CHAPTER # 1

FUNDAMENTAL OF CHEMISTRY

Q1)Define Chemistry. Name different branches of chemistry

CHEMISTRY

Chemistry is the branch of science which deals with the properties, composition and structure of matter. Chemistry also deals with the changes involved in the matter

Q2)Define different branches of chemistry

PHYSICAL CHEMISTRY

Physical chemistry is the branch of chemistry which deals with relationship between composition and physical properties of matter with the changes in them.

ORGANIC CHEMISTRY

Organic chemistry is the branch of chemistry which deals with hydrocarbons and their derivatives. Organic chemistry is the study of structure, properties, which include hydrocarbons except oxides, carbonates, bicarbonates and cyanides.

INORGANIC CHEMISTRY

Inorganic chemistry is the branch of Chemistry which deals with the study of all elements and their compound except hydrocarbons. These compounds are generally obtained from nonliving organisms.

BIOCHEMISTRY

Biochemistry is the branch of Chemistry which deals with the compounds of living organisms. Plants and animals and their metabolism and synthesis in the living body such as carbohydrates, proteins and fats.

NUCLEAR CHEMISTRY

Nuclear chemistry is the branch of chemistry which deals with the radioactivity, nuclear processes and properties. Radioactive elements are widely used in medicine as diagnostic tools.

ENVIRONMENTAL CHEMISTRY

It is the branch of Chemistry which deals with the study of the interaction of chemical materials and their effect on the environment of animals and plants. Personal hygiene, pollution, health hazards are the important areas of environmental chemistry.

ANALYTICAL CHEMISTRY

Analytical chemistry is the branch of chemistry which deals with separation and analysis of kind, quality and quantity of various components in given substance, It used in chromatography, electrophoresis and spectroscopy.

MEDICINAL CHEMISTRY

The branch of Chemistry which deals with synthetic organic chemistry, pharmacology and various biological specialties. The medicinal chemistry is used in synthesis of chemicals, bioactive molecules (Drugs) and pharmaceutical agents.

QUANTUM CHEMISTRY

The branch of Chemistry which deals with application, mechanics and experiments of physical models in chemical system. It is also called molecular quantum mechanics.

GREEN CHEMISTRY

The branch of chemistry which deals with study of processes and designing products, which are composed of less hazardous substances. It is also known as sustainable chemistry.

Q3)Give importance of chemistry in daily life.

IMPORTANCE OF CHEMISTRY IN DAILY LIFE

1. Cooking, eating and digestion of food are purely chemical processes. Construction, cleaning and washing of our homes are dependable on chemistry.
2. The production of fertilizers, glass, plastic synthetic fiber, polymer, ceramics, petroleum products, soaps, and detergents are based on chemistry.
3. The diseases transmitted through impure drinking water as cholera, typhoid, dysentery, skin and eye infections can be controlled with the help of chlorine treatment to kill the pathogenic organism to obtain pure water.
4. The chlorine is most important chemical which used commercially to produce more than one thousand compounds which are used in chemical industry.

Q4)Give one contribution of Following Scientists

1) **Jabir ibne Haiyan:** Invented experimental methods of nitric acid, hydrochloric acid and white lead.
2) **Al Razi:** Prepared ethyl alcohol by fermentation process.
3) **Al Beruni:** Determined densities of different substances.
4) **Ibne-Sina:** Contributed in medicines, philosophy and astronomy.
5) **J.Black:** Study of carbon dioxide
6) **J.Priesly:** Discovered oxygen, Sulphur dioxide and hydrogen chloride.

7) **Cavendish:** Discovered hydrogen

8) **Lavoisier:** Discovered that oxygen is one fifth of air

9) **Mendeleve:** Discovered periodic arrangement of elements.

10) **Neil bohr:** Proposed a theory for the hydrogen atom based on quantum theory

11) **Rutherford:** Postulated the nuclear structure of the atom.

12) **Elbert Einstein:** Proposed fourth state of matter

Q5)Define matter. What is atom?

MATTER Matter is any substance that has mass and takes up space by having volume.

ATOM An atom is the smallest unit of ordinary matter that forms a chemical element.

Q6)What is molecule. Give examples of mono, di, tri atomic elements

MOLECULE

A molecule is the smallest particle in a chemical element or Compound that has the chemical properties of that element or Compound.

MONO ATOMIC	Helium (He)	Argon (Ar)	Krypton (Kr)
DI ATOMIC	Nitrogen(N_2)	Oxygen(O_2)	Iodine(I_2)
POLYATOMIC	Ozone (O_3)	Sulphur(S_8)	Phosphorus(P_4)

Q7)Define substance with example

SUBSTANCE:

A substance is a matter that has definite properties and composition. Every pure compound and element are a substance.

EXAMPLE:

Baking soda (sodium bicarbonate) Table salt (sodium chloride) Pure sugar (sucrose)

Q8)What is an element. List 10 elements with their symbol and name

ELEMENT

An element is a pure substance consisting only of atoms that all have the same numbers of protons in their atomic nuclei.

Hydrogen (H)	Lithium (Li)	Carbon (C)	Oxygen (O)
Magnesium (Mg)	Sulphur (S)	Calcium (Ca)	Sodium (Na)
Chlorine (Cl)	Nitrogen (N)		

Q9)What is valence? Also give valance of some elements

VALENCE:

The Combining power of an element with other element is called valency. Valency is the number of electrons an atom/element can gain, lose or share.

Hydrogen	H	+1, –1
Lithium	Li	+1
Oxygen	O	–2
Chlorine	Cl	–1
Aragon	Ar	0

Q10) What is a chemical formula? Also give example of it0

CHEMICAL FORMULA

The chemical formula represents the symbol of elements and ratios of elements to one another in a compound. Chemical formula tells us number of atoms of each element in a compound with symbols

FOR EXAMPLE:

- Chemical formula of water is H_2O which indicates that 2 atoms of hydrogen combine with 1 atom of oxygen.
- Chemical formula of ammonia NH_3 shows that one nitrogen atom combines with 3 atoms of hydrogen.

Q11) What is compound. Give six examples of compound

COMPOUND

The Compound is a substance formed when two or more elements are chemically bonded together in a fixed ratio by mass, As a result a new entirely different properties possessing substance formed.

EXAMPLE

Water (H_2O) Silicon dioxide (SiO_2) Sugar ($C_{12}H_{22}O_{11}$)

Ammonia (NH_3) Sulphruic Acid (H_2SO_4)

Q12) Differentiate between elements and compound

Elements	Compound
Element is a substance made up of same atoms, and discovered naturally	Compound is formed by a chemical combination of atoms of the elements.

Element shows unique properties due to similarity of atoms.	Constituent of compound lose their identity and form a new substance with new properties.
Element cannot decompose in to simple substances by ordinary means	Components cannot be separated by physical means.
Element represented by symbols	Every compound represented by chemical formula.

Q13) Differentiate between mixture and compound

Mixture	Compound
Mixture formed by the simple mixing of the substances.	Compound is formed by a chemical combination of atoms of the elements.
Constituents of mixture retain their properties in mixture.	Constituent of compound lose their identity and form a new substance with new properties.
The components can be separated by physical means.	Components cannot be separated by physical means.
It consists of two or more components and does not show any chemical formula	Every compound represented by chemical formula.

Q14) Differentiate between empirical formula and molecular formula

Empirical Formula	Empirical Formula
The formula showing minimum relative numbers of each type of atoms in a molecule is called Empirical Formula	The Molecular formula is the formula which shows actual number of atoms of each element present in a molecule
Empirical Formula shows simplest ratio of each atoms present in a molecule.	Molecular formula of a compound may be same or multiple of empirical formula
Empirical Formula does not show the actual number of atoms in the molecule	Molecular Formula show the actual number of atoms in the molecule
E.F of benzene CH E.F of benzene CH_2O	M.F of benzene C_6H_6 M.F of benzene $C_6H_{12}O_6$

Q15) Define atomic number and atomic mass

ATOMIC NUMBER

The Atomic Number is number of protons present in the nucleus of atom of any Element.it represented by symbol Z.

FOR EXAMPLE

All oxygen atoms have 8 number of protons due to this atomic number is 8 (Z= 8).

ATOMIC MASS

The Atomic Mass is sum of number of protons and neutrons present in the nucleus of atom of any element.it represented by symbol A and calculated by A=Z + n where n is number of neutrons.

FOR EXAMPLE

Nitrogen atom have 7 number of protons and 7 number of electrons then Atomic mass of nitrogen is 14(A=7+7=14).

Q16) What is an ion? Also define cation, anion, molecular ion and free radical

ION Ion is an atom or group of atoms having a change on it. The change may be positive or negative.

CATION The cations are formed when an atom loses electrons form its outer most shell.

FOR EXAMPLE: Na^+, K^+ are cations

ANION An atom or group of atom that has a negative charge on it is called anion.

FOR EXAMPLE: O^{-2}, Cl^- are anions

MOLECULAR ION when a molecule loses or gains electrons called molecular ions. Molecular ions also possess positive or negative charge like any ion.

FOR EXAMPLE CH_4^+

FREE RADICAL Free radicals are atoms and group of atoms having number of unpaired electrons. It is represented by putting a dot over the symbol of an element.

FOR EXAMPLE: H^o, Cl^o ,H_3C^o

Q17) Differentiate between molecules and molecular ion

Molecules	Molecular Ion
Molecule is the smallest particle in a chemical element or compound that has chemical properties of that element or compound	Molecular ion formed by gain and lose of electrons by a molecule.

Molecule is always neutral.	Molecular ion have positive or negative charge
Molecule is formed by the combination of atoms	Molecular ion formed by the ionization of a molecule
Molecule is stable unit	Molecular ion is reactive species.

Q18) Give some examples of

1) **MONO ATOMIC MOLECULE:** Molecule consist of one atom.

   E.g. helium (He), neon(Ne), argon(Ar)

2) **DI ATOMIC MOLECULE:** Molecule consist of two atoms.

   E.g. Hydrogen (H_2) Oxygen (O_2), Chlorine (Cl_2)

3) **TRI ATOMIC MOLECULE** Molecule consist of three atoms.

   E.g. H_2O, CO_2

4) **POLY ATOMIC MOLECULE:** Molecule consist of many atoms.

   E.g. CH_4, H_2SO_4, $C_6H_{12}O_6$

5) **HOMO ATOMIC MOLECULE:** Molecule consist of same type of atoms

   E.g. H_2, O_3, P_4, S_8

6) **METRO ATOMIC MOLECULE:** Molecule consist of different type of atoms

   E.g. NH_3, H_2O, CO_2

NUMERICALS

Q1. Complete the table

Elements	Name of elements	Atomic Number	Mass Number
H			
Mg			
Ca			
B			
C			
N			
O			
Li			
F			
Al			
P			
S			
Cl			
Cu			
Na			
Ag			
I			
Pt			
Hg			
Au			
K			
Be			

ELECTRON, PROTON AND NEUTRON

$^{\text{Mass Number}}_{\text{Atomic Number}}Z^{\text{Gain/Loss of Electron}}$

Q2. How many Proton, Neutrons and Electron are present in the following atoms?

1. $^{23}_{11}Na$
2. $^{16}_{8}O$
3. $^{12}_{6}C$
4. $^{1}_{1}H$
5. $^{131}_{53}I$
6. $^{16}_{8}O^{-2}$
7. $^{23}_{11}Na$
8. $^{39}_{19}K$
9. $^{19}_{9}F^{-1}$
10. $^{23}_{11}Na^{+1}$
11. $^{32}_{16}S^{-2}$
12. $^{14}_{7}N^{-3}$

MOLECULAR MASS

Q. Calculate the molar mass of the following.

Example:

$Ca(HCO_3)_2$

Solution

Molecular mass of $Ca(HCO_3)_2$ =40 x 1+ 2(1 x 1+12 x 1+16 x 3)

Molecular mass of $Ca(HCO_3)_2$ =40 + 2(1 + 12 + 48)

Molecular mass of $Ca(HCO_3)_2$ =40 + 2(61)

Molecular mass of $Ca(HCO_3)_2$ = 40 + 122

Molecular mass of $Ca(HCO_3)_2$ = 162 a.m.u **Ans**.

1. KOH **Ans. 56 a.m.u**
2. CH_3COOH **Ans. 60 a.m.u**
3. $C_6H_{12}O_6$ **Ans. 180 a.m.u**
4. H_2SO_4 **Ans. 98 a.m.u**
5. H_2SO_7 **Ans. 146 a.m.u**
6. $Al(OH)_3$ **Ans. 78 a.m.u**
7. $Mg(OH)_2$ **Ans. 58 a.m.u**
8. Al_2O_3 **Ans. 73 a.m.u**
9. $MgCl_2$ **Ans. 95 a.m.u**
10. NaCl **Ans. 58.5 a.m.u**
11. KNO_3 **Ans. 101 a.m.u**

BALANCE THE CHEMICAL EQUATION

Q. Balance the following chemical reaction.

1. $Al + O_2 \rightarrow Al_2O_2$
2. $P + Cl_2 \rightarrow PCl_5$
3. $KClO_3 \rightarrow KCl + O_2$
4. $Mg + CO_2 \rightarrow MgO + C$
5. $H_2S + O_2 \rightarrow H_2O + S$
6. $NH_3 + Cl_2 \rightarrow N_2 + HCl$
7. $Cl_2 + H_2O \rightarrow HCl + O_2$
8. $H_2S + O_2 \rightarrow H_2O + SO_2$
9. $FeS + O_2 \rightarrow Fe_2O_3 + SO_2$
10. $Fe + O_2 \rightarrow Fe_3O_4$
11. $CaO + HCl \rightarrow CaCl_2 + H_2O$
12. $CaC_2 + H_2O \rightarrow C_2H_2 + Ca(OH)_2$
13. $NH_3 + O_2 \rightarrow NO + H_2O$
14. $KNO_3 \rightarrow KNO_2 + O_2$
15. $Ca + H_2O \rightarrow Ca(OH)_2 + H_2$
16. $NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

NUMBER OF MOLES

1. 20 gram of Be **Ans. 2.222 mole**
2. 15 gram of Ne **Ans. 0.75 mole**
3. 25 gram of K **Ans. 0.641 mole**
4. 130 gram of HNO_3 **Ans. 2.063 mole**
5. 50 gram of $C_6H_{12}O_6$ **Ans. 0.278 mole**
6. 35 gram of $CaSO_4$ **Ans. 0.257 mole**

MASS OF SUBSTANCE

Q. Calculate the mass of following.

1. 2 moles of Mg **Ans. 48 gm**
2. 3.5 moles of Al **Ans. 94.5 gm**
3. 0.5 moles of Ca **Ans. 20 gm**
4. 7.5 moles of N **Ans. 105 gm**
5. 1.75 moles of S **Ans. 56 gm**
6. 0.36 mole of $MgSO_4$ **Ans. 43.2 gm**
7. 2.23 moles of HCl **Ans. 81.395 gm**
8. 1.25 moles of KOH **Ans. 70 gm**

NUMBER OF ATOMS

Q. Calculate the number of atoms in following:

1. 1 gram of He **Ans. 2.007×10^{23} atoms**

2. 3 gram of Al **Ans. 0.669×10^{23} atoms**

3. 5 gram of Ca **Ans. 0.753×10^{23} atoms**

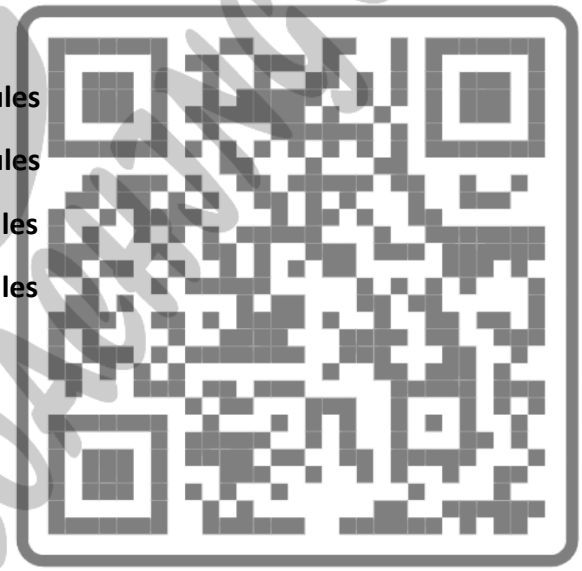
4. 1.75 gram of S **Ans. 0.329×10^{23} atoms**

NUMBER OF MOLECULES

Q. Calculate the number of molecules in following:

1. 4 gram of CO_2 **Ans. 0.547×10^{23} molecules**

2. 3 gram of SO_3 **Ans. 0.225×10^{23} molecules**
3. 4.5 gram of H_2SO_4 **Ans. 0.277×10^{23} molecules**
4. 3 gram of HNO_3 **Ans. 0.287×10^{23} molecules**



MULTIPLE CHOICE QUESTIONS

1. The branch of Chemistry which deals with hydrocarbons:

(a) Industrial chemistry (b) Inorganic chemistry

(c) Organic chemistry (d) Physical chemistry

2. The atomic mass of an element expressed in gram is:

(a) Gram molecular mass (b) Gram atomic mass

(c) Gram formula mass (d) Mole

3. Which of the following can be separated by physical means?

(a) Mixture (b) Element

(c) Compound (d) Substance

4 The molar mass of H2SO4is:

(a) 98 a.m.u (b) 9.8gm (c) 98gm (d) 9.8 a.m.u

5. The Molecule consist of two atoms is:

(a) Monoatomic molecule (b) Polyatomic molecule

(c) Hetero atomic molecule (d) Di atomic molecule

6. A formula that indicates actual number and type of atoms in a molecule is called:

(a) Chemical formula (b) Empirical formula

(c) Molecular formula (d) Formula mass

7. Ethyl alcohol was prepared by:

(a) Ibne-Sina (b) Al-Razi (c) Al-Beruni (d) Jaber bin-Hayan

8. which of the following is Not a homo atomic:

(a) H_2 (b) NH_3 (c) H_2O (d) CO_2

9. The Empirical formula of hydrogen peroxide is:

(a) H_2O_2 (b) HO (c) OH (d) O_2H_2

10. A piece of matter in pure form is termed as:

(a) Radical (b) Mixture (c) Compound (d) Substance

Chapter # 2

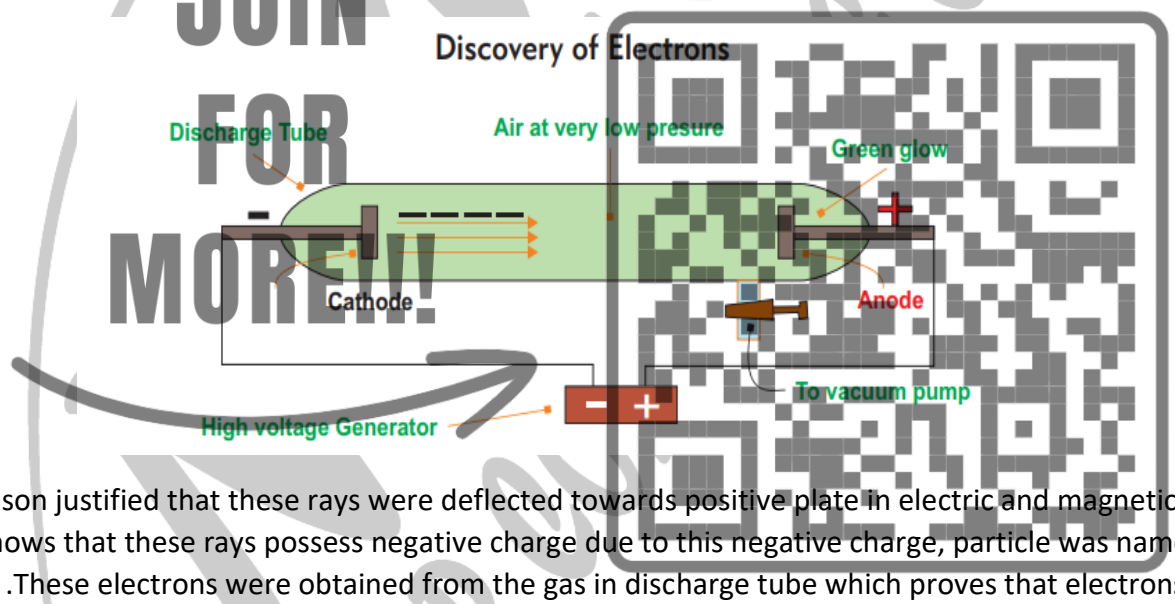
ATOMIC STRUCTURE

Q1)How are cathode rays produced?

DISCOVERY OF ELECTRONS

Electron is the lightest particle carrying negative charge in an atom discovered by J.J. Thomson and William crooks.

The apparatus used for this type of experiment is called discharge tube which consists of glass tube fitted with two metal electrodes connected to a high voltage source and a vacuum pump. When electrodes inside evacuated, discharge tube are connected with high voltage source at very low pressure (1mm of Hg), as the high voltage current start passing between electrodes a streak of bluish light originate and travel in straight line from cathode (-ve electrode) to anode (+ve electrode), Which cause glow at the wall of opposite end. These rays ere called cathode rays.



J.J.Thomson justified that these rays were deflected towards positive plate in electric and magnetic field which shows that these rays possess negative charge due to this negative charge, particle was named Electron .These electrons were obtained from the gas in discharge tube which proves that electrons are constituent of all matter.

Q2)Give the Properties of Cathode Rays.

PROPERTIES OF CATHODE RAYS

1. They travel in straight line from cathode towards Anode.
2. They produce sharp shadow of an opaque object placed in their path.
3. They have negative charge and bend towards positive plate in electric and magnetic field.
4. These rays when strike with glass and other material cause material glow.
5. The (e/m) charge and mass ratio of cathode particles is 1.7588x108coulomb per gram. This is same for all electrons, regardless of any gas in discharge tube.

6. They can produce mechanical pressure indicating they possess kinetic energy (K.E).

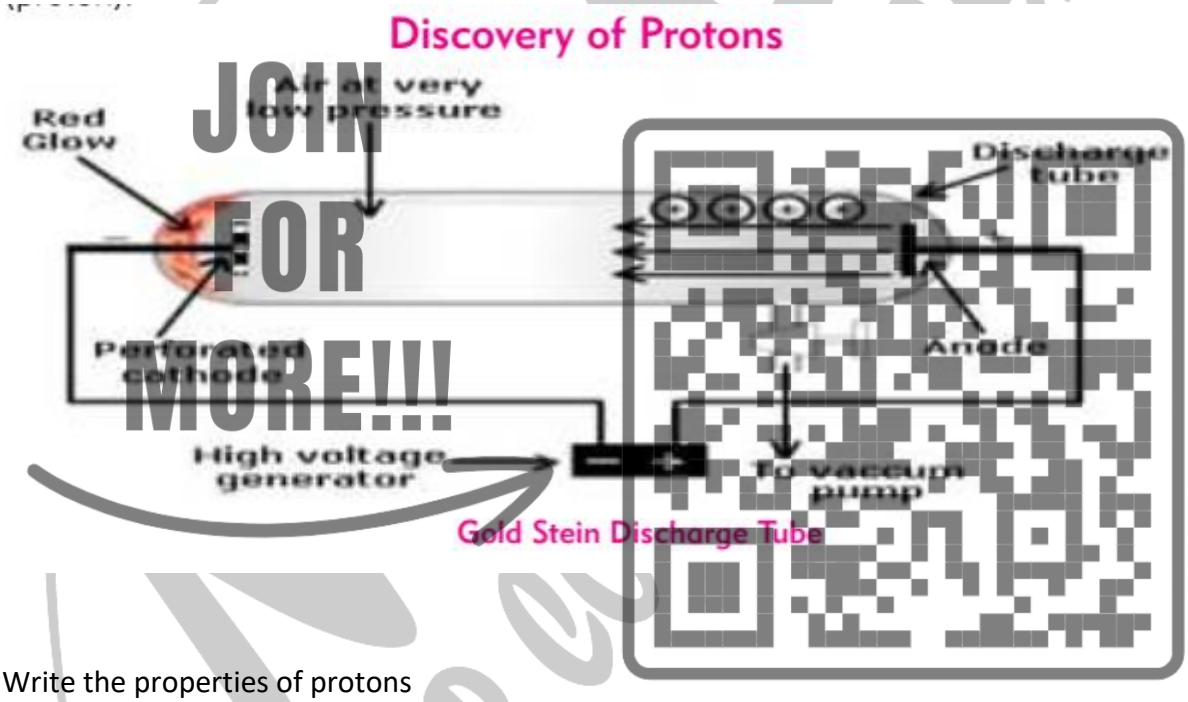
Q3)Discus the discovery of protons

DISCOVERY OF PROTONS

The Proton is positively charge particle discovered by Goldstein in 1886.J.J.Thomson investigate properties of proton in 1897.

Protons were observed in same apparatus of cathode rays tube but with perforated cathode. Goldstein discovered that not only negatively charge cathode rays but positively charge rays are moving in opposite direction by perforating cathode. These positive rays passes through the holes of cathode, where they strike cause the glow of tube. These rays named as Canal rays (proton).

Remember that canal rays are not emitted by anode, but they are result of striking of electron with residual gas molecules in discharge tube.



Q4)Write the properties of protons

PROPERTIES OF CANAL RAYS (PROTONS)

1. They travel in straight line from Anode towards Cathode.

2. They produce sharp shadow of object placed in their path.

3. They have positive charge and bend towards negative plate in electric and magnetic field.

4. The (e/m) charge and mass ratio of positive particles is much smaller than electron. It varies according to nature of gas present in tube.

5. The mass of proton is 1836 times more than electron.

Q5)Discus the discovery of neutron

DISCOVERY OF NEUTRON

In 1920 Rutherford predict that atom must possess another neutral particle with

equivalent mass of proton. Different scientists started working on this neutral particle. later on 1932 Chadwick become successful to discover Neutron. Chadwick found that when alpha (μ)particles bombarded on Beryllium some penetrating radiations were given out. Chadwick suggested that these radiations were due to material particle with mass comparable to hydrogen atom but have no charge. These radiations (particle) are called Neutron.

The neutron is fundamental part of an Atom, present in nucleus with proton and include in atomic mass.

Q6)Write the properties of neutrons

PROPERTIES OF NEUTRONS

1. The Neutrons are neutral particles.
2. They have no charge.
3. The mass of neutron is almost equal to that of proton.
4. These particles are most penetrating in matter.

Q7)Define atomic number (Z), mass number (A)

ATOMIC NUMBER (Z)

The number of protons in the nucleus of an atom is called Atomic Number.

MASS NUMBER (A)

The total sum of proton and neutrons in the nucleus of an atom is called Mass Number.

Q8)Discuss Rutherford gold metal foil experiment in the light of structure of atom.

RUTHERFORD ATOMIC MODEL

Lord Rutherford in 1911, carried out a series of experiment and proposed a new model for the atom.

EXPERIMENT

Rutherford took a thin sheet of gold and bombarded it with alpha (μ) particles obtained from a radioactive element (Like Polonium). These rays scattered from the atom and examined on a zinc sulphide (ZnS) screen.

OBSERVATIONS

1. Most of the particles passed straight and un deflected through the sheet and produced illumination on the zinc sulphide screen.
2. Very few alpha (μ) particles undergo small and strong deflection after passing through gold sheet.
3. A very few alpha (α) particles (one of 8000) retraced their path.

CONCLUSION

1. According to Rutherford an atom consist of two parts nucleus and extra nuclear part.

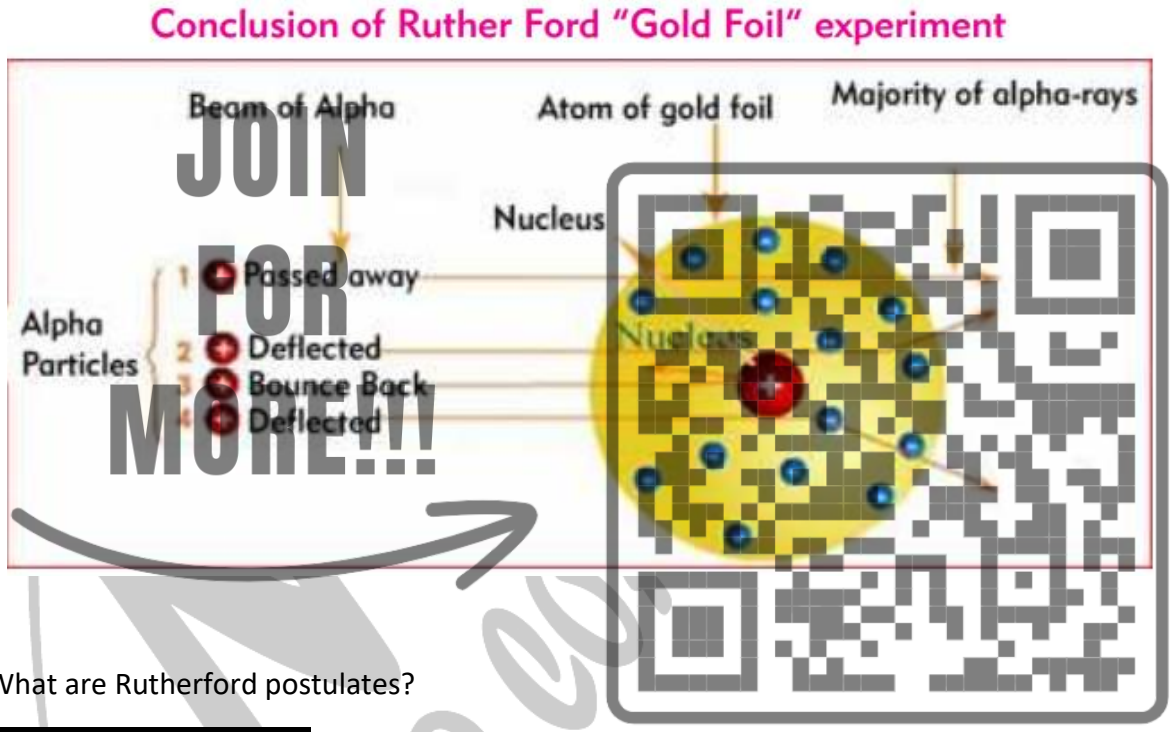
2. Majority of the alpha particles passed straight line and un-deflected, shows that most volume occupied by atom is empty.

3. Alpha particles are positively charged and their deflection indicates that the

spelling of atom has a positive charge, which is named as nucleus.

4. The mass is concentrated in the nucleus and the electrons are distributed outside the positively charge nucleus.

5. The electrons are revolving around the nucleus in extra nuclear part in orbits.



Q9)What are Rutherford postulates?

RUTHERFORD POSTULATES

1. An atom consist of positively charged, dense and very small nucleus containing
2. protons and neutron. The entire mass is concentrated in the nucleus of an atom.
3. The nucleus is surrounded by large empty space which is called extra nuclear part where probability of finding electron is maximum.
4. The electrons are revolving around the nucleus in circular paths with high speed (Velocity).
5. These circular paths were known as orbits (Shells).
6. An atom is electrically neutral because it has equal number of protons and
7. electrons.
8. The size of the nucleus is very small as compared to the size of its original atom.

Q10) Justify that Rutherford atomic model has defects.

DEFECTS OF RUTHERFORD ATOMIC MODEL

1. Rutherford did not explain the stability of an atom.

2. In Rutherford atomic model the negatively charged electrons revolve around the nucleus in circular path and emits energy continuously. Due to continuous loss of energy ultimately falls into the nucleus.

3. If the revolving electron continuous emits energy, then there would be a continuous spectrum but in contrast to it we get line spectrum from the atoms of elements.

Q11) Explain how Bohr's atomic model is different from Rutherford atomic model.

NEIL BOHR POSTULATE

Neil Bohr proposed the following postulates for atomic structure.

1. The atom has fixed orbits in which negatively charged electron is revolving around the positively charged nucleus.

2. These orbits possess certain amount of energy which are called shells and named as K, L, M, N shells.

3. The energy levels are represented by an integer (n= 1, 2, 3….) known as quantum number, this quantum range starts from nucleus side, where n=1 is lowest energy level.

4. Electrons are revolving in particular orbits continuously, but they are not emits or absorb energy.

5. When electron jumps from lower energy level (E1) to higher energy level (E2), it absorbs energy.

6. When electrons jump from higher energy level (E2) to lower energy level (E1), it emits energy.

7. The emission or absorption is discontinuous in the form of energy packet called Quantum or Photon.

8. The ΔE difference in energy of higher (E_1) and lower (E_2) energy level.

$$\Delta E = E_2 - E_1$$

$$\Delta E = \upsilon h = 1 \text{ photon}$$

Here h is planks constant, its value is 6.63×10^{-34} Js and u is a frequency of light.

9. Stationary state were present in those orbits in which angular moment of electron would be integral multiple of $\frac{h}{2\pi}$

$$mvr = \frac{nh}{2\pi}$$

Where,

n = no of orbits

h=planks constant

m= mass of electron

Q12) What are Limitations of Bohr's Atomic Model?

LIMITATIONS OF BOHR'S ATOMIC MODEL

Bohr's model of an atom failed to explain the Zeeman Effect (effect of magnetic field on the spectra of atoms).

It also failed to explain the Stark effect (effect of electric field on the spectra of atoms).

It deviates the Heisenberg Uncertainty Principle.

It could not explain the spectra obtained from larger atoms.

It explains the mono electronic species like H^{+1}, Li^{+2}, B^{+3}.

Q13) Prove that modern theory of De Broglie is related with Einstein and Plank's equations.

MODERN THEORY OF DE BROGLIE

In 1923 Lois De Broglie extend the wave particle duality to electron, and propose a hypothesis that all matter has particle as well as wave nature at the submicroscopic level. De Broglie combine the Einstein and Planck equations and argued that if

$E=hg$

where E = energy, h = plank 'constant, g= frequency of light

and $E = mc^2$

where E = energy, m = mass, c = speed of light

Then

$h\gamma = mc^2$ OR $\gamma = mc^2/h$

$\lambda = h/m\gamma$

Q14) Describe the Schrodinger atomic model.

SCHRODINGER ATOMIC MODEL

Schrodinger model is just an improvement of Bohr's atomic model. He took an atom of hydrogen because it has one proton and one electron. He proved mathematically that electron can be find in different position around the nucleus and determined by probability.

The quantum mechanical model determines that electron can be find in various

location around the nucleus. He found electrons are in orbit as an electron cloud.

Each energy subshell in an orbit have different shapes which determine the presence of electron.

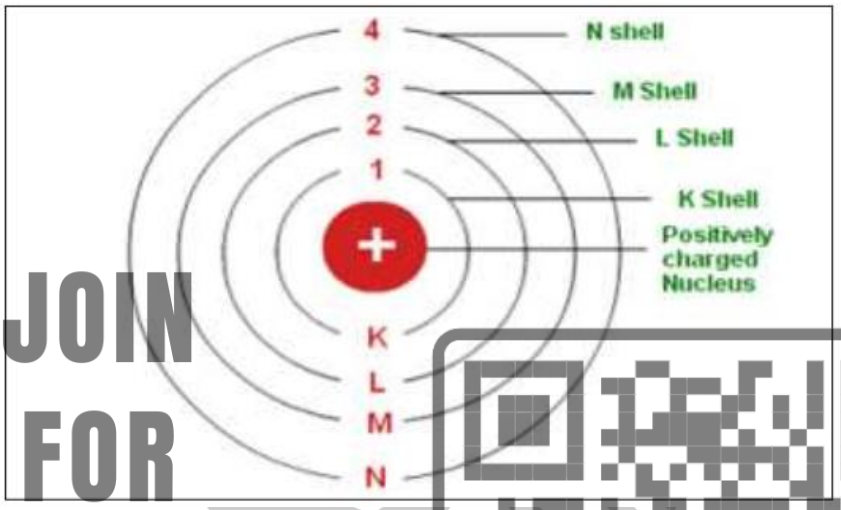
Different subshells of orbitals are orbitals named as s, p, d and f with different shapes as 's' is spherical and 'p' is dumbbell shaped.

The numbers and kind of atomic orbitals depends on the energy subshell.

Q15) What is shell? Explain the concept of shell (K, L, M, N and O)

CONCEPT OF SHELL (K, L, M, N,O & P)

The Energy levels or Shell or Orbit are all possible paths on which electrons are revolving around nucleus. Which shows by'n'. these shells are named as K, L, M, N, O, P with quantum numbers n= 1, 2, 3, 4, 5, 6 respectively. These shells have definite amount of energy by means of decreasing shown order as they become away from nucleus.



- First energy level is K shell has less energy.
- Second energy level is L shell has more energy than K shell.
- Third energy level is M shell has more energy than K and L shells.
- Fourth energy level is N shell has more energy than K, L and M shells.
- Fifth energy level is O shell has more energy than K, L, M and N shells.

Q16) Describe wave particle duality of electron of De Broglie Hypothesis

DE BROGLIE HYPOTHESIS

According to De-Broglie a light, or any other electromagnetic wave, can also exhibit the properties of a particle, similarly a particle should also exhibit the properties of a wave, and those two natures are interchangeable.

Q17) Define Electronic Configuration. Give maximum electronic configuration of shell and sub shell.

ELECTRONIC CONFIGURATION

The distribution of electrons among the different orbits/shells and subshells according to some rules is known as the electronic configuration of an atom

The maximum number of electrons that can be accommodated in a shell is represented by the formula $2n^2$, where 'n' is the shell number. The distribution of electrons in different orbits are as follows:

K-shell/ 1st orbit (n=1) = $2(1)^2 = 2$

L-shell/ 2nd orbit (n=2) = $2(2)^2 = 8$

M-shell/ 3rd orbit (n=3) = $2(3)^2 = 18$

N-shell/4th orbit (n=4) = $2(4)^2 = 32$ and so on

They are slight difference in Energy levels of subshells, that way subshell's' filled first then subshell 'p' and onward. The distribution of maximum electrons in subshells is as follows.

2 electrons in's' subshell

6 electrons in 'p' subshell

10 electrons in 'd' subshell

14 electrons in 'f' subshell

Q18) What is isotopes? Discus the isotopes of Hydrogen

ISOTOPES

Atoms of the same elements having same atomic number but different Mass number are called isotopes.

ISOTOPES OF HYDROGEN

There are three isotopes of Hydrogen. These are known as Protium, deuterium and tritium.

PROTIUM $^{1}H_{1}$

- Its atomic number is 1
- Its mass number is 1
- It has one proton in the nucleus
- It has no neutron in the nucleus
- It has one electron in its shell

DEUTERIUM $^{2}H_{1}$

- Its atomic number is 1
- Its mass number is 2
- It has one proton in the nucleus
- It has one neutron in the nucleus
- It has one electron in its shell

TRITIUM $^{3}H_{1}$

- Its atomic number is 3
- Its mass number is 1
- It has one proton in the nucleus
- It has two neutron in the nucleus
- It has one electron in its shell

Q19) Discus the isotopes of Uranium

ISOTOPES OF URANIUM

There are three common isotopes of uranium with atomic number 92 and mass number 234,235 and 238

Q20) Discus the isotopes of chlorine

ISOTOPES OF CHLORINE

There are two isotopes of Chlorine with atomic number 17 and mass number 35 and 37.

Chlorine 35 is 75% and chlorine 37 is 25% abundant in nature.

Q21) Discus the isotopes of carbon

ISOTOPES OF CARBON

There are two stable isotopes and one radioactive isotope of carbon.

- The carbon 12 contain 6 protons and 6 neutrons
- Carbon 13 possess 6 protons and 7 neutrons
- Carbon 14 contain 6 protons and 8 neutrons.
- Carbon 12 is the most abundant (98.89%) isotope.

Q22) Writ down the applications of isotopes in daily life.

NAME OF RADIOACTIVE ISOTOPES

PHOSPHOROUS-32 OR STRONTIUM -90 Treatment of skin cancer

COBALT 60 Treatment of body cancer due to more penetrating power.

LODINE ISOTOPES Detestations of thyroid glands in the neck.

TECHNETIUM To monitor the bone growth in fracture healing.

GAMMA RAY OF COBALT-60 To sterilization of medical instruments and dressings from harmful bacteria.

AMERICIUM-241 Used in back scatter gauges, smoke detectors fill height detectors and measuring ash content of coal.

GOLD-198 AND TECHNETIUM-99 Tracing factory waste causing ocean pollution. Tracing sand movement in rivers and Oceans.

URANIUM-235 Conversion of water energy from steam to generate electricity.

PLUTONITUM-238 Used to stimulate a regular heart beat in heart pose maker.

CARBON-14 Used to estimate the age of fossils.

QUESTION # 1

An atom has 5 electrons in M shell than:

(a) Find out its atomic number?

(b) Write Electronic configuration of atom?

(c) Name the element of atom?

QUESTION # 2

An atom has 2 electrons in M shell than:

(a) Find out its atomic number?

(b) Write Electronic configuration of atom?

(c) Name the element of atom?

QUESTION # 3

An atom has 3 electrons in L shell than:

(a) Find out its atomic number?

(b) Write Electronic configuration of atom?

(c) Name the element of atom?

QUESTION # 4

An atom has 2 electrons in K shell than:

(a) Find out its atomic number?

(b) Write Electronic configuration of atom?

(c) Name the element of atom?

QUESTION # 5

How the atoms of $O^{17}{}_8$ and $O^{18}{}_8$ are similar or different from each other?

QUESTION # 6

How the atoms of $Cl^{35}{}_{17}$ and $Cl^{37}{}_{17}$ are similar or different from each other?

QUESTION # 7

Write down the names of sub atomic particles their masses in a.m.u and gm with their unit charges.

QUESTION # 8

How many protons, neutrons and electrons are present in the following elements?

1. $^{56}Fe_{26}$
2. $^{235}U_{92}$
3. $^{23}Na_{11}$
4. $^{17}O_8$
5. $^{14}C_6$
6. $^{1}H_1$
7. $^{131}I_{53}$
8. $^{16}O_8{}^{-2}$
9. $^{23}Na_{11}{}^{+1}$
10. $^{39}K_{19}$
11. $^{19}F^{-1}{}_9$
12. $^{14}N^{-3}{}_7$

MULTIPLE CHOICE QUESTIONS

1. In an atom number of protons and neutrons are added to obtain:

(a) number of electrons (b) number of nucleons

(c) atomic number of element (d) number of isotopes

2. If proton number is 19, electron configuration will be:

(a) 2, 8, 9 (b) 2, 8, 8, 1 (c) 2, 8, 1 (d) 2, 8, 3

3. If nucleon number of potassium is 39, number of neutrons will be:

(a) 39 (b) 19 (c) 20 (d) 29

4. The isotope C-12 is present in abundance of:

(a) 96.9% (b) 97.6% (c) 98.8% (d) 99.7%

5. Electronic configuration is distribution of:

(a) proton (b) neutron (c) electron (d) positron

6. Which one of the following is most penetrating?

(a) electron (b) Proton (c) alpha particle (d) neutron

7. How many subshells in a L shell:

(a) one (b) two (c) three (d) four

8. De Broglie extend the wave particle duality to electron in:

(a) 1920 (b) 1922 (c) 1923 (d) 1925

9. Name the material of screen which used in Rutherford atomic model :

(a) Aluminum foil (b) zinc sulphide (c) sodium sulphide (d) Aluminum sulphide

10. Which rays are used for sterilization of medical instruments :

(a) α-rays (b) β-rays (c) x-rays (d) γ-rays

Chapter # 3

PERIODIC TABLE AND

PERIODICITY OF PROPERTIES

Q1) State Dobereiner's triad with two examples.

DOBEREINER'S TRIAD

Dobereiner's arranged the element in increasing order of atomic masses. He found that the atomic mass of the middle element was approximately equal to the arithmetic mean (average) of the atomic masses of the other two elements of that triad when they are arranged in their increasing order of atomic mass,

EXAMPLE

Lithium	7	$\frac{7+39}{2} = 23$	Calcium	40	$\frac{40+137}{2} = 88$
Sodium	23		Strontium	87	
Potassium	39		Barium	137	

Q2) State Newland law of octaves with example.

NEWLAND LAW OF OCTAVES

In 1864 British chemist Newland put forward Law of Octaves in order of increasing atomic masses.

STATEMENT

According to him eighth element has similar properties as first element in group of eight elements.

FOR EXAMPLE:

Li=7	Be=94	B=11	C=12	N=14	0=16	F=19
Na=23	Mg 24	Al=27.3	Si=28	P=32	C=35.5	

In the above arrangement Li and Na, Be and Mg, B and Al, C and Si, N and P, O and S, F and Cl shows same chemical properties.

Q3) State Mendeleev periodic law.

MENDELEEV PERIODIC LAW.

In 1869 Mendeleev published eight vertical columns(groups) and horizontal rows(periods)on the basis of physical and chemical properties of elements. In 1869 German scientist Luther Meyer published a periodic table in which 56 elements were arranged in 9 vertical columns or groups on the basis of atomic masses.

STATEMENT

He state that

"Physical and chemical properties are the periodic function of the atomic masses or atomic weight"

Q4) When and by whom modern periodic able was proposed. Also state the law.

MODERN PERIODIC LAW

In 1913 Moseley discovered that Atomic number is the basic property of an atom. He proposed a modern periodic law.

STATEMENT The Moseley states that

"The Physical and chemical properties of elements are the periodic function of their atomic numbers"

Q5) Define Periods in Periodic Table. Also discuss the period in modern periodic table.

PERIODS IN PERIODIC TABLE:

There are seven horizontal lines in periodic table known as periods. In periods physical and chemical properties changes from left to right.

FIRST PERIOD (SHORTEST PERIOD)

- This period contains only two elements Hydrogen (H) and Helium (He).
- K-shell is filled in this period.

SECOND AND THIRD PERIOD(SHORT PERIOD)

- Each period contains eight elements.
- In these Periods L and M shells are being filled by electrons.
- Second period contains Li, Be, B, C, N, O,F and Ne.
- Third period contains Na, Mg, Al, Si, P,S, Cl, and Ar.

FOURTH AND FIFTH PERIOD(LONG PERIOD)

- Each period contain 18 elements.
- In these periods M and N shells are being filled by electrons.
- Fourth period starts from Potassium (K) and ends on Krypton (Kr).
- Fifth period starts from Rubidium (Rb) and ends on Xenon (Xe).

SIXTH PERIOD(LONGEST PERIOD)

- This period contains 32 elements.
- The 14 elements in the bottom are named as Lanthanides.
- Sixth period starts from Cesium (Cs) and ends with Radon (Rn).

SEVENTH PERIOD (INCOMPLETE PERIOD)

- This period starts from Francium (Fr)
- This period is considering as incomplete.
- This period contains a group of 14 elements known as Actinides

Q6) Define Groups in Periodic Table. Give properties of each group of modern periodic table

GROUPS IN PERIODIC TABLE:

- There are Eight vertical columns in periodic table known as groups.
- The sub groups are divided on the basis of their similar properties as A and B and placed together in periodic table.
- The elements of sub group A are called Main or Representative Elements.
- The elements of sub group B are called Transition Elements.
- The group number indicate total number of electrons in valence shell of the element.

GROUP I A (ALKALI METAL) OR LITHIUM FAMILY:

- This Group include Lithium (Li), Sodium (Na), Potassium (K), Rubidium (Rb), Cesium (Cs) and Francium (Fr).
- Their Valence shell contain one electron.
- On reaction they lose one electron and form univalent positive ion.
- They are highly reactive metals.
- They have low melting point.

GROUP II ALKALINE EARTH METALS OR BERYLLIUM FAMILY:

- This Group include Beryllium (Be), Magnesium (Mg), Calcium (Ca), Strontium (Sr), Barium (Ba) and Radium (Ra)
- Their Valence shell contain two electrons.
- On reaction they lose two electrons and form divalent positive ion.
- They show irregular Densities, Melting and Boiling point.

GROUP ILL A(BORON FAMILY):

- This Group include Boron (B), Aluminum (Al) Boron (B) Gallium (Ga), Indium (In) And Thallium (Ti).
- Their valence shell contains three electrons.
- On reaction they lose three electrons and form trivalent positive ion except Boron.

GROUP IV A(CARBON FAMILY)

- This Group include carbon (C),silicon (Si), Germanium (Ge), Tin (Sn) and Lead (Pb).
- Their valence shell contains four electrons.
- C, Si and Ge form covalent bond, whereas Sn and Pb exhibit variable Valence 2 and 4.

- Carbon is nonmetal, Silicon, Germanium are metalloids and Tin and Lead are metals.

GROUP V A(NITROGEN FAMILY) :

- This Group include Nitrogen (N), Phosphorus (P), Arsenic (As), Antimony (Sb) and Bismuth (Bi).
- Their valence shell contains five electrons.
- They show large variations in their properties as we go down the group.
- Except Nitrogen all exist in allotropic form.

GROUP VI A(OXYGEN FAMILY)

- This Group include Oxygen(O),Sulphur (S),Selenium (Se), Tellurium (Te) and Polonium (Po).
- Their valance shell contains six elements.
- All of these elements exist in allotropic forms.
- Oxygen and sulphur are nonmetals, polonium is metal and all other are metalloids.

GROUP VII A(HALOGEN FAMILY):

- This Group include Fluorine (F), Chlorine (CI), Bromine (Br), Iodine (I) and Astatine (At).
- Their valence shell contains seven electrons.
- Except arsenic(metal) all are nonmetals,
- Fluorine and chlorine are gases, bromine is liquid and iodine is solid at room temperature.

GROUP VILLA(INERT OR NOBEL GASES):

- This Group include Helium(He), Neon(Ne), Argon[Ar), Krypton (Kr) Xenon(Xe) and Radon(Rn).
- Their valence shell contain eight electrons except Helium which contain two electrons.

GROUP 1B TO VILL B(TRANSITION ELEMENTS):

- These Groups are metals.
- In chemical reactions they show Variable valences.
- Their valence shells are incomplete.

Q7) Distinguish between periods and groups

Period	Group
Horizontal agreement in periodic table is known as period	Vertical agreement in periodic table is known as group
There are seven horizontal columns in periodic table known as periods	There are Eight vertical columns in periodic table known as groups
In periods physical and chemical properties changes from left to right	In periods physical and chemical properties changes from top to bottom

Period number indicate the number of shells in an element	Group number indicate the valance shell electronic configuration

Q8) Discuss in detail the long form of periodic table.

LONG FORM OF PERIODIC TABLE

The periodic table has been divided into four blocks s, p, d, and f based on electronic configuration.

NOBEL GASES:

- They are colorless, unreactive and diamagnetic,
- They are placed in zero group.
- Their electronic configuration is ns^2, np^6 and are exceptionally stable.

REPRESENTATIVE ELEMENTS

- Elements of s block and d block are known as representative elements.
- It includes metals and nonmetals. Some are diamagnetic and some are paramagnetic and marked as S block and P block elements.

(A) S-BLOCK ELEMENTS:

- In s block elements electrons occupy in ns orbital.
- The elements of group I A and II A are s block elements.
- Their electronic configuration varies ns^1 to ns^2

(B) P-BLOCK ELEMENTS:

- In p block elements electrons begin to fill np^1 to np^6
- Elements of group III A to VII A and zero group are p block elements.

(C) D-BLOCK ELEMENT (OUTER TRANSITION ELEMENTS):

- The Elements exhibit common oxidation state.
- In these elements electron fills in (n-1)d-orbital.
- Elements of B sub groups are d-block elements
- They exhibit electronic configuration ns^2, $(n-1)\ d^1$ to ns^2, $(n-1)\ d^{10}$

(D) F-BLOCK ELEMENTS (INNER TRANSITION ELEMENTS):

- The elements in which inner f-orbital filled, are called f block elements.
- They exhibit electronic configuration: ns^2, $(n-1)\ d^{10}$, $(n-2)\ \mathbf{f^1}$ to ns^2, $(n-1)\ d^{10}$, $(n-2)\ f^{\mathbf{14}}$.
- There are two series called Lanthanides and Actinides
- Elements of Group III B are considered to be f-block elements.

Q9) Define Atomic Radius. How it increases and decrease. Also give example

ATOMIC RADIUS

The distance between the centers of two bonded atoms of any elements. Half of this distance is considered to be the radius of the atom. It is measured in Angstrom unit (A^o)

EXAMPLE Atomic radii decrease in period

2nd Periods elements	Li	Be	B	C	N	O	F	Ne
Atomic radii (pm)	152	113	88	77	75	73	71	694

ATOMIC RADII INCREASES IN GROUP

1st group elements	**Atomic radii (pm)**
^{3}Li	152
^{11}Na	186
^{19}K	227
^{37}Rb	248
^{55}Cs	265

Q10) Define Ionization energy. How it increases and decrease. Also give example

IONIZATION ENERGY

The ionization energy is amount or energy required to remove an electron from a gaseous state and measured n joule mole.

The ionization energy depends upon atomic size and nuclear charge The higher ionization energy means removal of electron is more difficult.

EXAMPLE

IONIZATION ENERGY INCREASES IN PERIOD

Elements of 2^{nd} periods	^{3}Li	^{4}Be	^{5}B	^{6}C	^{7}N	^{8}O	^{9}F	^{10}Ne
i.E in Kj/mol	520	899	801	1086	1402	1314	1681	2081

IONIZATION ENERGY DECREASES IN GROUP

1ST GROUP ELEMENTS	**ATOMIC RADII (PM)**
^{3}Li	520
^{11}Na	496
^{19}K	416
^{37}Rb	403
^{55}Cs	377

Q11) Define electron affinity. How it increases and decrease. Also give example

ELECTRON AFFINITY

The electron affinity is amount of energy released when an electron is added in the outermost shell of a gaseous atom. It is also calculated in K J/mol.

EXAMPLE

ELECTRON AFFINITY INCREASES IN PERIOD

Elements of 2nd periods	^{3}Li	^{4}Be	^{5}B	^{6}C	^{7}N	^{8}O	^{9}F	^{10}Ne
E.A (kJ/mol)	60	241	29	123	0	141	322	-29

ELECTRON AFFINITY DECREASES IN GROUPS

Elements of 17th group	**Electron Affinity(KJ/mol)**
F	-328
Cl	-349
Br	-325
I	-295

Q12) Define shielding effect. How it increases and decrease. Also give example

SHIELDING EFFECT:

"Electrons present in the inner shells Shield the force of attraction of nucleus felt by the valence shell electrons is called Shielding effect."

The Shielding effect increases down the group in periodic table and remain same in period from left to right.

EXAMPLE

Shielding effect in potassium atom is more than sodium atom.

Q13) Define electronegativity. How it increases and decrease. Also give example

ELECTRONEGATIVITY:

The ability of an atom to attract the shared pair of electrons towards itself in a molecule is called electronegativity. The trend of electronegativity is same as ionization energy and electron affinity.

Electronegativity Increases in periods

EXAMPLE

ELECTRONEGATIVITY INCREASES IN PERIOD

Elements of 2nd periods	^{3}Li	^{4}Be	^{5}B	^{6}C	^{7}N	^{8}O	^{9}F
Electronegativity	1.0	1.6	2.0	2.6	3.0	3.4	4.0

ELECTRONEGATIVITY DECREASES IN GROUP

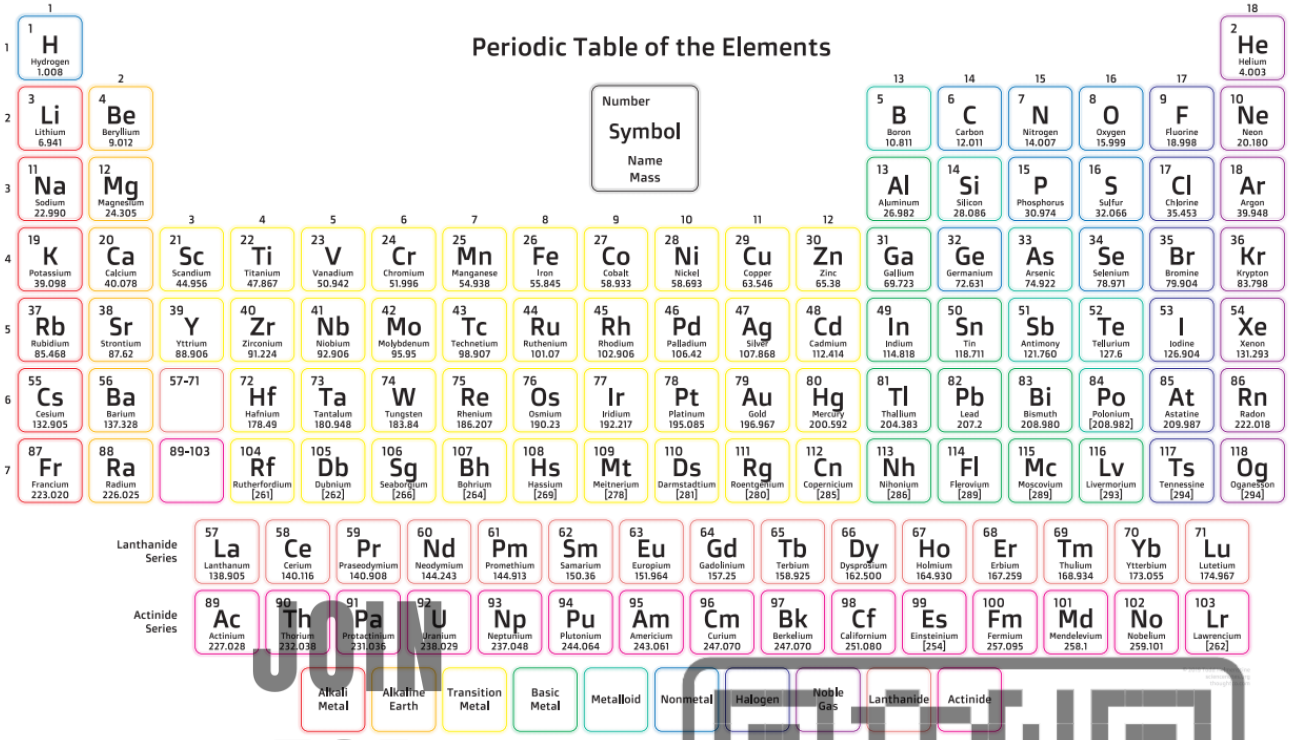
Elements of 17th group	Electronegativity
F	4.0
Cl	3.2
Br	3.0
I	2.7

Q1. Give valence shell Electronic of:

I-A	
II-A	
III-A	
IV-A	
V-A	
VI-A	
VII-A	
VIII-A	
Nobel gas	
s-block	
p-block	
d-block	
F-block	

Q2. Identify the electronic configuration of the following elements.

1. Na
2. Ca
3. F
4. H
5. C
6. O
7. Cl
8. Mg



a. Identify and list down the solid, liquid and gases at room temperature from the given periodic table.

b. Identify and name the artificial elements from the periodic table gives above.

c. Identify and list down the radioactive elements.

d. Identify alkali, alkaline, transition metals.

e. Identify and list down metalloids, lanthanide and actinide.

MULTIPLE CHOICE QUESTIONS

Tick Mark the correct answer

1. In 1869 Mendeleev put forward his periodic law about:

(a) Atomic Number (b). Chemical properties (c) Physical properties (d). Atomic Mass

2. The periodic table divided into S, P, d, and f block based on.

(a) Atomic Radius (b). Electronic Configuration

(c) Ionization Energy (d). Electron Affinity

3. 4th and 5th period in periodic table are known as:

(a) Short period (b). Long period (c) Normal period (d). Very long period

4. Which one of the following decreases along the period?

(a) Ionization Energy (b). Atomic Radius (c) Electronegativity (d). Electron Affinity

5. The elements of VIIA group are known as:

(a) Lanthanides (b). Actinides (c) Halogens (d). Nobel Gases

6. According to Mosely the chemical properties of elements are the periodic function of their :

(a) Atomic Size (b). Atomic Mass (c) Atomic Radius (d). Atomic Number

7. The shielding effect across the period.

(a) Increases (b). Decrease (c) Moderate (d). Same

8. The ability to attract shared pair of electrons is called:

(a) Electron Affinity (b). Electronegativity (c) Ionization Energy (d) Shielding Effect

9. In group electron affinity values decreases from top to bottom because:

(a) Atomic size normal (b) Atomic size increases (c) Atomic size decreases (d) Atomic size same

10. All Transition Elements are:

(a) Gases (b) Metals (c) Nonmetals (d) Metalloids

Chapter # 4

CHEMICAL BONDING

Q1)What are valence electrons? What is meant by octet and duplet rule?

VALENCE ELECTRON

Electrons present in the outermost shell of any atom play an important role in determining the chemical properties of the atom, including its ability to form chemical bonds. These electrons in the outermost shell of an atom are called as valence electrons or outer electrons.

DUPLET

Atoms to acquire two electrons in the valence shell is called duplet rule,

OCTET

Atoms to acquire eight electrons in the valence shell is called octet rule,

Q2)Define Chemical bond. Name the types of chemical bond.

CHEMICAL BOND

Chemical bonding is the combining of atoms to form new substances. An interaction that holds two atoms together is called a chemical bond. Atoms can lose, gain or share valence electrons to form chemical bonds.

TYPES OF CHEMICAL BOND

There are three types of bonds depending on the tendency of an atom to lose or gain or share electrons.

1. Ionic Bond
2. Covalent Bond
3. Co-ordinate covalent bond or dative covalent

Q3)What do you know about cation and anion.

CATION

An atom loses electrons and changes into positive ion is known as cation

ANION

An atom gains this electron and changes into negative ion is known as anion

Q4)Define Ionic bonds. Explain if with two examples.

IONIC BOND

The force of attraction that holds the oppositely charged ions together are called as ionic bond or electrovalent bond.

EXAMPLE # 1

The Reaction between Sodium and Chlorine Sodium atom is a metal of IA group of the periodic table and has only one electron in the outer most shell. The electron arrangement of sodium atom is 2, 8, 1. By losing one electron from the outer most shell, sodium forms cation (Na+). Whereas chlorine atom is non-metal of VIIA group and has seven electrons in its outermost shell. The electron arrangement of chlorine atom is 2, 8, 7. Since chlorine atom has seven electrons in its outermost shell, it needs one electron to complete octet. By gaining one electron, chlorine atom now has eight electrons in its outermost shell and a chloride ion is formed (Cl-).

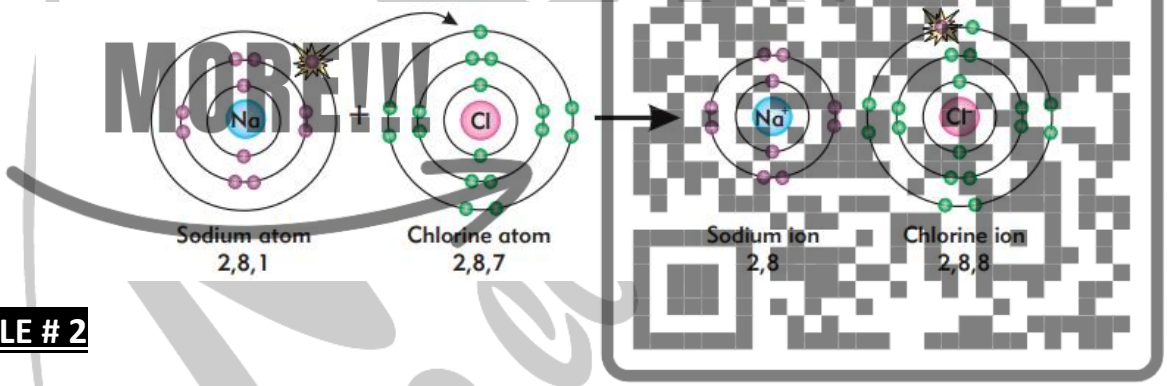
$$Na \rightarrow Na^{+} + e^{-}$$

2, 8, 1 2, 8

$$Cl + e^{-} \rightarrow Cl^{-}$$

2, 8, 7 2, 8, 8

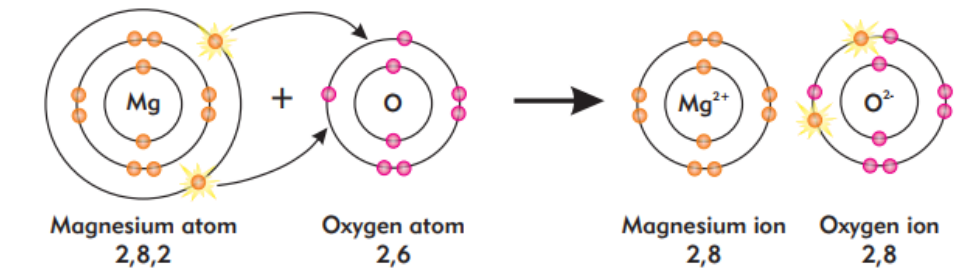
Both these atoms are now oppositely charged ions. Therefore, two charged ions are attracted to each other by electrostatic force of attraction. Thus Na+ and Cl- ions are joint by ionic bond and form sodium chloride. The formation of ionic bonds by a 'dot and cross' diagram is shown.



EXAMPLE # 2

The Reaction between Magnesium and Oxygen

Consider another example of ionic bond formation is the reaction between magnesium and oxygen forming magnesium oxide. Magnesium is in group-IIof the periodic table and has only two electrons to share and oxygen is in group VIA and has six electrons in its outermost shell. By losing two electrons from the outermost shell, magnesium becomes Mg2+ and it is left with 8 electrons in the second shell. By gaining two electrons, oxygen atom now also has eight electrons in its outermost shell and becomes O^{2-}. Both these atoms are now changed into oppositely charged ions. The attraction between the oppositely charged ions forms the ionic bond between magnesium and oxygen. The formula of magnesium oxide is MgO. The formation of ionic bonds by a 'dot and cross diagram is shown.



Q5)Define Covalent bond. Discuss the types of covalent bond with Example

COVALENT BOND

In this type of bond, electrons are not gained or lost by atoms. A covalent bond is formed by mutual sharing of electrons between two atoms. This type of bonding occurs between two atoms of the same element or atoms of different elements.

TYPES OF COVALENT BOND

Depending upon the number of bond pair, a covalent bond is further

classified into three types.

- Single Covalent Bond
- Double Covalent Bond
- Triple Covalent Bond

SINGLE COVALENT BOND

A covalent bond which is formed by the mutual sharing of one bond pair is called a single covalent bond and it is represented by a single short straight line (–).

EXAMPLE:

Hydrogen H_2 Hydrochloric acid HCl Methane CH_4

DOUBLE COVALENT BOND

A covalent bond which is formed by the mutual sharing of two bond pairs called a double covalent bond and it is represented by two short straight lines(=).

EXAMPLE:

Oxygen O_2 Ethene C_2H_4

TRIPLE COVALENT BOND

A covalent bond which is formed by the mutual sharing of three bond pairs is called a triple covalent bond and it is represented by three short straight line(≡).

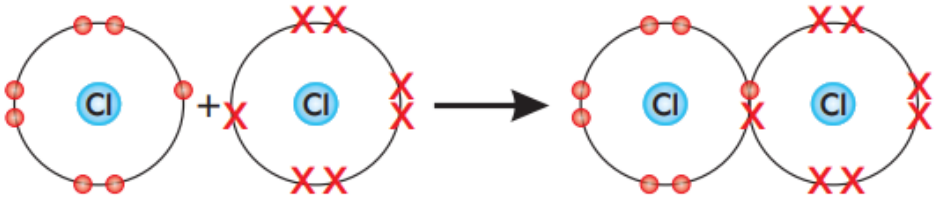
EXAMPLE,

Nitrogen (N_2) Ethyne (C_2H_2).

Q6)Describe the formation of single covalent bond. With a suitable example

FORMATION OF CHLORINE MOLECULE

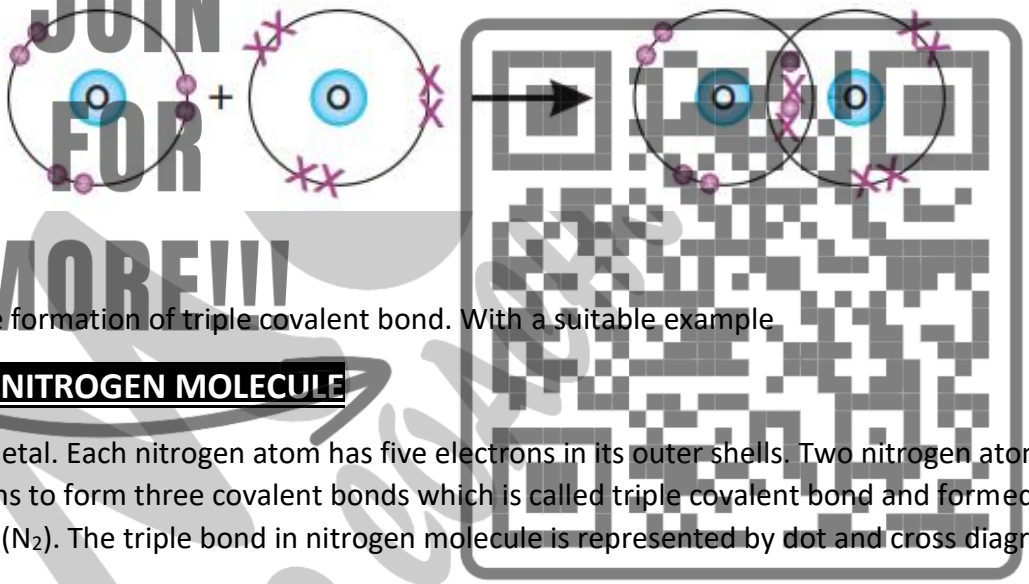
A chlorine atom belongs to group VIIA and it has seven outer electrons. It needs one more electron to achieve a stable octet electronic configuration. When two chlorine atoms share their valence electrons, both atoms achieve the electronic configuration of noble gas. The single bond in chlorine molecule is represented by a dot and cross diagram as shown



Q7)Describe the formation of double covalent bond. With a suitable example

FORMATION OF OXYGEN MOLECULE

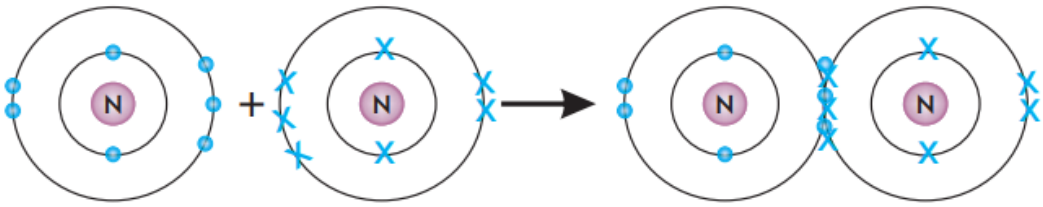
Oxygen atom belongs to group VIA of the periodic table and it has 6 valence electrons in its outer shell. It needs two more electrons to achieve a stable octet electronic configuration. Each oxygen atom will share two of its outer electrons with another oxygen atom to form an oxygen molecule (O_2). Thus, two pair of electrons are shared between the two oxygen atoms to form a double covalent bond. The double covalent bond in an oxygen molecule is represented by a dot and cross diagram as shown



Q8)Describe the formation of triple covalent bond. With a suitable example

FORMATION OF NITROGEN MOLECULE

Nitrogen is a non-metal. Each nitrogen atom has five electrons in its outer shells. Two nitrogen atoms will share three electrons to form three covalent bonds which is called triple covalent bond and formed a nitrogen molecules (N_2). The triple bond in nitrogen molecule is represented by dot and cross diagram is shown



Q9)Distinguish polar and non-polar bond.

Polar bond	**Non – polar bond**
The covalent bond formed between similar atoms is called polar covalent bond	The covalent bond formed between identical atoms is called non-polar covalent bond
Both atoms exert unequal force on the shared electron pairs.	Both the identical atoms exert some force on the shared electron pairs.

non-polar covalent bonds are formed when the electro negativities of the two atoms are unequal.	non-polar covalent bonds are formed when the electro negativities of the two atoms are equal.
Example:HCl, NaCl	Example: H_2, Cl_2

Q10) What is Coordinate Covalent Bond or Dative Covalent Bond? Discuss it with an example.

COORDINATE COVALENT BOND

The type of bond in which bond pair of electrons is contributed by one atom only, is called coordinate covalent or dative covalent bond.

REACTION BETWEEN AMMONIA AND HYDROGEN CHLORIDE

The reaction between ammonia and hydrogen chloride involves the formation of a dative bond between N atom in NH3 containing lone pairs and H+ ion from HCl. When ammonia reacts with hydrogen ions (H+) in an aqueous solution of an acid, the hydrogen ion is attracted to the lone pair and a coordinate covalent bond is formed.

Q11) Define the following

ACCEPTOR

The other atom which accepts the electron pair is called acceptor.

DONOR

The atom that donates the electron pair is called the donor

INTERMOLECULAR FORCES

Intermolecular forces are defined as the set of all the forces that occur between two neighboring molecules.

Q12) Define Dipole-Dipole Interaction also give the formation with an example

DIPOLE-DIPOLE INTERACTION

Dipole-Dipole interactions result when the two dipolar molecules interact with each other. When partially negative portion of one of the polar molecules is attracted to the partially positive portion of the second polar molecule, the electrostatic attraction is created between two molecules. These attractive forces are called Dipole-Dipole interactions

EXAMPLE DIPOLE-DIPOLE INTERACTION

Dipole-dipole interaction can be seen in hydrogen chloride. Chlorine atoms are much more electro negatives than hydrogen atoms. A partial negative charge is created on Chlorine and in turn a partial positive charge on hydrogen due to electronegative difference.

$H^{+\delta} - Cl^{-\delta}$

When two molecules of hydrogen chloride come close to each other, the slightly negative end of one molecule is attracted to the slightly positive end of another molecule. These attractive forces are simply called dipole-dipole interaction

Q13) Define Hydrogen Bonding also give the formation with an example

HYDROGEN BONDING

The interaction between partially positive charged hydrogen atom of one molecule with electronegative atom of other molecule is called Hydrogen bond.

Consider the example of hydrogen fluoride. The fluorine atom is more electronegative.

EXAMPLE OF HYDROGEN BONDING

They tend to pull on the shared pair of electrons, creating a partial negative charge on itself and a partial positive charge on the hydrogen. The partial positive charge bearing hydrogen, then forms a bond with the electronegative atom of a neighboring molecule, while its electronegative element forms another bond with the positive hydrogen of another neighboring molecule

Q14) Write some properties of ionic compounds.

PROPERTIES OF IONIC COMPOUNDS

i) Ionic compounds form crystals.

ii) Ionic compounds tend to be hard and brittle

iii) Ionic compounds have high melting points. For example, melting point of NaCl is 801^0C and boiling point 1413^0C.

iv) Aqueous solutions of ionic compounds also conduct electricity. This is because

when an ionic compound dissolves in water, the ions are free to move in

aqueous solution.

v) Ionic compounds usually dissolve in polar solvent like water and are insoluble in non-polar solvents like oil, petrol, kerosene oil etc.

Q15) Write some properties of covalent compounds.

PROPERTIES OF COVALENT COMPOUNDS

i) Covalent compounds can exist as crystals, **examples** include sugar crystals and

diamond.

ii) The melting and boiling points of most covalent compounds are usually low.

iii) They are bad conductors of electricity.

iv) They are insoluble in water, but soluble in non-polar solvents like oil, petrol,

kerosene, etc.

Q16) Write some properties of non-polar compounds.

PROPERTIES OF NON POLAR COMPOUNDS

i) Nonpolar covalent compounds are generally insoluble in water

ii) Non-polar covalent compounds do not conduct electricity in the solid, molten or aqueous solution,

iii) Non-polar covalent compounds are soluble in non-polar solvent like petrol,

benzene etc.

iv) Few examples of polar covalent compounds are H_2SO_4, H_2O, HCl, HF, HBr

Q17) Write some properties of polar compounds.

PROPERTIES OF POLAR COMPOUNDS

I. Polar covalent compounds are soluble in water.
II. polar covalent compounds usually conduct electricity due to the formation of ions with water.
III. polar covalent compounds insoluble in non-polar solvent.
IV. Few examples of non-polar covalent compounds are CO_2, CH_4, C_2H_6.

Q18) Write some properties of metals.

PROPERTIES OF METALS

i· Metals are usually malleable and ductile.

ii· They are conductor of electricity and heat due to the presence of delocalized electrons (mobile electrons).

iii· Melting and boiling points of metal are usually high as the atoms in metals are packed tightly.

iv· Metals have high densities

Q19) Write uses of adhesive material.

USES OF DIFFERENT SYNTHETIC ADHESIVES

1. It is used in book binding.
2. It is used in fixing of soles to the bodies of shoes and wood working.
3. It is used in self-adhesive envelopes.
4. Conductive adhesive is commonly used in electronics to repair equipment.
5. It is use for epoxy resin is the decorative flooring applications

Q20) Why an atom forms chemical bond?

Q21) When atoms are considered to be unstable?

Q22) Why doesn't helium atom tend to gain electron?

Q23) Where are valence electrons located, and why are they important?

Q24) What is meant by bonding electrons?

Q25) Why, noble gases do not react with other element to form compounds?

Q26) Find the number of valence electrons in the following atoms.

(a) Chlorine (b) Sodium (c) Magnesium (d) Potassium

Q27) Draw dot and cross diagrams to show how different types of chemical bonds are formed when fluorine reacts with

(a) Hydrogen (b) potassium

Q28) Can you draw an ion which is formed by the atom losing three electrons?

Q29) Complete the chart

Atomic Number	**Number of protons**	**Number of electrons**	**Electronic configuration**	**Number of valence electrons**
1				
2				
4				
8				
10				
11				
12				
13				
14				
15				
16				
18				

MULTIPLE CHOICE QUESTIONS

1. An example of ionic compound is:

(a)H_2 (b)CH_4 (c) N_2 (d)NaCl

2. Interaction between highly electron deficient hydrogen and highly electronegative atom is called

(a) covalent bond (b) ionic bond (c) hydrogen bond (d) metallic bond

3. Two fluorine atoms share one electron each in their outermost shell to achieve electronic configuration of:

(a) Xe (b) Ar (c) Kr (d) Ne

4. Number of electrons lost by atoms of group IIIA equals:

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

5. Atom which loses two electrons from its outer shell to form ion is called:

(a) oxygen (b) potassium (c) magnesium (d) carbon

6. In NaCl crystal lattice each Na+ ion is surrounded by:

(a) 6 Cl- ions (b) 6 Na+ ions (c) 8 Cl- ions (d) 12 Cl- ions

7. At room temperature most of ionic compounds are:

(a) amorphous solids (b) crystalline solids (c) liquids (d) gases

8. Tendency of atoms to acquire eight electrons in their valence shell is:

(a) octet rule (b) duplet rule (c) triplet rule (d) none of above

9. When one atom forms cation by losing electron and other forms anion by accepting that electron then bond form between them is:

(a) Covalent bond (b) Ionic bond (c) coordinate covalent bond (d) hydrogen bond

10. Nobel gases are stable because they contain:

(a) 4 electrons in valence shell (b) 6 electrons in valence shell

(c) 8 electrons in valence shell (d) 10 electrons in valence shell

11. Bond which involve 3 shared electron pairs is a:

(a) double covalent bond (b) single covalent bond

(b) triple covalent bond (d) none of above

12. A non-metal atom form anion by

(a) loses of electrons (b) gain of electrons (c) loses of protons (d) gain of protons

13. When two identical atoms share electron pairs and exert force on each other than bond form is:

(a) non-polar covalent bond (b) polar covalent bond

(c) double covalent bond (d) co-ordinate covalent bond

14. Synthetic resins are used on places where:

(a) electric resistance is required (b) water resistance is required

(c) adhesion is required (d) friction is required

15. Oxygen belongs to group VIA so number of electrons in its valence shell are:

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

16. Electron pairs which are not shared by atoms are called:

(a) electron pairs (b) lone pairs (c) bond pairs (d) shared pairs

17. Strength of intermolecular forces from ionic or covalent bond is:

(a) Weaker (b) stronger (c) equal (d) none of above

18. Ionic crystals have _____ melting points

(a) high (b) moderate (c) low (d) none of above

19. Bond formed by mutual sharing of electron is:

(a) ionic bond (b) metallic bond (c) covalent bond (d) co-ordinate covalent bond

20. Which of the following diagram shows atoms are bonded with same electro negativity?

(a) A ------ ●------ B (b) A - ● --------- B (c) A --- ● -------- B (d) A ---------- ● - B

CHAPTER 5

STATES OF MATTER

Q1. Give postulate of gas

POSTULATE OF GAS

1. The molecules in gases are widely separated from each other.
2. The molecules hove negligible volume.
3. The gas molecules are in constant random motion.
4. The gas molecules move in straight line until they collide with each other or wall of container
5. On collision molecules do not lose energy because they ore elastic in nature.
6. Pressure Produced when molecules collide with the wall of container.
7. There are attractive and repulsive forces between molecules.

Q2. Give postulate of liquid

POSTULATE OF LIQUID

1. The molecules of a liquid are randomly arranged like gases.
2. The molecules of liquids have less kinetic energy than gases.
3. The molecules of liquids are fairly free to move.
4. The Liquids has no definite shape but assumes the shape of container.
5. The Boiling point of liquids depends on the external atmospheric pressure.
6. The Liquids are denser and not compressible like gasses.

Q3. Give postulate of solid

POSTULATE OF SOLID

1. The molecules in solids are closely packed due to stronger forces of attraction.
2. The molecules are unable to move freely as they have little space between them.
3. The molecules can vibrate and rotate in their fixed position.
4. Solids have definite shape and definite volume.
5. Pure solids have sharp melting point.

Q4. State and explain Boyle's law. Also establish a relation between volume and pressure of a gas

BOYLES LAW

According to Boyle's law the volume (V) of a given mass of a gas decreases with the increase of pressure (P) at constant temperature.

EXPLANATION

$$V \propto \frac{1}{P}$$

$$V = \frac{K}{P}$$

$$PV = K$$

The product of pressure and volume of a gas at constant temperature is always constant where K is same as amount of given gas. Therefore, product of pressure and volume of a fixed mass of a gas is constant at a constant temperature.

If

$P_1V_1 = k$

then

$P_2V_2 = k$

Where

P_1 = Initial pressure

P_2= Final pressure

V_1= Initial volume

V_2= Final volume

As both equations have constant therefore their variable are also depended to each other so

$$P_1V_1 = P_2V_2$$

Q5. State and explain Charles's law. Also establish a relation between volume and temperature of a gas

CHARLES LAW

According to Charles law if temperature of a gas is increased, its volume will also increase.

MATHEMATICALLY IT IS REPRESENTED AS

$$V \propto T$$

$$V = KT$$

$$\frac{V}{T} = K$$

Where K is proportionality constant. Then when temperature increases the volume also increases.

You have a gas at a certain temperature (T_1) and volume (V_1). If you change the temperature (T_1) to a new value (T_2), the volume (V_1) changes to a new value (V_2). We can use Charles's law to describe both sets of conditions.

$$\frac{V_1}{T_1} = K$$

$$\frac{V_2}{T_2} = K$$

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

Q6. Define evaporization. Discus the factor of evaporation

EVAPORIZATION

The process by which a liquid change to a gas phase is called evaporization.

Water (liquid) → Vapours (gas)

FACTORS AFFECTING EVAPORATION:

I. SURFACE AREA:

The evaporation is a surface-based process. Greater the surface area greater is evaporation.

FOR EXAMPLE

Water left in bowl evaporate slowly than water left in a large tub. A saucer is used to cool the tea quickly than tea cup.

II. TEMPERATURE:

The rate of evaporation increases with the increase in temperature. Because temperature increases the kinetic molecular energy which overcome the intermolecular forces and makes evaporation rapidly.

FOR EXAMPLE

Clothes dry quickly in a sunny day than a cloudy day.

III. INTERMOLECULAR FORCES:

The rate of evaporation increases with less intermolecular forces. If intermolecular forces are stronger evaporation is lesser.

FOR EXAMPLE,

perfume have lesser intermolecular forces than water therefore they it evaporates quickly

Q7. Define vapor pressure. Discus the factor of vapor pressure

VAPOUR PRESSURE

The pressure exerted by vapors in equilibrium with its pure liquid at a particular temperature is called Vapours Pressure.

FACTORS AFFECTING VAPOUR PRESSURE:

I. NATURE OF LIQUID:

The vapour pressure depends upon the nature of liquids. Polar liquids have low vapour pressure than nonpolar liquids at the same temperature. It is because of strong intermolecular forces of molecules and high boiling point in the polar liquids.

FOR EXAMPLE

water (polar liquid) has less vapour pressure than alcohol (non-polar liquid).

II. SIZE OF MOLECULES:

The vapour pressure is more in small size molecules because small sized molecules evaporate easily and exert more vapour pressure.

FOR EXAMPLE

Hexane (C_6H14) has a small size molecule as compared to decane ($C_{10}H_{22}$), due to this hexane evaporate rapidly and exert more pressure.

III. TEMPERATURE:

The vapour pressure increases with raise in temperature. The average kinetic energy of molecules increases with temperature which causes increase in vapour pressure.

FOR EXAMPLE

Vapour pressure of water at 0 is 4.58 mm Hg while at 100^oC it increases up to 760mm Hg.

Q8. Define boiling point. What are the factors on which it depends?

BOILING POINT

The temperature at which vapour pressure of a liquid become equal to atmospheric pressure is called boiling point of the liquid.

I. ATMOSPHERIC PRESSURE:

The boiling point is directly proportional to atmospheric pressure. Boiling point can be increased by increasing atmospheric pressure.

FOR EXAMPLE

Working of pressure cooker

II. NATURE OF LIQUID:

The boiling point depends upon the nature of liquid as polar liquids hove high boiling point than nonpolar liquids, because polar liquids have stronger intermolecular forces than nonpolar liquids.

II. INTERMOLECULAR FORCES:

The intermolecular forces play very important role in the boiling points of liquids. Substances having stronger intermolecular forces have high boiling points, because such liquids attain a level of vapour pressure equal to external pressure at high temperature.

Q9. Define Diffusion in liquid. Write its factors.

DIFFUSION

The diffusion is spreading out of the liquid molecules throughout the vessel. The liquids diffuse less rapidly than gases.

FACTORS AFFECTING DIFFUSION

I. INTER MOLECULAR FORCES:

liquids have weaker intermolecular forces than solid due to this diffuses faster than solid but less rapidly than gases.

II. SIZE OF MOLECULES:

Diffusion depends upon size of molecules small size of molecules diffuses rapidly than bigger one.

FOR EXAMPLE

Diffusion is slow in water than alcohol.

II. SHAPE OF MOLECULES:

Molecules with irregular shape diffuses slowly while regular shaped molecules diffuse foster because they can easily slip over and move faster.

IV. TEMPERATURE:

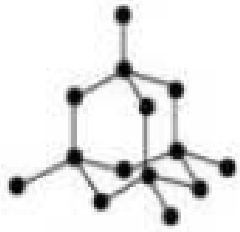
Diffusion increases by increasing temperature because at high temperature intermolecular forces becomes weak due to high kinetic energy of the molecules.

Differentiate between Amorphous and crystalline solid

AMORPHOUS SOLIDS	CRYSTALLINE SOLIDS
They don't have definite geometrical shape.	They have characteristic geometrical shape.
Amorphous solids do not have particular melting point.	They have sharp melting point.
Amorphous solids are isotropic.	Crystalline solids are anisotropic.
Amorphous solids are unsymmetrical.	Crystalline solids are symmetrical.
Amorphous solids do not break at fixed cleavage planes.	Crystalline solids break along particular direction at fixed cleavage planes.

Q10. Define Allotropy. Name the different allotropies of carbon

ALLOTROPY: The existence of an element in more than one crystalline form is known as allotropy. These forms of the element are called allotropes or allotropic forms.

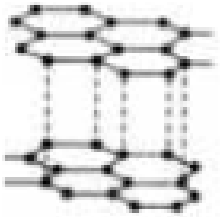


DIAMOND

Where the carbon atoms are bonded together in a four-cornered lattice arrangement.

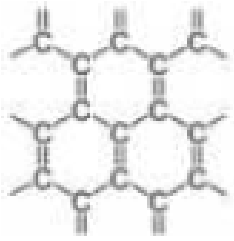
GRAPHITE

Graphite, where the carbon atoms are bonded together in sheets of a six-sided lattice.



GRAPHENE

Single sheets of graphite.



FULLERENES

Where the carbon atoms are bonded together in spheres, cylinders or egg-shaped formations.

Q11. What do you know about plasma state? Also give examples of plasma state.

PLASMA

It was discovered by adding energy to a gas. As a result, some electrons left their atoms and formed positive and negative ions by ionization. In plasma these charged particles react strongly to electric and magnetic fields

SOME EXAMPLES OF DAILY LIFE ARE AS FOLLOW:

1. The lightning makes plasma naturally.
2. The Artificial (man-made) uses of plasma include fluorescent light bulbs, Neon signs.
3. The use of plasma display of television or computer screens.
4. The plasma lamps and globes are popular in children's toys and room decoration.
5. Scientists are experimenting with plasma to make a new kind of nuclear power, called fusion, which will be much better and safer than ordinary nuclear power with less radioactive waste

Q12. What is Bose Einstein Condensate?

BOSE EINSTEIN CONDENSATE

Condensation happens when several gas molecules come together and form a liquid. It all happens because of a loss of energy. Gases are really excited or energetic atoms. When they lose energy, they slow down and begin to gather. They can gather into one drop

Exercise/ Numerical

Q1. Convert the following units:

(a)100 ^{o}C to K

(b) 150^{o}C to K

(c) 780K to ^{o}C

(d) 170 K to ^{o}C

Q2. The pressure of a sample gas is 3 atm and the volume is 5 liters. If the pressure is reduced to 2 atm, what will be the new volume?

Q3. The 700 cm^3 of a gas is enclosed in a container under a pressure of 650 mm of Hg. If the volume is reduced to 350 cm^3 , what will be the pressure then?

Q4. A 600 ml sample of gas is heated from 27 °C to 77 °C at constant pressure. What is the final volume?

Q5. A sample of Hydrogen gas has a volume of 350 cm3 at 40OC. If gas is allowed to expand up to 700 cm at constant pressure. Find out its final temperature?

Q6. it is desired to increase the volume of a fixed amount of gas from 90.5 $cm^3$to 120 cm^3 while holding the pressure constant. What would be the final temperature if initial temperature is 33 ^{O}C.

Q7. A 78ml sample of gas is heated from 35°C to 80°C at constant pressure. What is the final volume?

Q8. A gas occupies a volume of 40.0 dm^3 at standard temperature (0^{O}C) and pressure (1 atm), when pressure is increases up to 3 atm unchanged temperature what would be the new volume?

Q9. The 800 cm^3 of a gas is enclosed in a container under a pressure of 750 mm. If the volume is reduced to 250 cm^3, what will be the pressure?

Q10. The pressure of a sample gas is 8 atm and the volume is 15 liters. If the pressure is reduced to 6 atm, what is the volume?

CHAPTER 6

SOLUTIONS

Q1. Define the following

SOLUTION

A solution is a homogeneous mixture of two or more substances.

AQUEOUS SOLUTION

The aqueous solution is a type of solution, in which water used as a solvent.

SOLUTE

Component of solution which is present in small quantity and it can be dissolved in solvent is called "solute".

SOLVENT

Component of solution which is present in large quantity and it can dissolve solute is called "solvent".

DILUTED SOLUTION

Dilute solution contains a relatively small amount of a solute in a large amount of solvent like adding more water to a solution.

CONCENTRATED SOLUTION

Concentrated solution contains a relatively large amount of solute in a small amount of solvent.

Q2. Differentiate between Saturated and Unsaturated Solution

SATURATED	UNSATURATED
In saturated solution maximum amount of solute that can be dissolved at particular temperature.	In unsaturated solution more amount of solute that can be dissolved at particular temperature.
The solution has high concentration than unsaturated solution.	The solution has low concentration than saturated solution.
There is no formation of precipitation at the bottom of container.	There is also no precipitation at the bottom of container.
A solution having 20.9 gram of sodium sulphate 3 per 100cm of water at 20°C is the example of saturated solutions.	A solution having amount of salt less than 20.9 gram per 100cm3 of water at 20°C is the example of unsaturated solution.

Q3. Differentiate between Solution and suspension.

SOLUTION	**SUSPENSION**
Particle size less than 1 n m	Particle size greater than 1000 nm
Homogeneous (particles dissolve uniformly)	Heterogeneous (particles settle down after sometimes)
Particles cannot be distinctly seen with the naked eye.	Particles are big enough but can be seen with naked eyes.
Clear, transparent and homogeneous	Cloudy, but uniform and homogeneous
Transparent but often colored	Translucent and often opaque but can be transparent
Cannot be separated	Can be separated
Do not scatter light	Scatter light, but are not transparent
Particles can pass through filter paper	Particles pass through filter paper

Q4. What are colloid

COLLOID

1. Particle size 1 to 100 nm
2. Homogeneous and heterogeneous (Particles do not settle down for a long time)
3. Colloidal particles cannot be seen with the naked eye but can be seen through ultra-microscope
4. Cloudy, heterogeneous, at least two substances visible Often opaque, but can be transparent
5. Scatter light (Tyndall effect) Particles do not passthrough filter paper

Q5. What is supersaturated solution

SUPERSATURATED

1. In super saturated solution more amount of solute has been dissolved than its maximum capacity.
2. The solution has more concentration than saturated solution.
3. There is formation of precipitation at the bottom of container.
4. A solution having more amount than 20.9 gram of salt per 100cm3 of water at 20^{o}C is the example of supersaturated solution.

Q6. Define solubility. Give the general principles of solubility.

SOLUBILITY

Solubility is defined as the maximum quantity of solute that can be dissolved in 100 grams of solvent to prepare saturated solution at a particular temperature

GENERAL PRINCIPLES OF SOLUBILITY

1. DISSOLUTION

The general, principle of solubility is "Like dissolves like". Its mean that two substances with similar intermolecular forces are likely to be soluble in one another.

2. SOLUTE-SOLVENT INTERACTION

A solute will dissolve in a solvent if the solute-solvent forces of attraction are greater enough to overcome the solute-solute and solvent-solvent forces of attraction. A solute will not dissolve if the solute-solvent forces of attraction are weaker than individual solute and solvent intermolecular attractions.

3. TEMPERATURES

Solubility is directly proportional to the temperature in solid & liquid. Solubility is increased by increasing the temperature because hot water molecules have greater kinetic energy and collide with solid solute more vigorously.

For all gases, the solubility decreases as the temperature of the solution increases.

FOR EXAMPLE,

A greater amount of sugar will dissolve in warm water than in cold water. The solubility of potassium chloride is 34.7g to 100g of water at 20°C. It will become 56.7gm/ cm^3 at 100°C.

EXERCISE / NUMERICAL

Q1. What is the molarity of the solution prepared by dissolving 1.25 g of HCl gas into enough water to make 30 cm^3 of solution?

Q2. A solution of potassium chloride was prepared by dissolving 2.5 g of potassium chloride (KCl) in water and making the volume up to 100 cm^3. Find the concentration of solution in mol/ dm^3.

Q3. A flask contains 0.25 M NaOH solution. What mass of NaOH is present per dm^3 of solution?

Q4. What volume of 0.5M acid is needed to neutralize 200ml of 4M base?

Q5. A mineral water bottle contains 28 mg of calcium in 100 cm3 of solution. What is the concentration in g/dm^3?

Q6. A solution of 20cm^3 of alcohol is dissolved in 80cm^3 of water. Calculate the concentration (v/v) of this solution.

Q7. How much sodium hydroxide (NaOH) is required to prepare 400 cm^3 of 0.3M solution?

Q8. How do you prepare 100ml of 0.40M $MgSO_4$ from a stock solution of 2.0M $MgSO_4$?

Q9. How would you prepare 500 cm3 of 0.20 M NaOH (aq) from a stock solution of 1.5 M NaOH?

Q10. Calculate the percentage concentration (m/m) of the solution obtained by dissolving 15g salt in 110g water.

Q11. Calculate the volume/volume percent of solution obtained by mixing 25cm^3 of ethanol in water to produce 150cm^3 of the solution.

Q12. 20 gram of salt is dissolved in 500cm^3 of a solution. Calculate the molarity of that solution.

Q13. What is the mass of oxalic acid present in 100 cm^3 of 2 molar solutions?

Q14. A sample of Sulphuric acid has the molarity 20M. How many cm^3 of solution should you use to prepare 500 cm^3 of 0.5M H_2SO_4?

CHAPTER 7

ELECTRO CHEMISTRY

Q1. Define electrochemical reactions

ELECTROCHEMICAL REACTIONS

The chemical reactions in which chemical energy changes into electrical energy or vice versa are called electrochemical reactions

Q2. What is oxidation reaction. Give two chemical equations for oxidation

OXIDATION

Oxidation may involve introduction of oxygen or removal of Hydrogen from a chemical substance.

EXAMPLE:

$C + O_2 \rightarrow CO_2$ (burning of coal)

$2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$ (combustion of octane)

$N_2H_4 + O_2 \rightarrow N_2+2H_2O$ (removal of Hydrogen from Hydrazine)

Q3. What is reduction reaction. Give two chemical equations for oxidation

REDUCTION

Reduction may involve addition of Hydrogen or removal of oxygen from a chemical substance.

EXAMPLE

$CuO + C \rightarrow Cu + CO$ (reduction of copper oxide)

$C_2H_4 + H_2 \rightarrow C_2H_6$ (Reduction of ethene)

$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe + heat$ (Reduction of iron Oxide)

Q4. Differentiate between oxidation and reduction reaction

Oxidation	reduction
Addition of oxygen from a substance.	Removal of oxygen from a substance.
Removal of hydrogen.	Addition of hydrogen.
Loss of electrons by a substance.	Gain of electrons by a substance.

Q5. What are oxidizing and reducing agent. Give some examples of it

OXIDIZING AGENTS

Oxidizing agents are substances that accept electrons.

EXAMPLE

H_2SO_4, HNO_3, $KMnO_4$, $K_2Cr_2O_7$, Cl_2, Br_2, I_2

REDUCING AGENT

Reducing agent are substances which loses electrons.

EXAMPLE

Alkali metals, Al, H_2S, Zn, NaH, KH

Q6. What is electrochemical cells. Name its types

ELECTROCHEMICAL CELLS:

The device which convert chemical energy into electrical energy or vice versa using redox reaction are called electrochemical cells.

TYPES OF ELECTROCHEMICAL CELL

(1) Electrolytic Cells

(2) Galvanic Cells or Voltaic Cells

Q7. Define electrolytes and non-electrolytes. Give their examples

ELECTROLYTES

The substances which are able to conduct electricity in molten state or in aqueous solution form are called electrolyte

EXAMPLE

HCl, KOH, NaCl

NON-ELECTROLYTES

The substances which are unable to conduct electricity in molten state or in aqueous solution form are called non electrolyte

EXAMPLE:

Benzene, Glucose, Sucrose and Urea

Q8. What are strong electrolytes and weak electrolytes

STRONG ELECTROLYTE

The electrolytes which are completely ionized, called strong electrolytes.

WEAK ELECTROLYTE

The electrolytes which are partially ionized called strong electrolytes.

Q9. Define Electrolytic cells and Electrolysis. Give an example of Electrolysis in electrolytic cell.

ELECTROLYTIC CELLS

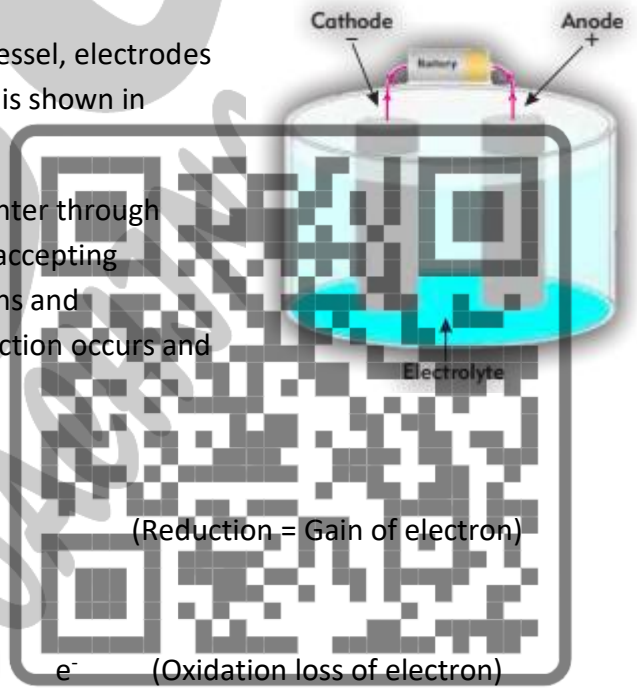
The type of cell which uses electricity for a non-spontaneous reaction to occur is called electrolytic cell.

ELECTROLYSIS

The electrolysis involves redox reactions and carried out in electrolytic cell. In electrolysis current passes through an electrolyte, due to this migration of positive and negative ions towards cathode and anode takes place.

ELECTROLYSIS IN ELECTROLYTIC CELL

An electrolytic cell consists of electrolyte in a vessel, electrodes and a battery. The sketch of an electrolytic cell is shown in figure.



The figure shows that electrons from battery enter through cathode at which positive ions are reduced by accepting electrons. At anode negative ions loses electrons and undergoes oxidation. It means at cathode reduction occurs and oxidation takes place at anode.

AT CATHODE

$M + e^- \rightarrow M$ (Reduction = Gain of electron)

AT ANODE

$X \rightarrow X + e^-$ (Oxidation loss of electron)

Q10. Give the Applications of Electrolytic cells.

APPLICATIONS OF ELECTROLYTIC CELLS:-

Important uses of electrolytic cell are given below.

1. It is used to prepare sodium metal from molten sodium chloride using the down's cell.
2. It is used to prepare caustic soda (NaOH) from aqueous sodium chloride by Nelson's cell. It is also used to obtain chlorine gas.
3. It is used to extract aluminum metal.
4. It is used in electro refining of copper.
5. Electrolytic cell is used for electro plating of metals

Q11. State Faraday's first law of Electrolysis. Also explain it.

FARADAY'S FIRST LAW OF ELECTROLYSIS:-

It states that amount of any substance that is deposited or liberated at an electrode during electrolysis is directly proportional to the quantity of electricity passed through the electrolyte.

$$W \alpha A \times t$$

or $$W = ZAt$$

Where,

W = Weight of the substance deposited or liberated

A = Current in ampere

t = time in second

Q12. State Faraday's second law of Electrolysis.

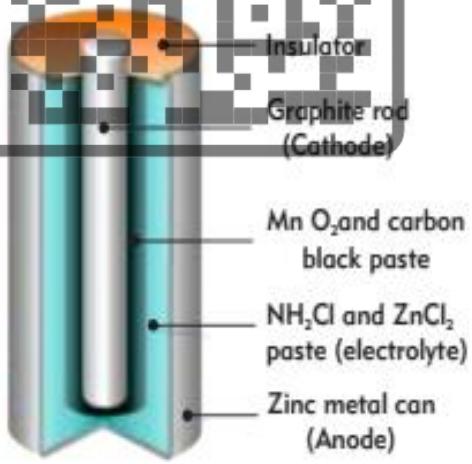
FARADAY'S SECOND LAW OF ELECTROLYSIS: -

The number of different substances deposited or liberated due to passage of same quantity of current through different electrolytes are proportional to their chemical equivalent masses.

Q13. Write shote note on dry cell and Lead Storage Battery

DRY CELL: -

It is also known as Leclanche cell. It is a type of primary cell which produce electricity using redox reaction between their chemical substances placed in it.
It uses zinc as anode, magnesia dioxide as cathode and aqueous ammonium chloride (NH_4Cl) or zinc chloride ($ZnCl_2$) as electrolyte. The cell diagram is given in Fig.



A copper cap is fixed on the top of the carbon rod for conduction of electricity. Zinc and graphite are then connected by a metal wire as a result following reaction take place

REACTION AT ANODE

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

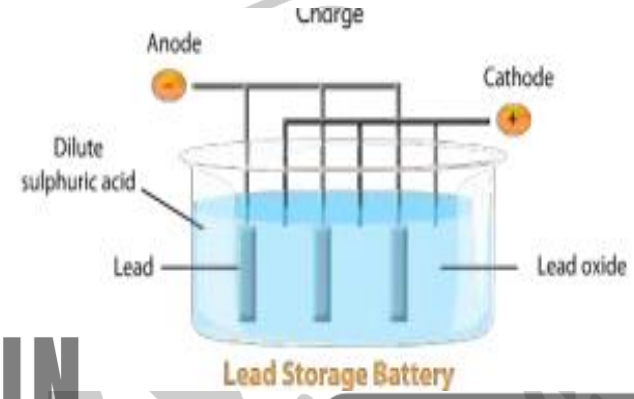
REACTION AT CATHODE

$$2NH_4 + 2MnO_2 + 2e^- \rightarrow Mn_2O_2 + 2NH_3 + H_2O$$

LEAD STORAGE BATTERY: -

A battery is a device which produces electricity through electro chemical reactions. Lead storage battery is an example of secondary cell in which chemical changes can be reversed. It has several voltaic cells connected in series. It contains lead plates which serve as anode and lead oxide (PbO_2) which acts as cathode. These electrodes are immersed in electrolytic solution of dilute Sulphuric acid (H_2SO_4). Chemical changes during charging and discharging processes can be shown as

$$Pb + PbO_2 + 2H_2SO_4 \overset{Discharge}{\Longleftrightarrow} 2PbSO_4 + 2H_2O$$

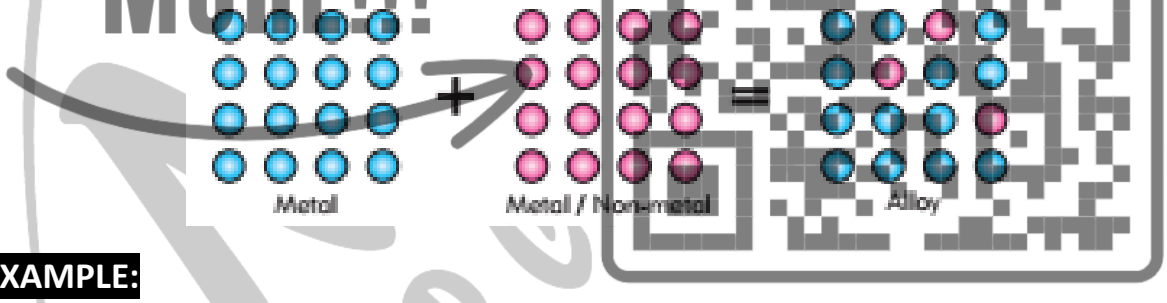


Lead Storage Battery

Q14. Define alloy. Also give examples

ALLOY

Alloy is the mixture of metal with metal or metal with nonmetal. There are about 7000 alloys which are used for different purposes in the world.



EXAMPLE:

Brass is an alloy of Copper (Cu) and Zinc (Zn). Steel is a alloy of iron and carbon.

Q15. Give application of some alloys

NAME OF ALLOY	COMPONENTS	APPLICATIONS
Bell metal	Cu-Sn	Casting of bell
Brass	Cu Zn	Door nobs and hand rails due to antibacterial nature, Hose nozzles, Stamping dies.
Bronze	Cu-Zn Sn	Coins, medals, tools, etc.
Monel	Ni-Cu-Fe	Corrosion resistant containers
Duralumin	Al-Cu-Mg-Ni	Boat, Air craft etc

Solder	Sn-Pb-Cu-Sb	Joining electrical components into circuits.
Alnico	Fe-Al-Ni-Co	Magnets used in loudspeakers
Amalgam	Hg-Ag-Cu-Zn	Dental filling
Cupronickel	Cu-Ni-Mn	Coins
Sterling silver	Ag-Cu	Cutlery set, medical tools
White gold	Au-Pb-Ag-Cu	Jewelry (18 carat)

Q16. What is corrosion. Give methods for prevention form corrosion.

CORROSION AND ITS PREVENTION:

Metals react with oxygen in presence of moisture and can form harmful metal oxide. These metal oxide layers are porous and expose metal for further reaction with oxygen to form harmful metal oxide. It is called Corrosion of metal.

PREVENTION FROM CORROSION:

All metals can be prevented from corrosion by following methods.

1- ALLOYING:

Formation of alloy prevents metal from corrosion by reducing its ability of oxidation. Example: Iron (Fe) can be changed into stainless steel by mixing with chromium (Cr) and Nickle (Ni). Thus iron (Fe) is prevented from corrosion.

2- METALLIC COATING (ELECTROPLATING)

All metals can be protected from corrosion by coating its surface with other metal like tin (Sn) or zinc (Zn). The coating of metal at the surface of other metal by electrolytic process is called electroplating. Metals like iron can be electroplated with chromium (Cr), Nickle (Ni) and silver (Ag).

3- CATHODIC PROTECTION:

It is applied to protect underground pipes tanks, oil rigs etc. from corrosion by making these materials as cathode. The active metal like magnesium (Mg) or aluminum (Al) is used as Anode and connected with iron (Fe). These active metals itself oxidizes and prevent other metal from corrosion.

4- COATING WITH PAINT:

A metal is commonly coated with paint to protect it from corrosion. Paint prevents the reaction of metal with oxygen moisture and other harmful chemical agents.

Q17. Write short note on rusting of iron

RUSTING OF IRON

Corrosion of iron is an electro chemical process. Iron under goes redox reaction in presence of air or water to form iron (III) oxide (Fe2O3. nH2O) called rusting of iron. Rusted surface of iron provides no protection to underlying iron and eventually convert whole iron into reddish brown rust. Rusting occurs at different places of metal surface. A metal surface area of less moisture act as anode and oxidizes iron in this region.

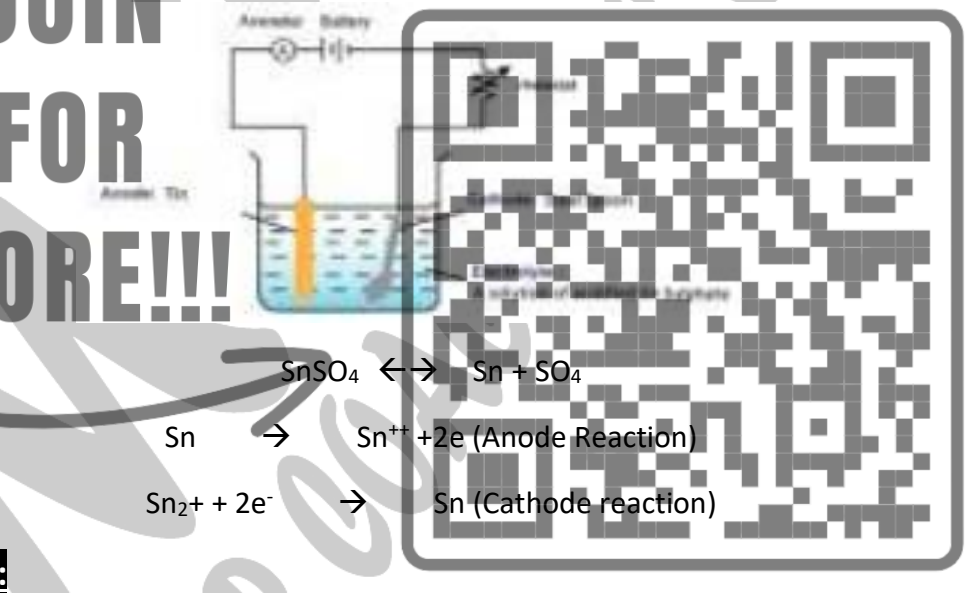
Q18. What is electroplating. Describe tin plating, zinc plating, silver plating and chromium plating

ELECTROPLATING

The process of deposition of metal at the surface of other metal through electrolysis is called electroplating.

TIN PLATING:

Steel spoon can be tin plated by using acidified tin sulphate as electrolyte. Tin (Sn) metal is used as anode and steel spoon is used as cathode. When current passes through electrolyte tin ions (Sn^{+2}) deposits at cathode as tin (Sn) metal. Tin (Sn) electrode is then changes into tin ion (Sn^{2+}).



$SnSO_4 \leftrightarrow Sn + SO_4$

$Sn \rightarrow Sn^{++} + 2e$ (Anode Reaction)

$Sn_2+ + 2e^- \rightarrow Sn$ (Cathode reaction)

ZINC PLATING:

The process in which zinc is electrolytically coated at the surface of other base metal is called galvanizing. Potassium zinc cyanide is used as electrolyte to produce zinc ions(Zn^{+2}). Zinc (Zn) metal serves as anode and steel object is used as cathode. During electrolysis Zn++ deposits at cathode and Zinc (Zn) anode is then changes into zinc ion Zn^{2+}.

Following reactions occur during zinc electroplating.

$Zn \rightarrow Zn^{2+} + 2e-$ (Anode Reaction)

$Zn^{+2} + 2e^- \rightarrow Zn$ (Cathode reaction)

ELECTROPLATING OF SILVER:

In this process silver (Ag) is coated electrolytically at the surface of steel or other metal. It is called silver plating. In this process aqueous solution of silver chloride (AgCl) is used as electrolyte to produce silver (Ag+) ions. Silver (Ag) metal is used as anode and steel object like spoon used as cathode. Silver (Ag+) ions are reduced at cathode by accepting electron. Silver anode loses electron and oxidized to silver (Ag+) ion.

Following chemical changes takes place.

$$AgCl \leftrightarrow Ag^{+} + Cl^{-}$$

AT CATHODE

$$Ag^{+} + e^{-} \rightarrow Ag$$

AT ANODE

$$Ag \rightarrow Ag^{-} + e^{-}$$

CHROMIUM PLATING:

The process in which chromium (Cr) is coated electrolytically at the surface of other base metal is called chromium plating. Acidified chromium sulphate $Cr_2(SO_4)_3$ is taken as electrolyte to produce chromium (Cr_{+3}) ion. Chromium metal serves as anode and other metal object is used as cathode. Following chemical changes take place in chromium plating.

$$Cr(SO_4)_3 \rightarrow 2Cr^{3+} + 3SO_4^{2-}$$

At cathode $Cr^{+3} + 3e^{-} \rightarrow Cr$

At anode $Cr \rightarrow Cl^{-3} + 3e^{-}$

EXERCISE/ NUMERICAL

Q1. Identify the oxidizing and reducing agents from the following.

1. Al 2. Na 3. H_2S 4. H_2SO_4 5. $KMnO_4$ 6. Zn

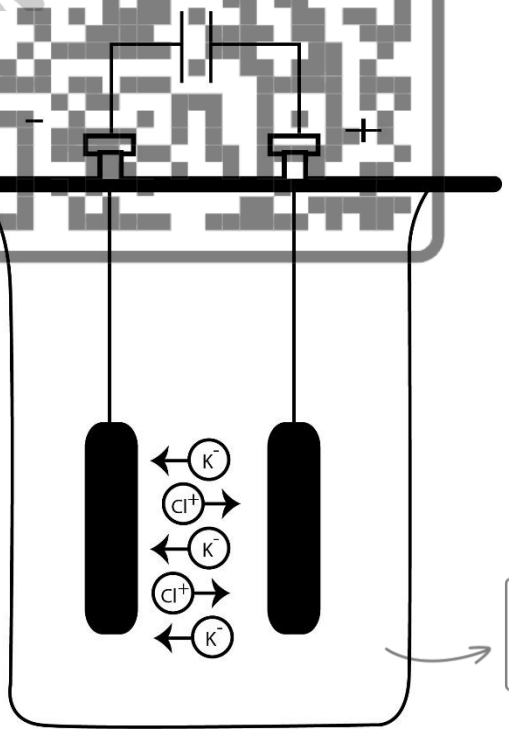
Q2. Identify the oxidizing and reducing agents for the following reaction.

$$H_2 + Cl_2 \rightarrow 2HCl$$

Q3. Identify strong and weak electrolytes from the following

1. $HCl_{(aq)}$, 2. $KI_{(aq)}$, 3. $NaOH_{(aq)}$, 4. $H_2S(aq)$, 5. $CH_3COOH_{(aq)}$, 6. $NH_4OH_{(aq)}$

Q4. Identify cathode and anode, oxidation, reduction reaction, movement of electron from the following sketch of electrolytic cell.



CHAPTER 8

CHEMICAL REACTIVITY

Q1. Differentiate between metals and nonmetals.

METALS	NON-METALS:
1. All metals except mercury are solids with high melting points and boiling points.	1. Non-metals have low melting and boiling points, about half of the non-metals are gases.
2. Metals have characteristic luster, known as metallic luster and can be polished.	2. Non-metals do not have luster like metals and cannot be polished.
3. They on hitting with hammer give off notes i.e they are Sonorous.	3. They are not sonorous and break on hitting.
4. Metals are malleable and ductile that is they can be converted into sheets and wires.	4. They are usually brittle and break easily when subjected to stress or strain.
5. Metals have great tensile strength and can withstand stress and strain.	5. They are neither malleable nor ductile.
6. They have relatively high densities.	6. They are generally bad conductors of heat and electricity.
7. They are good conductors of heat and electricity. Some common metals are Iron (Fe), Copper (Cu), Aluminum (Al) and Chromium (Cr).	7. They have relatively low densities. Some examples of non-metals are Sulphur (S), Carbon(C), Oxygen (O,), Nitrogen (N,) and Chlorine (Cl).

Q2. Describe metalloids in brief

METALLOIDS

Intermediate properties of metals and non-metals

Boron (B), Silicon (Si), Germanium (Ge), Arsenic (As), Antimony (Sb), Tellurium (Te), Polonium (Po) and Astatine (At) are metalloids.

Q3. Compare the properties of Alkali and Alkaline Earth Metals

ALKALI METALS (IA)	ALKALINE EARTH METALS (IIA)
They are highly reactive than (IIA) group elements due to low ionization energy.	They are less reactive than (IA) group elements due to high ionization energy.

They form monovalent cation(M^+)	They form divalent cation(M^{2+})
They react violently with halogens $2Na + Cl_2 \rightarrow 2NaCl$	They react slowly with halogens $Ca + Cl_2 \rightarrow CaCl_2$
They react with oxygen on heating. $2Mg + O_2 \rightarrow 2MgO$	They immediately tarnish in air and form metal oxide. $K + O_2 \rightarrow KO_2$
They react with water vigorously at room temperature and form strong alkaline solution $2K + 2H_2O \rightarrow 2KOH + H_2$	They react with water less vigorously and form alkaline solution $Mg + H_2O \rightarrow MgO + H_2$ $MgO + H_2O \rightarrow Mg(OH)_2$
Their oxides and hydroxides are more basic than those of IIA group elements.	Their oxides and hydroxides are less basic than those of IA group elements.
They do not form metal carbides.	They form metal carbides on heating. $Ca + 2C \rightarrow CaC_2$

Q4. Give properties of sodium and give its uses

SODIUM (NA)

POSITION:

It is sixth most abundant element and constitutes 2.87% of earth's crust. It belongs to IA group, 3rd period of periodic table.

PHYSICAL PROPERTIES

1. Sodium is silvery white alkali metal.
2. It melts at 97.8°C and boils at 881.4°C.
3. It is soft and can be cut with Knife due to weak metallic bonding between their atoms.
4. Sodium metal has shining surface but its appearance becomes dull due to action of air.

CHEMICAL PROPERTIES

1. Reaction with oxygen

$$2Na + H_2SO_4 \rightarrow Na_2SO_4 + H_2$$

2. Sodium reacts with halogens to form sodium halide.

$$2Na + Br_2 \rightarrow 2NaBr$$

3. Sodium reacts with Sulphruic acid to form H_2 gas

$$2Na + O_2 \rightarrow Na_2O_2$$

4. It violently reacts with H_2O water and form Sodium Hydroxide and Hydrogen gas

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$

USES:

1. It is an excellent heat transfer fluid so it is used as coolant in nuclear reactors.
2. It is used in Detergent preparation.
3. It is used as Street lights and gives yellow colour.
4. It is used as Reducing agent in the extraction of Calcium, Zirconium and Titanium

Q5. List common compounds of Sodium and their uses

Soda Ash	Na_2CO_3	Used as water softener	Soda Ash
Baking Soda	$NaHCO_3$	Used in Baking Powder, Health Salt, Beverages	Baking Soda
Table Salt	NaCl	Food Items	Table Salt
Sodium Nitrate	$NaNO_3$	Sodium Nitrate	Used as fertilizer and in Dynamite

Q6. Give properties of magnesium and give its uses

MAGNESIUM (MG)

POSITION:

It is 8th most abundant element found in earth's crust. Magnesium belongs to II-A group and 3rd period of periodic table.

PROPERTIES:

1. It is a grey-white metal.
2. It melts at 650°C and boils at 1090°C.
3. Magnesium fire cannot be extinguished with water because H_2 gas is highly flammable and intensifies the fire.
4. Magnesium fire can be extinguished by using dry sand.
5. Magnesium reacts violently with water and releases Hydrogen gas

$$Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$$

USES:

1. It is used in flares and photographic flash bulbs because it burns to produce brilliant white light.
2. Magnesium hydroxide are used as an Antacid.
3. It is used for manufacturing of Mobile Phones, Laptop and Tablet Computers because of light weight and electrical properties.
4. The use of Magnesium reduces the weight of vehicle by replacing steel components of a vehicle.
5. Magnesium alloys are used in aviation industry, space crafts and missile because they are light weight and remain stable at high temperature.

6. Magnesium can be changed into intricate (twisters, knotty) shapes, so it is used in tennis rackets and handles of archery bows.

Q7. Give properties of calcium and give its uses

CALCIUM (CA)

POSITION:

It is 5th abundant metal in earth's crust. It belongs to IIA group and 4th period.

PROPERTIES:

It is silvery white soft metal. It melts at 851oC and boils at 1484oC.

USES:

Calcium is essential for healthy teeth and bones

List common compounds of calcium and their uses.

Slaked lime	$Ca(OH)_2$	As soil conditioner, used in water treatment to reduce acidity. Used in steel industry to remove impurities from Iron ore
Gypsum	$2CaSO_4.H_2O$	It is used as component in construction of buildings. It is used medically in plaster for setting broken bones.
Calcium hypochlorite	$CaOCl_2$	It is used for sterilization of water in swimming pool.
Calcium tungstate	$CaWO_4$	It is used in Luminous paints.
Limestone	$CaCO_3$	As source of CO_2, In Cement industry

Q8. What are soft and hard metals. Also give their examples

SOFT METALS

The metals which are scratched easily are called soft metals.

EXAMPLE

Alkali metals like; Sodium(Na), Potassium (K) and Rubidium (Rb) are soft metals.

HARD METALS

Metals which show strong resistance towards scratching are called hard metals.

EXAMPLE

Nickle (Ni), Iron (Fe), Tungsten(W) are hard metals.

Q9. Differentiate between sodium and iron

Sodium	**Iron**
It is a soft metal of group IA	It is a hard metal VIIIB
It has large atomic size	It has smaller ionic radii
It has low value (0.5) on moh scale	It has high value (4.5) on moh scale
It has weak metallic bonding so it is a soft metal	It has strong metallic bonding so it is hard metal.
It can be cut easily with knife.	It is hammered to form sheets and wires.
It is light due to its low density (0.971 g/cm^3).	It is heavier metal due to its high density (7.87 g/cm^3).
It has low melting and boiling point values (melting point = 98^{o}C, boiling point = 890^{o}C)	It has high melting and boiling point values (melting point = 1535^{o}C, boiling point = 2450^{o}C)

Q10. What is Noble Metal

NOBEL METALS

Nobel metals are less electro positive so they are difficult to oxidize. Therefore, they show no reaction with atmospheric gases and resist corrosion.

EXAMPLES

Gold (Au), Silver (Ag), Platinum (Pt), Iridium (Ir), Osmium (Os), Rhodium (Rh), Ruthenium (Ru), Palladium (Pd).

Q11. Write short note in silver, gold and platinum

SILVER (AG): -

1. It is widely used in society.
2. It is used in Jewelry, decorative items and silver tableware because it does not tarnish and maintain its silvery shiny appearance.
3. It is used to make mirror because it is best reflector of visible light.
4. Silver forms compounds of significant importance.
   Silver Nitrate ($AgNO_3$) or Lunar caustic is used in detection of Halogen.
5. Light sensitive material AgBr and AgI are used in Photographic films.

GOLD (AU): -

1. Gold has importance in our society.
2. It is used in jewelry because it has very high luster, yellow colour and tarnish resistance.
3. Gold is used in electronic components because it is highly efficient conductor of current and cannot corrode.
4. Gold is used in connecting wires, connection strips, switches and relay contacts to make electronic devices highly reliable.
5. Gold is used in cellphones, global positioning systems, Calculators etc.
6. Gold is used in Laptop Computers for rapid and accurate transmission of digital information.
7. It is used in dentistry because it is chemically inert, non-allergic and easy for dentist to work.
8. Gold coated polyester films are used in space vehicles to reflect infrared radiation and stabilize the temperature of space vehicle.
9. The helmet of Astronaut is coated with thin film of gold which reflect intense Solar radiation and protect eyes, skin of astronaut.
10. Glass surface coated with gold will reflect solar radiations outward and keep the buildings cool in summer.
11. It also reflects internal heat inward and keeps the Building warm in winter.
12. Gold symbolizes purity, beauty and stability so it is used in making medals, trophies awards etc.

PLATINUM (PT): -

1. It is a silvery white corrosion resistance metal. It is paramagnetic transition metal.
2. It is used in chemical reactions as catalyst.
3. It is used as catalytic converter in vehicles.
4. It helps the complete combustion of Hydrocarbons and reduces the emission of air pollutants.

Q12. Define Electronegative Characteristics.

ELECTRONEGATIVE CHARACTERISTICS:

A Non-metal has property to accept electron easily and form Anion. It is called electronegative character.

Q13. What are halogens? Give their chemical reaction

HALOGENS

Halogen belongs to VII-A group and consists of Fluorine (F), Chlorine (Cl), Bromine (Br), Iodine (I) and Astatine (At). Halogens exist in Molecular form. The reactivity of halogens decreases down the group because atomic size increases and electro negativity decreases down the group

1. Halogens act as oxidizing agent, because they easily accept electron.

$$2Na + Cl_2 \rightarrow 2NaCl$$

2. More reactive Halogen can displace less reactive Halogen form a solution of its salt.$2KCl + F_2 \rightarrow 2KF + Cl_2$

3.Reaction of Hydrogen with Halogen form Halogen acid.

$$H_2 + X_2 \rightarrow 2HX \ (X = F_2, Cl_2, r_2, I_2)$$

The Acidic strength of Halogen Acid decreases in the following order

HI > HBr > HCl > HF

EXERCISE/NUMERICAL

Q1. Identify the elements as Metals, Non-metals and Metalloids from the following elements :-

C, Ca, Sb, S, Sr, Si, K, P, Ba, Ge

Q2. Arrange the following Halogen Acids in increasing order of their Acidic strength: HBr, HCl, HI, HF

Q3. Identify the VIIIA group elements from the following

N, Na, Ni, Ne, Ar, At, He.

Q4. Write names and symbols of Nonmetals of VA group elements.

Q5. Which group contain nonmetals in gaseous state only?

Q6. Write names and symbols of few noble metals?

Q7. Why helmets of astronauts are coated with thin film of gold?

Q8. Why glass surface is coated with gold?

Q9. Why gold is used in jewelry?

Q10. Why platinum is used as catalytic converter in vehicles?

Q11. Write melting point, boiling point, density and moh values of sodium and iron.

Q12. Which metal is found in liquid state?

Q13. Identify the alkaline earth metals from the following elements.

Bi, Br, Ba, B, Se, Si, Sb, Sr