_3$	$\text{CO}_2 + \text{H}_2\text{O}$	Substitution reaction
$\text{CH}_3\text{-CH=CH}_2 + \text{H}_2$	$\text{CH}_4 + \text{C}_2\text{H}_4$	Combustion
$\text{CH}_3\text{-CH}_2\text{-CH}_3 + \text{Cl}_2$	$\text{CH}_3\text{-CH}_2\text{-CH}_3$	Thermal cracking
$\text{CH}_3\text{-CH}_2\text{-CH}_3 + \text{O}_2$	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-Cl} + \text{HCl}$	Addition reaction

- Some reactions of hydrocarbons are given below

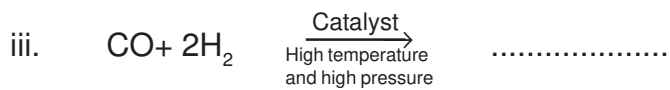
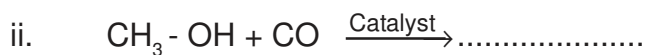
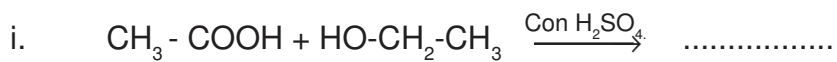


- Name the reaction when chloro methane is converted to dichloro methane.
- Identify the unsaturated compound in the (ii) reaction.
- Which polymer is used for coating on the inner surface of non-stick cookware?

3. Some reactions related to hydrocarbons are given below. Complete the equation.



4. Write the products formed in the following chemical reactions



5. Excessive use of the detergents cause environmental problems. Justify.

Answer Key

1. $\text{CH}_3\text{CH}_2\text{Cl}$
2. A. $\text{CH}_2=\text{CH}_2$ B) CH_3-CH_3 c. CH_3-CH_3
3. a. $\text{CH}_3-\text{CHCl}-\text{CH}_2\text{Cl}$
b. $\text{CH}_3-\text{CH}_2-\text{CHCl}-\text{CH}_3$
4. a. Polyvinyl Chloride
b. $n\text{CH}_2=\text{CHCl} \rightarrow \left\{ \text{CH}_2-\underset{\text{Cl}}{\text{CH}} \right\}_n$
5. $\left\{ \text{CF}_2-\text{CF}_2 \right\}_n$
6. $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$
7. Plastic wastes can be converted to simpler molecules by thermal cracking.
8. Wood Spirit
9. a) Invertase, Zymase
b) Fractional distillation
10. a) Propanol, Ethanoic acid
b) $\text{CH}_3\text{COOH} + \text{HO}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \rightarrow \text{CH}_3-\text{COOCH}_2-\text{CH}_2-\text{CH}_3 + \text{H}_2\text{O}$
11. Non polar end of soap dissolves in oils. Polar end dissolves in water. Soap decreases the surface tension of water. Soap Molecules acts as a link between water and dirt

12.	Soap	Detergent
	<ul style="list-style-type: none">● Salt of fattyacids● Not lather in hard water● Not causes environmental problems	<ul style="list-style-type: none">● Salt of sulphonic acid● Lather in hard water● causes environmental problems

Model Questions : Answer Key

1	Reactants	Products	Name of the reaction
	$\text{CH}_3 - \text{CH}_2 - \text{CH}_3$	$\text{CH}_4 + \text{C}_2\text{H}_4$	Thermal cracking
	$\text{CH}_3 - \text{CH} = \text{CH}_2 + \text{H}_2$	$\text{CH}_3 - \text{CH}_2 - \text{CH}_3$	Addition reaction
	$\text{CH}_3 - \text{CH}_2 - \text{CH}_3 + \text{Cl}_2$	$\text{CH}_3 - \text{CH}_2 - \text{CH}_2\text{-Cl} + \text{HCl}$	Substitution reaction
	$\text{CH}_3 - \text{CH}_2 - \text{CH}_3 + \text{O}_2$	$\text{CO}_2 + \text{H}_2\text{O}$	Combustion

2. a) Substitution reaction
 b) Ethene ($\text{CH}_2 = \text{CH}_2$)
 c. Teflon $\{ \text{CF}_2 - \text{CF}_2 \}_n$
3. a. $\{ \text{CH}_2 - \text{CH}_2 \}$
 b. CH_4
 c. 7O_2
4. i. $\text{CH}_3 - \text{COOCH}_2 - \text{CH}_3$
 ii. $\text{CH}_3 - \text{COOH}$
 iii. $\text{CH}_3 - \text{OH}$
5. Detergents increases the growth of algae. It decreases the quantity of oxygen for the breath of organisms in water and causes their destruction.

MODEL QUESTION PAPER

CHEMISTRY

Time: 1.30 hours

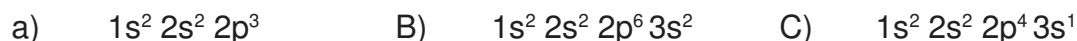
Total score : 40 Marks

Instructions

- * First 15 minutes is cool off time
- * Read all questions carefully
- * questions with scores 1,2,3 & 4 are categorised separately
- * Five questions are given in each category. Answer any 4 questions from each category.
- * Answer each questions by keeping time.

Answer any four questions from 1 to 5. 1 score each (4x1=4)

1. Find the wrong electronic configurations from the following and correct them



2. Find the number of water molecules in 18 g of water.

3. The method used to separate magnetic impurities from tinstore.....

4. Which of the following is an oxidation reaction?



5. PVC is a polymer used the preparation of pipes. What is the name of its monomer?

Answer any four questions from 6 to 10 2 score each (4x2=8)

6. Names of some alloy steels are given in the box.

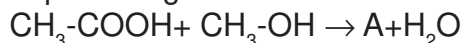
Alnico	Stainless Steel	Nichrom
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7. Find the number of mole atoms in the following samples and arrange them in the increasing order of number of atoms.

(hint : atomic mass : H = 1, Ca = 40)



8. See the question given

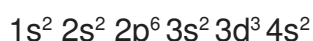


- a) Write the formula of A and complete the equation
b) To which category of compounds does A belong?

9. The structure of a compound is $\text{CH}_3\text{-CH=CH}_2\text{-CH}_3$

- a) To which category of hydrocarbon does this compounds belong?
(Alkane, Alkene, Alkyne)
- b) Give the IUPAC name of the compound

10. The subshell electrone configuration of an element is



- a) What is the atomic number of this elements?
- b) To which group do this element belong?

Answer any four questions from 11 to 15 3 score each

(4x3=12)

11. Metals Mg, Zn, Fe and Cu of same size are taken in foru test tubes. Same amount of dil: HCl is added to them.

- a) Which metal reacts vigorously with dilute acid?
- b) Which gas is formed by the reaction of metals with dil : HCl acid?
- c) Which of these metals can displace Zn from $ZnSO_4$ solution?

12. Complete the table. (Hint : atomic mass : He = 4, N = 14, O = 16)

Substance	Molecular mass	Amount taken (g)	Volume L	Number
N_2	28	(a)	22.4	(b)
Cl_2	71	(c)	(d)	$10 \times 6.00 \times 10^{23}$
O_2	(e)	160	(f)	$5 \times 6.022 \times 10^{23}$

13. a) Write examples for a pair of position isomers from the following compounds.

- $CH_3-O-CH_2-CH_3$
- CH_3-O-CH_3
- $CH_3-CH_2-CH_2-OH$
- $CH_3-\underset{\substack{| \\ OH}}{CH}-CH_3$

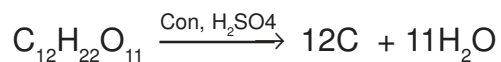
- b) Write the IUPAC name of the compound 4.
- c) Select a functional isomer of this compound from the give.

14. Some metals and solution are given in the box

$MgSO_4$ solution	$AgNO_3$ solution	$CuSO_4$ solution
KCl solution	Pb rod	Mg rod Cu rod

- a) Select from the box the materials needed to construct a galvanic cell.
- b) Which is the anode of the cell constructed?
- c) Write the equation of the reaction taking place at the cathod of the cell.

15. A few drops of Conc. H_2SO_4 are added to a little sugar crystals taken in a watch glass
- What will be the observation?
 - Analyse the equation and explain the reason



- Which property of sulphuric acid is exhibited here?

Answer any four questions from 16 to 20 4 score each

(4x3=16)

16. The electrolysis of molten NaCl is done in an electrolytic cell.
- Write the product obtained at the cathode?
 - Write the chemical equation of the reaction taking place at the cathode.
 - If an aqueous solution of NaCl is electrolysed instead of molten NaCl, what products will be obtained at the anode and cathode?
17. Match Suitably

	Reactants	Products	Name of the Reaction
1.	$\text{CH}_3\text{-CH}_3\text{-Cl}_2$	$\text{CH}_3\text{=CH}_2\text{+CH}_4$	Addition Reaction
2.	$2\text{CH}_3\text{-CH}_3\text{+7O}_2$	$\text{CH}_3\text{-CH}_3$	Substitution Reaction
3.	$\text{CH}_2\text{=CH}_2\text{+H}_2$	$4\text{CO}_2\text{+ 6H}_2\text{O}$	Thermal cracking
4.	$\text{CH}_3\text{-CH}_2\text{-CH}_3$	$\text{CH}_3\text{-CH}_2\text{-Cl+HCl}$	Combustion

18. A glass rod dipped in con HCl is shown in a gas jar filled with ammonia.
- Write the observation
 - Sulphuric acid is not used to dry the ammonia gas. Why?
 - A system at equilibrium is given.

$$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{heat}$$
19. The main chain of hydrocarbon is given
 C - C - C - C
- Complete the structural formula.
 - Write the IUPAC name of this compound.
 - Write the IUPAC name of the compound obtained by adding a -COOH group in the first carbon atom of this compound.
20. Analyse the given subshell electronic configuration and answer the question
- A- $1s^2 2s^2 2p^6$
 B- $1s^2 2s^2 2p^6 3s^2 3p^4$
 C- $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$
 D- $1s^2 2s^2 2p^6 3s^2$
- Which among these elements shows -2 oxidation number?
 - Which is the element that does not take part in chemical reaction?
 - Which element shows different oxidation states?
 - Which among the given elements shows the lowest ionisation energy?