Subject:-BasicChemistry(22102)

Chapter No.	Name of chapter	Marks
4	CHEMICAL BONDING AND CATALYSIS	09
5	METAL CORROSION,ITS PREVENTION AND ELECTROCHEMISTRY	12
6	PAINTS,VARNISHES,INSULATORS,POLYMERS,ADHSIVES AND LUBRICANTS	14
Total Marks :-		35

CLASS TEST - I
PAPER PATTERN

COURSE:- BASIC CHEMISTRY (22102)

PROGRAMME: - ALL

Syllabus:-

Unit No.	Name of the Unit	Course Outcome (CO)
1	**CHEMICAL BONDING AND CATALYSIS**	**102.4**
2	**METAL CORROSION ,ITS PREVENTION AND ELECTROCHEMISTRY**	**102.5**

Q.1	**Attempt all MCQ questions.** **First six questions** **6*1= 6 Marks** **(g) & (h) questions** **2*2= 4Marks**	**Course Outcome (CO)**
a)	Question on first chapter with four options	**102.4**
b)	Question on first chapter with four options	**102.4**
c)	Question on first chapter with four options	**102.4**
d)	Question on second chapter with four options	**102.5**
e)	Question on second chapter with four options	**102.5**
f)	Question on second chapter with four options	**102.5**
g)	Question on first chapter with four options	**102.4**
h)	Question on second chapter with four options	**102.5**

COURSE OUTCOME (CO)

COURSE:- BASIC CHEMISTRY

(22102) PROGRAMME: - ALL

CO.NO	Course Outcome
CO-102.4	Apply the catalysis process in industries.
CO-102.5	Use corrosion preventive measures in industry
CO-102.6	Use relevant engineering materials in industry.

Academic Year 2020-21

Chapter No 04

Chemical Bonding & Catalysis

Total Marks - 09

Chemical Bond Formation

In chemical bond formation, atom interact by losing ,gaining or sharing of electrons so as to acquire inert gas configuration.

Ionic Bond

- An ionic bond formed **by the complete transfer of one or more electrons** from the outermost shell of one atom to another dissimilar atom, so that acquires stable configuration.
- **Examples of electrovalent compounds** are KCl , NaCl ,MgO, AlCl3 , MgCl2 etc.

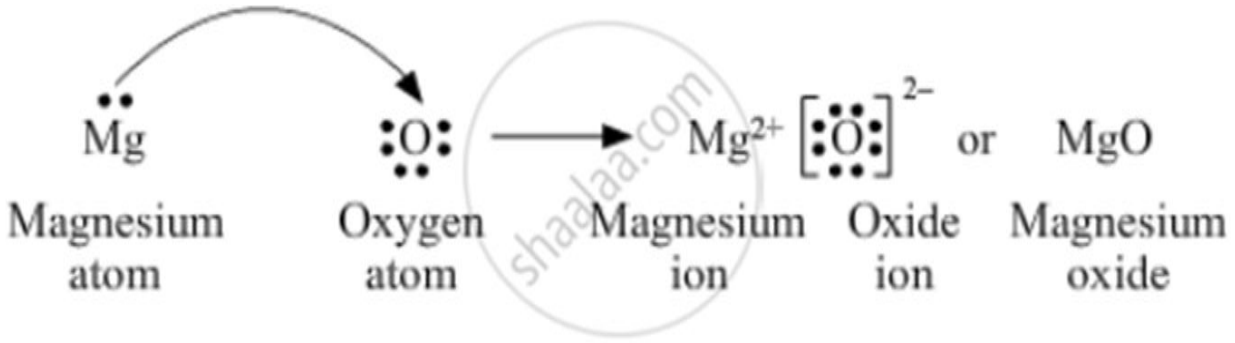
For Example : Formation of MgO Molecule :

- Number of valence electrons – 2

To attain stable configuration Mg atom loses its two valence electrons and become an ion with two positive charges (Mg++)

- O-atom A=16 , Z=08 Electronic Configuration-2,6

Number of valence electrons – 6



Q .1. The loss & gain of electron from atom of element forms bond ----------

(a) Covalent bond **(b) Electrovalent bond**
(c) Co-Ordinate bond (d) Hydrogen bond

Q.2.The arrangement of eight electron in outer most shell of an atom is ----------

(a) Octet (b) Duplet
(c) Triplet (d) None

Q.3..Electronic Configuration of Sodium (Na) ----------

(a) 2,8,1 (b) 2,6
(c) 2,8,8 (d) 2,4

Q.4. Ions posses charge which depends on los & gain of ----------

(a) Neutron (b) Nucleons
(c) Proton **(d) Electron**

Covalent Bond

- Covalent Bond is formed by Sharing of electrons in pairs between two similar or dissimilar atoms.
- **OR** 'The valency obtained by the mutual sharing of electrons between similar or dissimilar atoms so as to complete their last orbit is called Covalent bond.
- Sharing of electrons take place by three ways (Types of Covalent bond)

Q.5.Representation of bond by single, double, triple line is done in ----------

(a) Covalent bond (b) Hydrogen bond

(c) Ionic bond (d) Co-Ordinate bond

Formation of Covalent compound

1.Single covalent bond

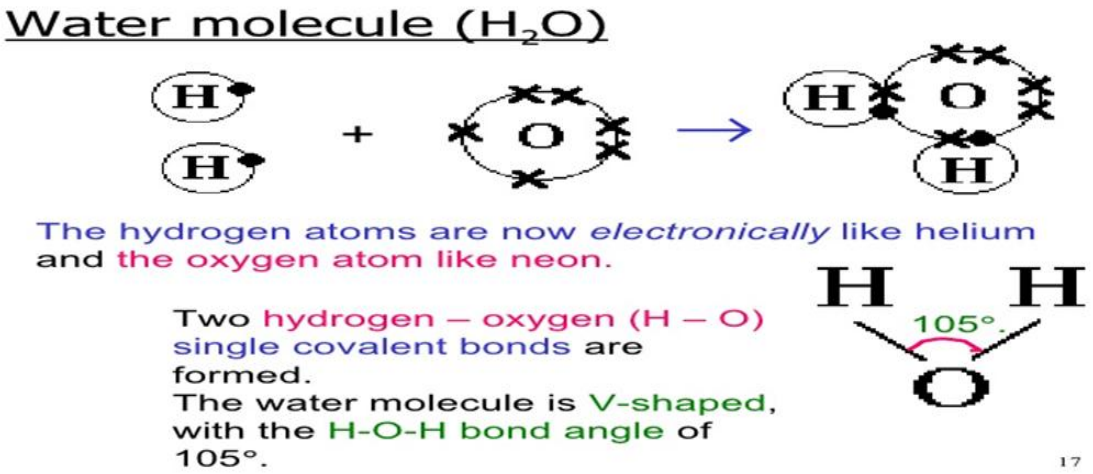
When a covalent compound is formed by mutual sharing of one pair of electrons between two atoms is called as Single covalent bond.(-)

Ex.H_2O,NH_3,Cl_2,H_2,CH_4

Q.6.The Covalent bond is formed by ……..

(a) Sharing of electrons (b) loss of electrons

(c) Gain of electrons (d) one sided sharing of electrons



Q.7.In Water molecule ……pairs are shared between hydrogen and oxygen.

(a) one (b) two

(c) three (d) four

Q.8.Electronic Configuration of Oxygen (O) -------

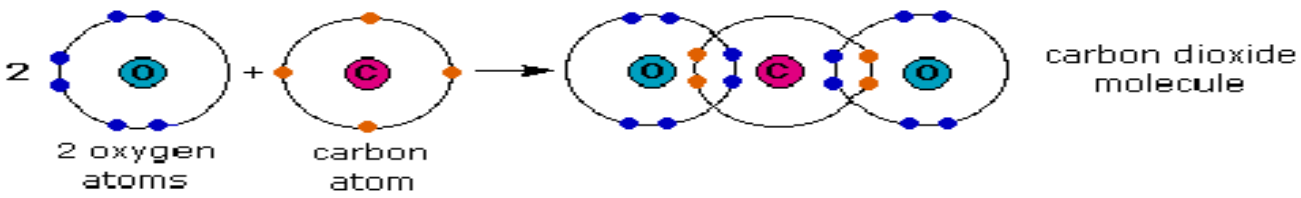
(a) 2,8,2 **(b) 2,6**

(c) 2,8,8 (d) 2,4

2.Double covalent bond

- When a covalent compound is formed by mutual sharing of two pairs of electrons between two atoms is called as Double covalent bond.(=) Ex.CO2,O2,C2H4

Reaction of Carbon dioxide and Oxygen molecule:



Q.9.In CO_2 molecule ……pairs are shared between hydrogen and oxygen.

(a) one **(b) two**

(c) three (d) four

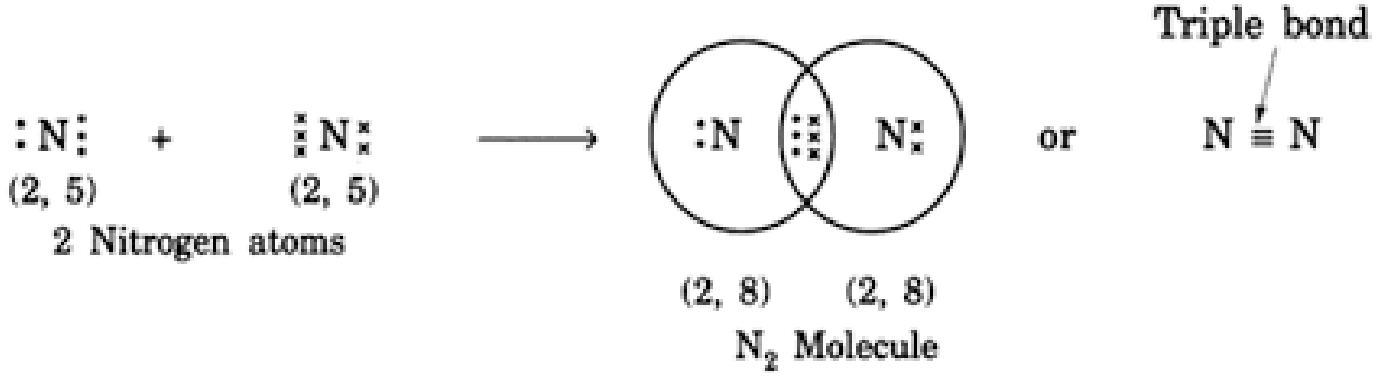
Q.10.Electronic Configuration of Carbon (C) ----------

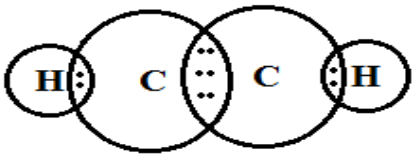
(a) 2,8,2 (b) 2,6

(c) 2,8,8 **(d) 2,4**

3.Triple covalent bond

- ❖ When a covalent compound is formed by mutual sharing of three pairs of electrons between two atoms is called as Triple covalent bond. (≡) Ex.CO2,O2,C2H4 .





Structure of Ethyne molecule

Electron dot structure of Ethyne

Structural formula of Ethyne

Q.11.Nitrogen molecule is formed by mutual sharing of electron are -------

(a) Five **(b) Three**

(c)Two (d) One

3.Co-ordinate or Dative bond :

- It is a special type of covalent bond in which the shared electrons are contributed by one atom only, while the atom accepts their sharing without any contribution of electrons.
- Co-ordinate or Dative bond is generally represented by an arrow head (⟶), Starting from the donor and ending at the acceptor.
- After sharing of electron pain each atom gets stability.

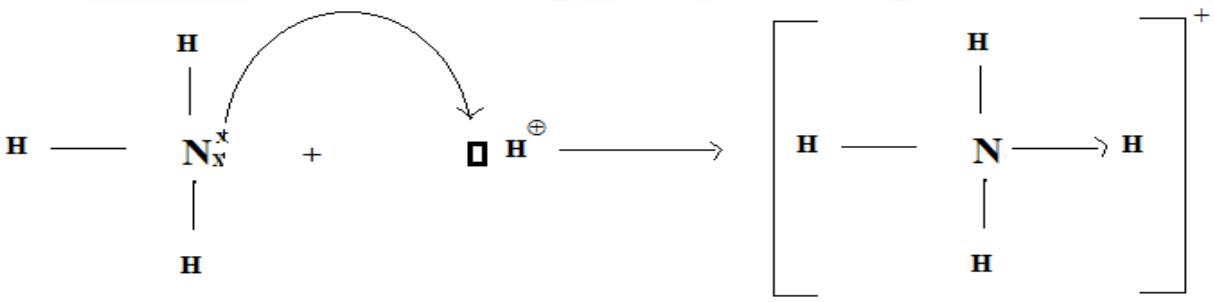
Q.12.Dative bond is the another name of----------

(a) Ionic bond (b) Electrovalent bond

(c) Covalent bond **(d) Co-Ordinate bond**

Co-Ordinate Bond Examples

Formation Of Ammonium Ion



AMMONIUM ION

Q.13. Dative covalent bond is found in----------

(a) Ammonia **(b) Ammonium Ion**

(c) Urea (d) Nitrogen

4.Hydrogen bond

- The negative end of one molecule attracts the positive end of the other and as a result, a weak bond is formed between them. This bond is called the hydrogen bond.
- **Example Hydrogen Bonding in Hydrogen fluoride -** Fluorine having the highest value of electronegativity forms the strongest hydrogen bond.

Types of Hydrogen Bonding

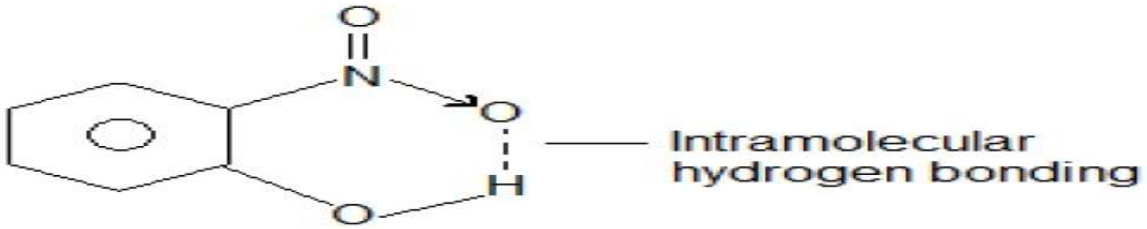
- There are two types of H bonds, and it is classified as the following:

1.Intermolecular Hydrogen Bonding

- When hydrogen bonding takes place between different molecules of the same or different compounds, it is called intermolecular hydrogen bonding.
- For example – Hydrogen bonding in water, alcohol, ammonia etc.

2.Intramolecular Hydrogen Bonding

- The hydrogen bonding which takes place within a molecule itself is called intramolecular hydrogen bonding.
- For example – p- nitrophenol , Salicylic acid



Q.14.Compound with identical crystal structure and analogous chemical formula are called—

(a) Isomers (b)Isotones

(c) Allotropes (d) Isomorphous

Q.15.---------Molecule does not have hydrogen bonding.

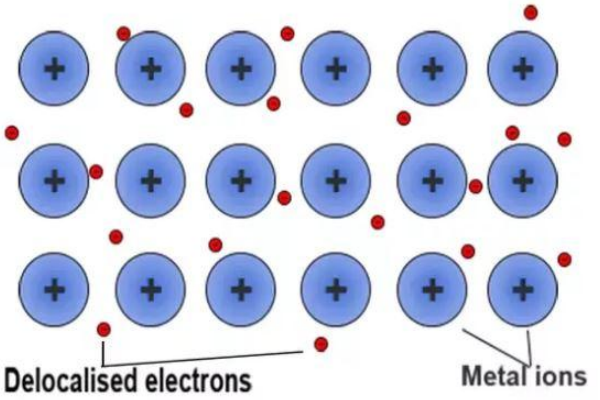
(a) Benzene (b) Hydrogen Fluoride

(c) water **(d) Liquid Ammonia**

5.Metallic bond

- The metal lattice is held together by the strong forces of attraction between the positive nuclei and delocalized valence electron is called as metallic bond.

- Metallic bonding is the electrostatic attractive force between valence electrons and positively charged metal ions .
- Examples- Pure metal Na , Al , Cu , Ag , Au



Q.16.Metals having bright shiny surface , this property is called---------

(a) Metallic conduction (b) Castability

(c) Forgeability **(d) Metallic lustre**

Q.17.Electron sea exists in----------

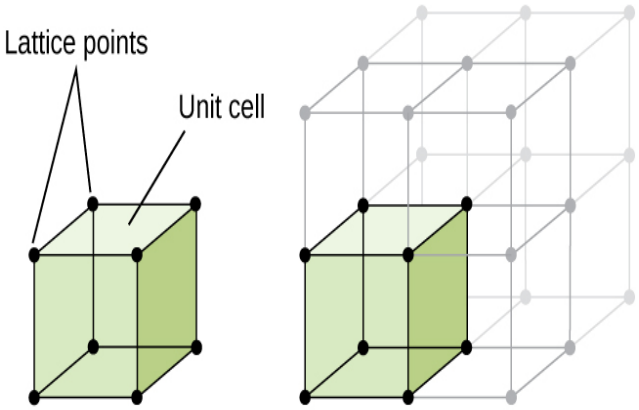
(a) Polar bonds (b)Ionic bonds

(c) Covalent bonds **(d) Metallic bonds**

MolecularArrangement

Matter has the unique property of existing in different temperature and pressure.

Crystal Lattice and Unit Cell



- Crystal lattice is three dimensional structure formed by its constituents of atom or molecules or ions.
- **Unit Cell** – It is small representative group of atoms or molecules called as a Unit cell.
- Unit cell is the smallest building unit of a crystal lattice which , when repeated in all direction generate entire lattice of crystal.

Q.19. Repeatable entity of a crystal structure is known as----------

(a) Crystal (b) lattice

(c) Unit cell (d) Miller indices

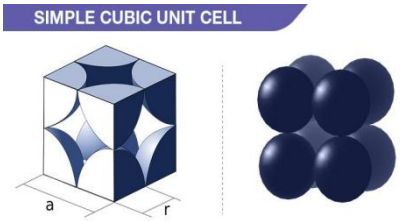
- **Unit cell described as 1.Simple cubic (SC),**

2.Body centered cubic (BCC) ,

3.Faced centered cubic packed (FCC).

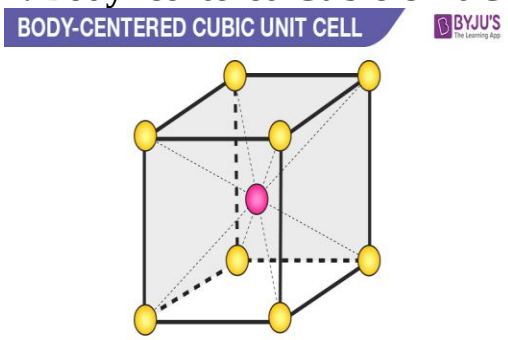
- All structure can be changed depending in temperature.

1.Simple cubic



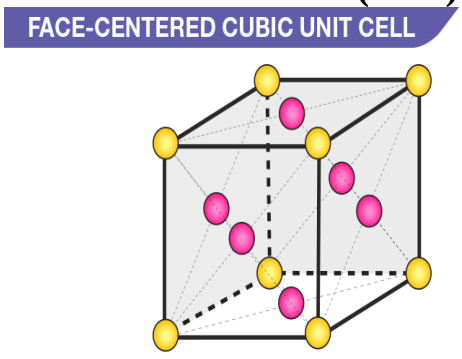
1.The atoms in the **primitive cubic unit cell** are present only at the corners
2.Every atom at the corner is shared among eight adjacent unit cells
3.Four unit cells are present in the same layer
4.Four unit cell in the upper/lower layer

2. Body- centered Cubic Unit Cell (BCC)



1.A BCC unit cell has atoms at each corner of the cube and an atom at the center of the structure. The diagram shown below is an open structure. According to this structure, the atom at the body center wholly belongs to the unit cell in which it is present.
2.In BCC unit cell every corner has atoms

3.Face centered cubic (FCC) Structure



1.An FCC unit cell contains the atom present at the face-centered is shared between 2 adjacent unit cells and only 1/2 of each atom belongs to an individual cell.
2.In FCC unit cell atoms are present in all the corners of the crystal lattice
Also, there is an atom present at the center of every face of the cube
3.This face- center atom is shared between two adjacent unit cells
Q. 20.Co- ordination number of hexagonal close packing is ----------
(a)8 (b) 4

(c) 12 (d) 6

Q. 21.Aluminium & gold has crystal lattice.

(a) Body centered cubic structure (b) Simple cubic structure

(c) Face centered cubic structure (d) None of these

Q.22. Crystal lattice is actually ----------

(**a) arry of points** (b) Lines of points

(c)Sum of points (d) Triangles of points

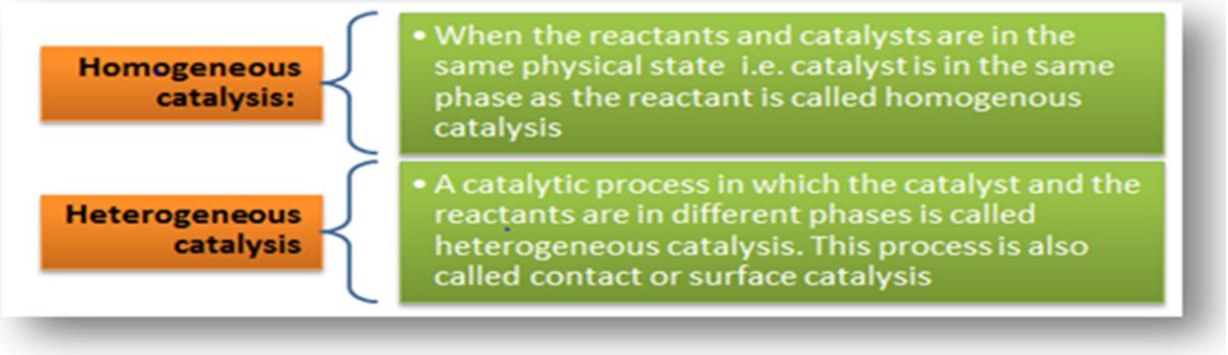
Q.23. Lattice energy is decreased when size of anion is----------

(a) Decreased (b) Increased

(c) Remains same (d) No change

Catalysis-The phenomenon of altering the velocity of a chemical reaction by presence of the catalyst is known as catalysis

TypesofCatalysis-



Q. 24.A Catalyst cannot affects ----------

(a) Product (b)Rate of reaction

(c) Reactants (d) both (a) & (b)

TYPES OF CATALYST

Positive Catalyst	Negative Catalyst	Auto Catalyst
When a catalyst accelerate the speed of reaction is called Positive Catalyst.	When a catalyst retards the speed of reaction is called Negative Catalyst.	When one of the product formed in the reaction acts as a catalyst is called as Auto catalyst.
EX.Rate of decomposition of KClO3 is increased in the presence of MnO2.	EX.Rate of oxidation of Chloroform is decreased in presence of alcohol catalyst	

Q.25.The substance which decrease the efficiency of a catalyst is known as ----------

(a) Positive catalyst (b) Auto catalyst

(c) Negative catalyst (d) Catalytic inhibitors

Q.26.The substance which Increases the efficiency of a catalyst is known as ----------

(a) Positive catalyst (b) Auto catalyst
(c) Negative catalyst (d) Catalytic inhibitors

Q.27.When a product acts as a catalyst then it is called as……..
(a) Self catalysis **(b) Autocatalysis**
(c) Positive catalysis (d) none of these

Catalytic Promoter & Inhibitor

1.Catalytic Promoter

The substance which are add with catalyst in a chemical reaction to increase the efficiency of the catalyst are called catalytic Promoters.

2.Inhibitor

The substance which are add with catalyst in a chemical reaction to decrees the efficiency of the catalyst are called catalytic Inhibitor.

Q.28.The substance that reduced the effectiveness of a catalyst are called……
(a) Inhibitors (b) Autocatalysis
(c) Polymer (d) none of these

Q.29.Substance which either increases or decrease rate of chemical reaction without any chemical change------
(a)Catalyst (b) Polymer
(c) Rubber (d) Thermo Cole

Industrial Application

1.Catalytic converters are used in automobiles to convert harmful pollutants in exhausts in to less harmful substances through oxidation – Reduction reactions.
2.Catalysts are used in industrial production of many basic chemicals like ammonia, nitric acid, sulphuric acid, methanol etc.
3.Catalysts are used for production of bio-fuels from corn,switch,grass trees.
4.Catalysts are used in water softening and treatment plants.
5.Catalysts are used in batteries and fuel cells to improve their durability and efficiency.

Q.30.Polythene & Polypropene formation is catalyzed by ----------
(a) Hydrogen (b) Iron
(c) Ziegler natta catalyst (d) Peroxide catalyst

Chapter No – 05
Metal Corrosion, its Prevention & Electrochemistry

Total Marks - 14

……

1.Corrosion is nothing but the deterioration of a substance due to its reaction with its environment.

2.The tendency of the metals to undergo such reaction readily with atmospheric gases and other matters .

3.There are few other impurities of atmosphere which also affect metals ,forming carbonates,suphides etc.

- **Definition and Types of Corrosion**

Corrosion-Any process causing decay or destruction of any material is known as "Corrosion".
There are two types of corrosion.

1. Dry CORROSION
2. WET CORROSIO

Q1.Corrosion is the example of…….

(a)Oxidation (b) reduction
(c) Electrolysis (d) erosion

Q.2.During corrosion metal converts in to …….

(a) hydroxide **(b)oxide**
(c) carbonates (d)all of the above

Q.3. Rusting is a special term,given to the corrosion of which metal.

(a) zinc (b) copper
(c) nikel **(d) iron**

Mechanism of Dry or Atmospheric Corrosion

1. **Oxidation corrosion (reaction with oxygen):**

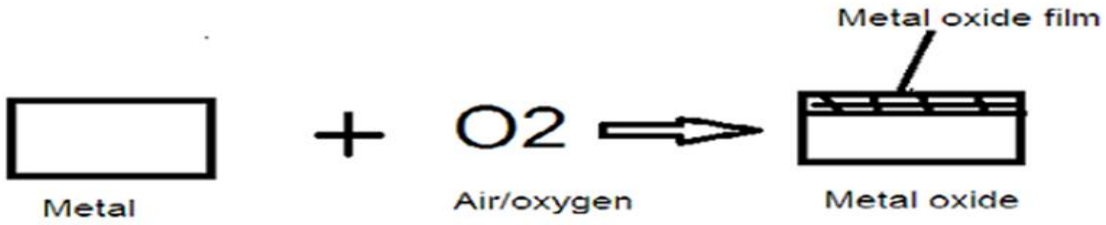
$$2M \xrightarrow{\text{Loss of electrons}} \underbrace{2M^{n+}}_{\text{Metal ions}} + 2ne^-$$

$$\frac{n}{2}O_2 + 2ne^- \xrightarrow{\text{Gain of electrons}} \underbrace{nO^{2-}}_{\text{Oxide ions}}$$

The overall reaction can be given by

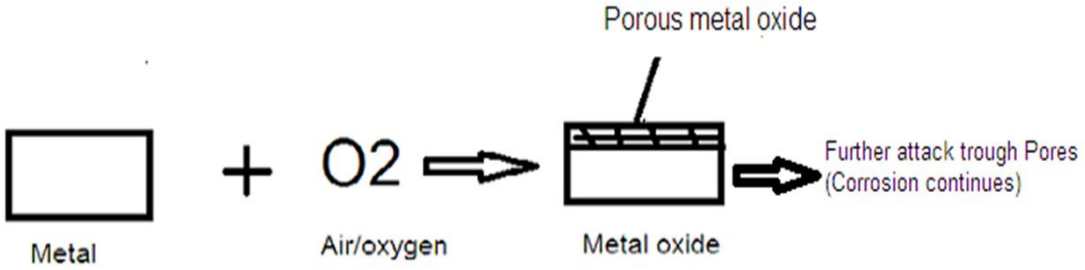
$$2M + \frac{n}{2}O_2 \rightarrow \underbrace{2M^{n+}}_{\text{Metal ions}} + \underbrace{nO^{2-}}_{\text{Oxide ions}} \rightarrow \text{Metal oxide}$$

In the above reaction,the electrons are transferred from metal atom to oxygen. Metal looses electrons while oxygen accepts electrons forming their respective ions. These two types of ions combine together to form metal oxide layer.



1) Stable film-Stable film is tightly adhering and impervious in nature.
It was having two sub-types.

1) Porous (Non-Protective)-This type of film is observed on the surfaces of alkali metals (Li,K,Na) & alkaline earth metals(Ca,Sr,Mg)



*Porous oxide film permits free access of oxygen to the fresh metal surface below (through pores)thus corrosion continues.

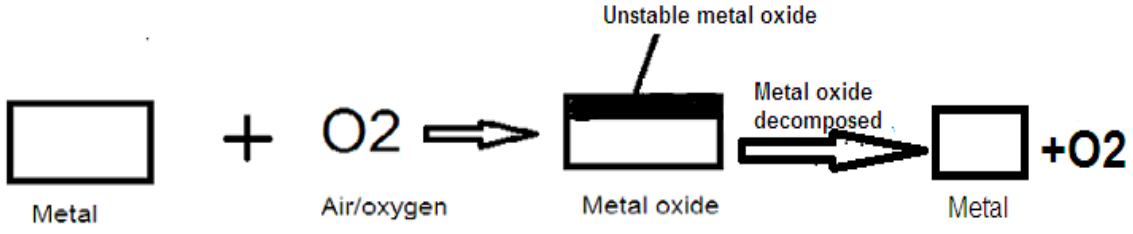
- **2)Non-Porous(Protective)-**
- The metal like aluminum forms oxide (Al2O3) whose volume is greater than the volume of metal (Al).
- This oxide film is extremely adherent and non-porous (Protective).Due to absence of pores or cracks in the oxide film, it forms a barrier for further action and therefore, the rate of oxidation of metal rapidly decreases.
- Aluminum oxide film covers all surface area of metal, hence aluminum metal is not undergoes corrosion.

2)Unstable film-

When the oxide film is unstable ,it decomposed back into the metal and oxygen, as soon as it is formed.

Corrosion is not possible in case of noble metals such as sliver, gold, platinum.

Cycle of formation and decomposition of film is continuously so corrosion of metal is not take place.



*Cycle of formation and decomposition of film is continuously so corrosion of metal is not take

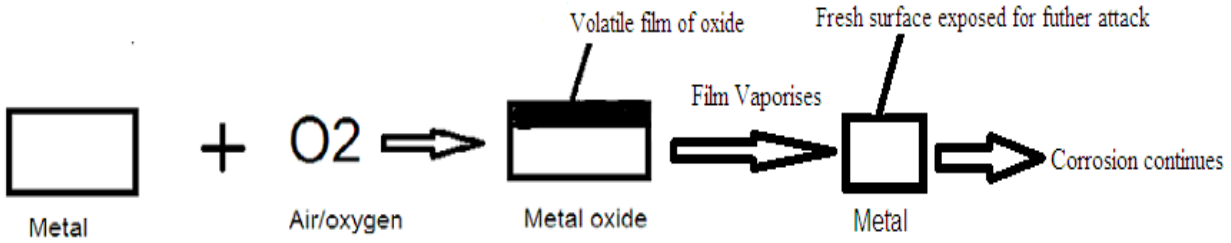
place.

Volatile film- When the oxide film is volatile ,it vaporizes as soon as it is formed on the metal surface.

Therefore the fresh metal surface is exposed continuously to the atmosphere.

It cause rapid corrosion, molybdenum oxide, stannic chloride

.



*Volatile substance are the substance those evaporate at the room temp.so volatile film is vaporized so fresh metal is available for corrosion.

Q4.Which oxide film is non-protective?

(a)stable porous (b)stable non-porous

(c)volatile (d)both (a) & (b)

Q5.Which film is more protective?

(a) Porous **(b) non-porous**

(c) volatile (d)none of the above

Wet corrosion or Electro-chemical corrosion or Immersed corrosion-

The corrosion which is brought about through ionic reaction in the presence of moisture or solution as a conducting medium when two dissimilar metals are in contact with each other is called as wet corrosion or electrochemical corrosion.

Explanation-

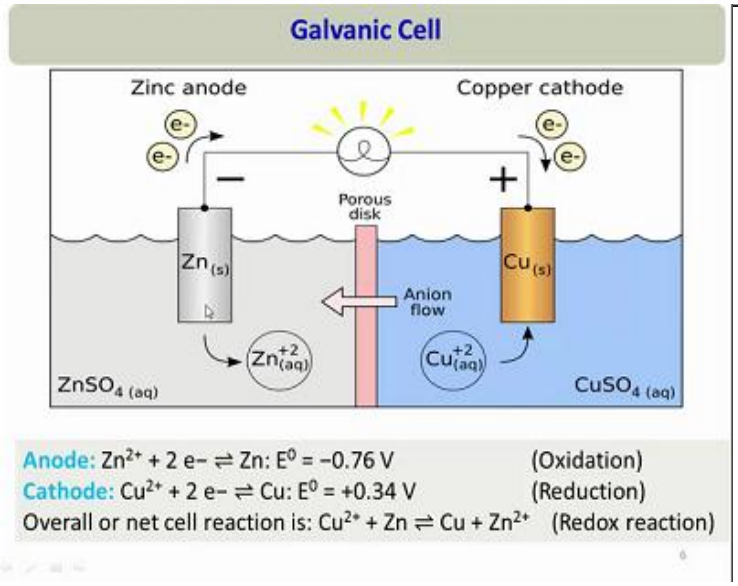
*If two dissimilar metals are dipped in a solution ,the solution acts as a conducting medium between them. One of the metal acts as the anode and other acts as cathode.

*The anode gives off ions in the solution , so anodic metal is destroyed by either dissolving hence anode gets corroded.

*The cathode receives the ions and forms protective coating, hence it is not corrected.

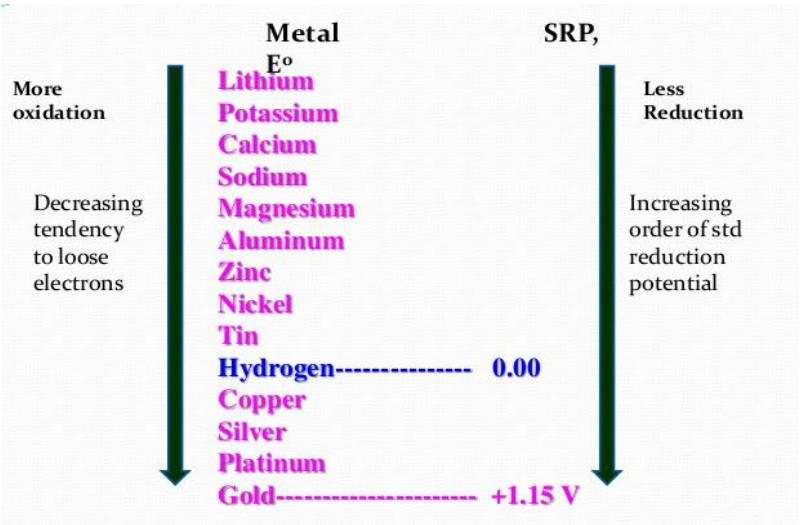
*It having sub type- 1)Galvanic cell corrosion
2)Concentration cells

1.Galvanic cell corrosion-When two dissimilar metal are electrically connected and dipped in an electrolyte solution, galvanic cell is formed.



Here zinc is act as a anode and it losses electron and copper acts as cathode it gains electron so zinc undergoes corrosion.

GALVANISING SERISE



Q.6. When two dissimilar metals are electrically connected, then more active metal become……

(a) Cathode & gets protected (b) Cathode & undergoes corrosion

(c) Anode & gets protected **(d) Anode & undergoes corrosion**

Q.7.The metal at the top of electrochemical series is…….

(a) most stable (b) more noble

(c)less active **(d)most active**

Q.8. The corrosion of metal by galvanic cell action take place on account of the impurities ……

(a) noble metal (b)less active metal

(c) more active metal (d) none of these

Q.9 Which of the following is intert to oxidation?

(a) Cu (b) Fe

(c) Steel (d) Pt

Q.10 Zinc-Copper electrochemical cell is called ……..

(a) Concentration cell (b)Electrolytic cell
(c)Daniel cell (d) Dry cell

Q.11. Standard electrode potential of $Zn^{2+/}Zn$ is…….
(a)-0.76V (b)+0.76
(c)-2.76 (d)+2.76

Q.12. Standard electrode potential of hydrogen is…
(a)1.00V **(b)0.00V**
(c)0.01V (d)0.001V

Q.13. Which is the most active metal ?
(a)Au (b)Ag
(c)Cu (d)pt

Q.14. Metal at the bottom of galvanic series are ……..
(a)Most stable (b)Least stable
(c)Most active (d)highly corroded

- **Mechanism of the Galvanic cell corrosion-**

- **<u>HYDROGEN EVOLUTION MECH-</u>**

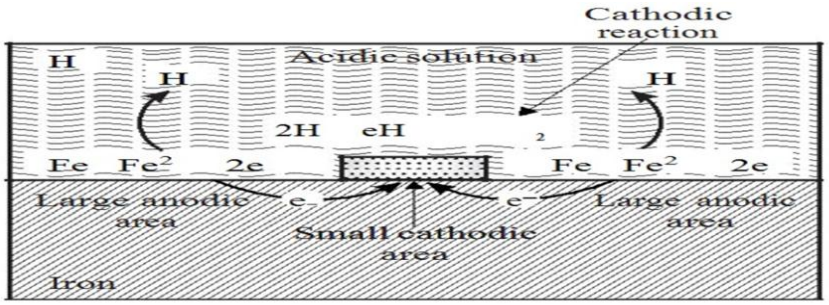


Fig.(a) Mechanism of electrochemical Corrosion with evolution of hydrogen

Overall Chemical Reaction

$$Fe + 2H^+ \rightarrow Fe^{2+} + H_2$$

Oxidation Half Reaction

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

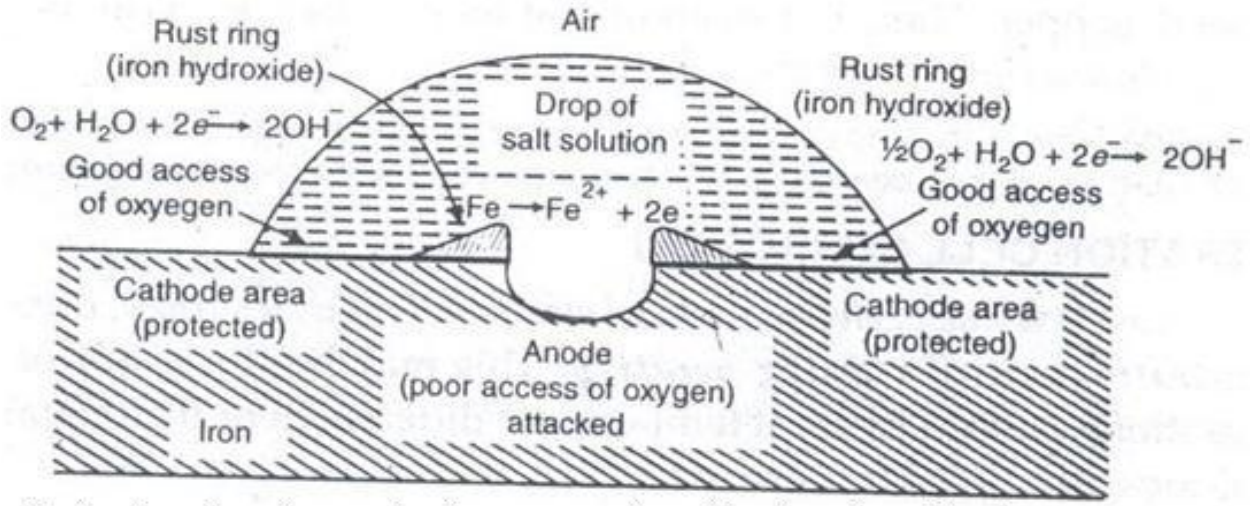
Reduction Half Reaction

$$2H^+ + 2e^- \rightarrow H_2$$

At-Anode loss of Electron

At- Cathode gain of Electron

- **Oxygen Absorption Mechanism-**



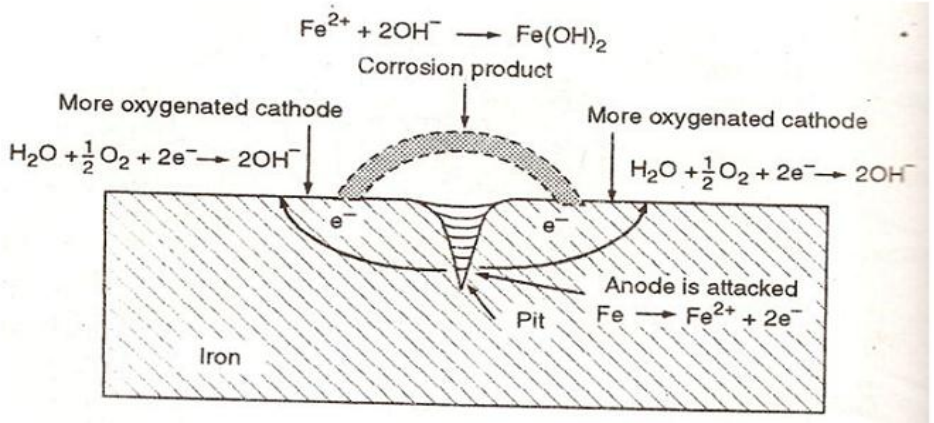
Mechanism of wet corrosion by oxygen adsorption (rusting of iron)

Q.15) Oxygen absorption mechanism of metal is observed when corrosion medium is……..
(a)Acidic **(b)Basic**
(c)Neutral (d)Basic & neutral

Q.16) Electrochemical corrosion in acidic medium with evolution of hydrogen……..
(a)Cathode have larger area than anode
(b)Anode have larger area than Cathode
(c)Area of cthode and anode similar
(d)None of these

Q.17) Corrosion occurs with evolution of hydrogen in medium**.**
(a) Neutral (b)Basic
(c) Alkaline **(d) Acidic**

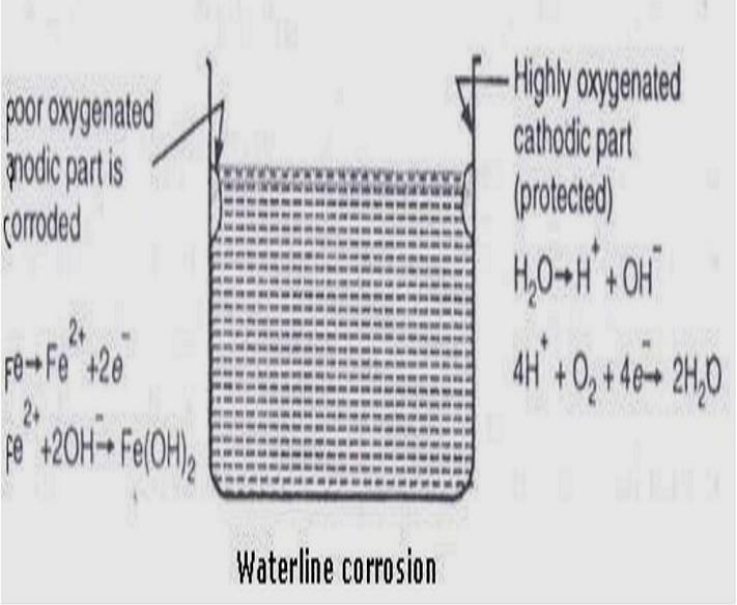
- Pitting corrosion-Pitting corrosion is a localized accelerated attack at some place on metal surface ,resulting in the formation of pits, holes or cavities in metal.
- Pitting corrosion occurs due to breakdown of protective film on a metal at specific point.



As a result of pitting small anodic and large catholic areas are developed and this gives rise to corrosion current in corrected environment.

* The rate of corrosion is increased after formation of pit.

- **Waterline Corrosion-**



*When water is stored in a steel tank it is generally found that the maximum amount of corrosion takes place along a line just beneath the level of the water.
*The area above the waterline acts as cathodic area (highly oxygenated) and is completely unaffected by corrosion.
*Poor oxygenated area are acts as anode so, it undergoes corrosion.
*Waterline corrosion is also caused in marine ship and is accelerated by marine plants which are attached to the sides of ship.
*This type of corrosion is prevented by painting the sides of ships by special antifouling paints.

Q.18.Pitting corrosion is due to……
(a)Breaking of oxide layer of the metal (b) Acidity
(c) Stress in the metal **(d) all of the above**

Q.19. In water line corrosion the maximum amount of corrosion take place…….
(a)Along a line just above the level of water meniscus
(b)Along a line at the level of water meniscus
(c)Along a line just below the level of water meniscus
(d)at the bottom of the vessel

Factors affecting the rate of corrosion

Nature of the metal	Nature of the Environment
1.Position in the galvanic Series	1.Temperature
2.Purity of metal	2.Humidity
3.Physical state of the metal.	3.Effect of pH
4.Nature of the oxide film.	4.Conductance of the medium
5.Relativeareas of anode and cathode	5.Differential aeration

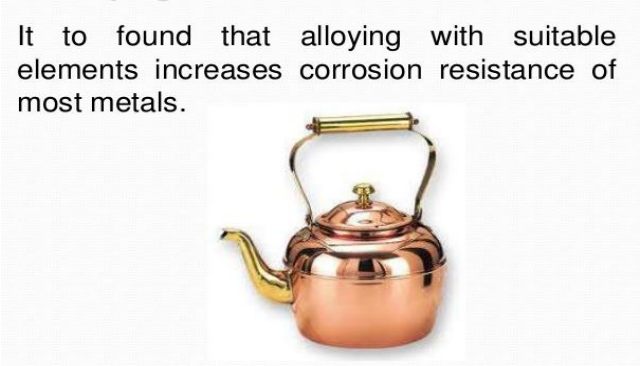
6.Solubility of the corrosion Product.	6.Presence of impurities.

Q.20) Passivity is due to…….

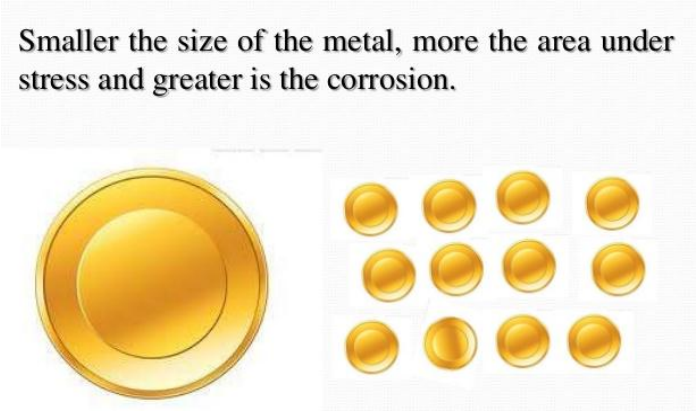
(a) Suitable PH
(b) Application of suitable EMF
(c) Formation of adhering oxide film
(d)All of these

2.Purity of Metal-

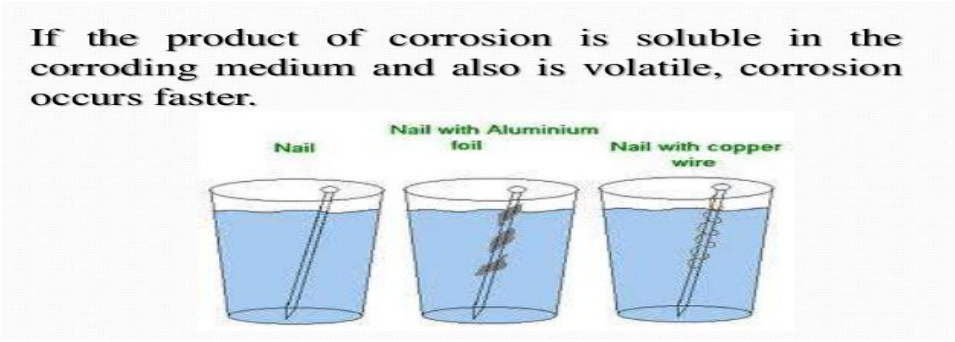
2.Metal Alloy



3.Physical State of Matter



- **4..Solubility of the corrosion Product.**

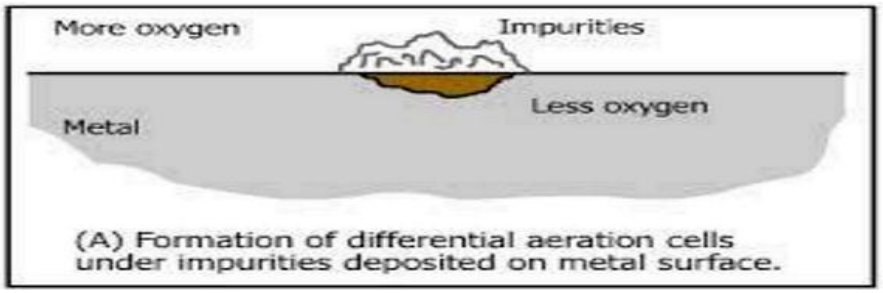


- **<u>5.Differential aeration</u>**

*Differential Aeration Corrosion takes place when there is an uneven supply of oxygen to areas of the same metal component. It is a type of electrochemical corrosion that affects metals such as steel and iron. ... This is where the oxidation occurs, corrosion product forms and a pit develops weakening the metal.

*The is in the poor oxygenated area so it undergoes in corrosion

- Part of metal exposed to air is more oxygenated part & acts as CATHODE
- Part of metal immersed in electrolyte is poorly oxygenated & acts as ANODE



(A) Formation of differential aeration cells under impurities deposited on metal surface.

- **Conductance of the medium-**

A dry sandy soil has much less conductance and there fore the rate of electrochemical corrosion of the metal in contact with such soil is very less. While the clay, mineralized soil, sea water have much higher conductance and cause fast corrosion of the me.tal by electrochemical corrosion

Q.21) Metals can be protected from corrosion by……..

(a) Formation of alloy of metal (b)Purification of metal

(c)Making of metal cathode **(d)All of these**

Q.22.) Differential aeration principle is the……

(a) Absorption of oxygen (b) Evolution of hydrogen

(c) Absorption of Hydrogen **(d)Difference in air concentration**

- **Corrosion Control-**

1.Modification of the Environment- a)Removal of Corrosion Stimulants
b)Use of corrosion Inhibitors

2.Cathodic Protection -a)Using Sacrificial anode
b) Using Impressed current

3.Use of protective coatings -a)Galvanizing
b) Tinning

1.Modification of theEnvironment- a)Removal of Corrosion Stimulants-To prevent corrosion due to oxygen , dissolved oxygen from water is removed by physical or chemical means.

b) Either deaeration is done or reducing substance are add like N2H4,Na2SO3 etc.

C)To prevent corrosion by moisture from air is removed by dehumidification.

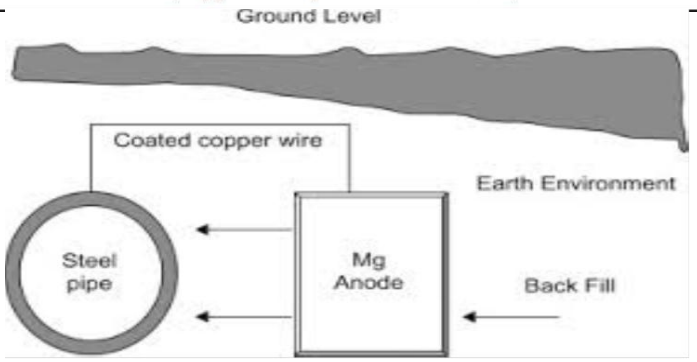
2.Use of Corrosion Inhibitors-

a) Inhibitors are organic or Inorganic sub. Which when added to the environment are able to reduce the rate of corrosion. It forms physical barrier between metal and medium.

b) Quinoline, Organic amines cyanides chromates are effective inhibitors.

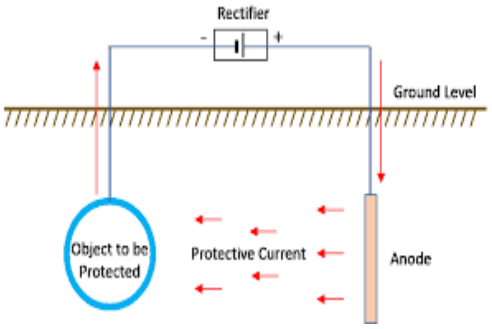
Cathodic Protection-

- **A)Using sacrificial anode-**



- The metallic structure to be protected from corrosion is connected to the anodic metal(active)by an insulating wire.
- The more active metal like Zn,Al,Mg.acts as a anode and gets corroded ,hence it is known as sacrificial anode.
- For increasing electrical contact the active metal placed in back fill (coal+Nacl)
- When the sacrificial metal is consumed completely, it is replaced by fresh piece.
- This method is applicable to protect buried pipeline, buried cables, hot water tank, ship null.
- Mg or Zn rods are bolted along the sides of ship, hot water tank or inserted in to boiler to prevent corrosion.

2.Using impressed current-



- An impressed current is applied in opposite direction to nullify the corrosion current and covert the corroding metal from anode to cathode.
- The impressed current is derived from a D.C source and given to insoluble anode like graphite, stainless steel, buried in soil.
- The negative terminal of D.C.is connected to the pipeline to be protected.
- The anode is kept in back fill ,To increase electrical contact with the surrounding soil.
- Cathodic Protection is applicable to-
  Open box cooler,water tanks,burried water pipeline,condensers,transmission line towers, marine piers

Q.23) One of the common sacrificial anodic metal is……

(a) Zinc **(b) Magnesium**
(c) Copper (d) Titanium

Q.24) Heavy Machineries protected by making it cathode inserting near by anode, due to…….

(a)Sacrifice anode (b) Inactivity

(c)Absorbtion of hydrogen (d) Noble character

- **Metal coating-**
- Coating of more active metals like zinc,aluminium,cadmium protect the base
- Metal from corrosion. In this case base metal acts as a cathode and coating metal become an anode.
- **1. Galvanizing**-Galvanizing is the process of coating iron or steel sheet with a thin coat of zinc to prevent it from rusting.

In which zinc acts ass a anode and undergoes corrosion while base metal acts as a cathode and gets protected

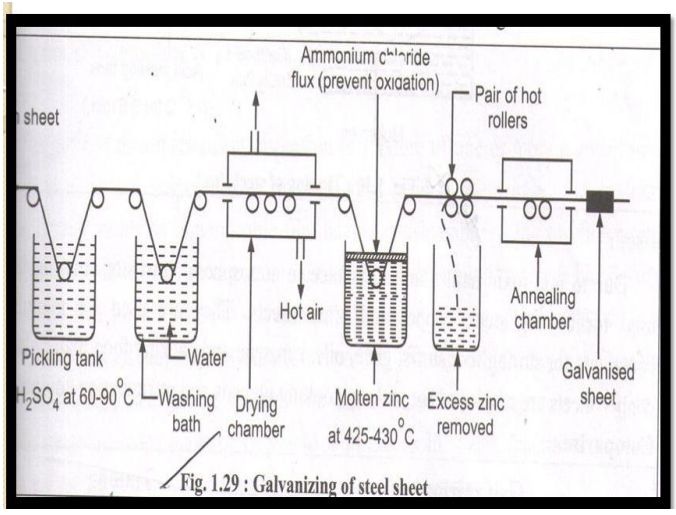
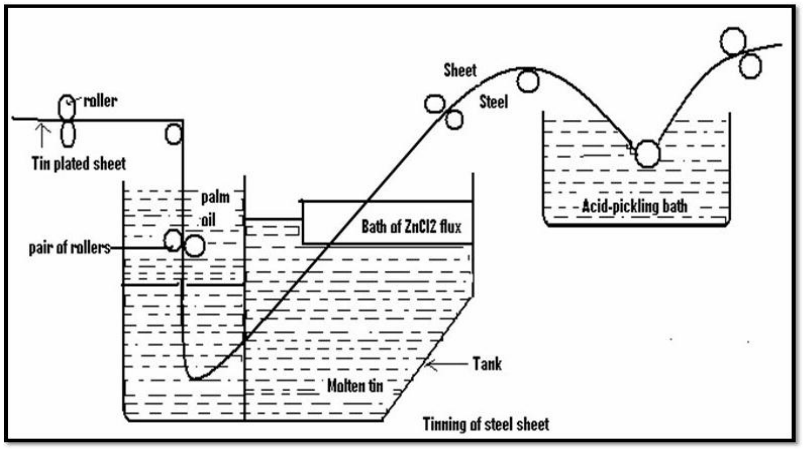


Fig. 1.29 : Galvanizing of steel sheet

- Tinning-It is the process of covering iron or steel sheets with a thin coat of tin to prevent it from corrosion.
- Tinning is less electropositive metal than molten metal than iron and therefore, it is more resistant to chemical attack. Tin having low melting point 232 c.It is used for mfg. of tin cans for storage of food stuff..

TINNING OF STEEL SHEET



Q.25.) The process in one metal is coated on another metal by electrolysis is known as…….

(a)Hot dipping **(b) Electroplating**
(c) Cementation (d) cladding

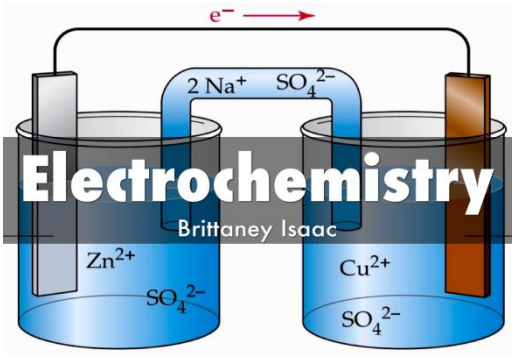
Q.26) Coating of Tin on iron by hot dipping process is known as……..
(a)Sherardizing (b) colorizing
(c) Tinning (d) Galvanizing

Q.27) Electro refining of metal is……..
(a) purification of metal (b) extraction of metal
(c)Fabrication of metal (d) metallurgy of metal

Q.28).Zn is more ……..than Fe
(a) Electronegative (b) Corrosive
(c)Electropositive (d) None of above

Q.29) When object is galvanized, what metal is used to protect the iron.
(a) Aluminum (b) Copper
(c) Nickel **(d)Zinc**

Q.30) Corrosion can be prevented by…….
(a)alloying (b) Tinning
(c)Galvazing **(d)all of the above**



Definition of Electrochemistry

- Electrochemistry – A branch of physical chemistry deals with interconversion of chemical energy and electrical energy.

A quantitative relation between chemical energy and electrical energy.

Conductor : The substance which allows the electric current to pass through it is called as Conductor.

Ex. All metals , Graphite, Fused salts, Aqueous solutions of acids ,Bases and Salts

Different terms involved in electrolysis

Non- conductor (Insulators) : The substance which not allow electric current to pass through it is called as non-conductor.

Electrolyte : The substance which is in fused state or aqueous solution liberates ions and allows the electric current to pass through it , resulting in the chemical decomposition known as electrolyte.

Ex. NaCl Na+ + Cl –

Types of Electrolytes :

Strong Electrolyte : The electrolyte which ionizes completely in solvent is called as Strong electrolyte. Ex. HCl, H2SO4, HNO3, KOH

Weak Electrolyte : The electrolyte which ionizes partially in solvent is called as Weak electrolyte.

Ex. H_2CO_3 , CH_3COOH, NH_4OH

Q.31) Ionization of an electrolyte increases on dilution ,till the complete ionization.

(a) Sugar (b) Urea

(c)Glucose **(d) All of these**

Q.32) Which of the is the weak electrolyte?

(a) NaoH (b) KOH

(c)$Ca(OH)_2$ (d) Alky amines

Q.33) The substance which get highly ionized is called …….

(a) Weak electrolyte (b) Strong electrolyte

(c) Both (d) None

Q.34) The cell which cannot be recharged is…….

(a)Secondary cell (b) Ni-Cd cell

(c) fuel cell **(d) primary cell**

Q.35) Which is strong electrolyte**?**

(a) HCl (b) HNO_3

(c) H_2SO_4 (d) All

Application of Electrolysis

- **There are two applications:**

  1] Electroplating

  2] Electro-refining

1.Electroplating

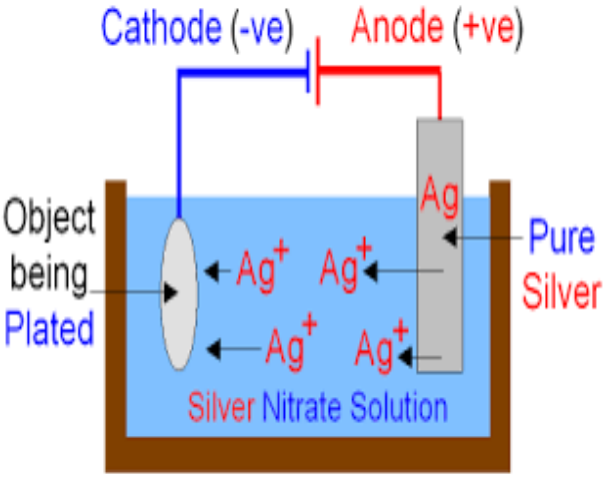
- The process of producing metallic coating of more resistant metals (like silver,gold,nickel,chromium) on the base metal with the help of electric current is called as electroplating.
- In electroplating the active coating metal act as anode, deposits on cathodic article by passage of electric current into cell.
- Example : Electroplating of Silver

The electrolytic bath used for electroplating with silver.

Electroplating of Silver on Iron article

- Electrolyte : Potassium argenrocyanide solution K[Ag(CN)2]
- Electrodes : Cathodes : Clean articles to be coated made as cathode
  Anode : Plate or block of pure silver metal as anode
- Electrolytic procedure : On passing direct electric current at the applied voltage , the article gets plated with a smooth and brighter deposit of silver.

At Anode : Ag Ag+ + 1e-
At Cathode : Ag+ + 1e- Ag



Advantages of Electroplating

1. Improves the appearance of the base metal.
2. Electroplated metal become resistant to corrosion, chemical attack and wear.
3. Increases hardness of base metal.

Applications of Electroplating

- Electroplating is used for decoration or better appearance.
- Plating for protection
- Plating for special surfaces

Electro refining

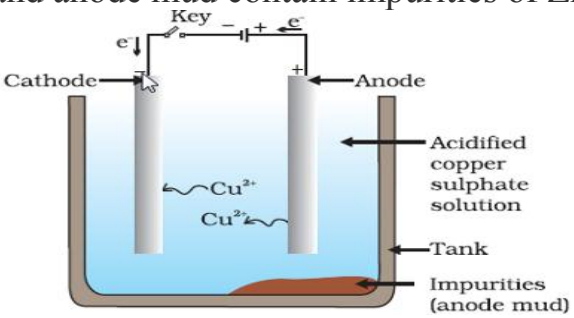
- Electro refining- It is electrolytic purification of a metal.
- It is process in which a pure metal can be obtained from impure metal by the method of electrolysis.
- For Example : Electro refining of Blister copper (Impure copper)
- In diagram of Electro refining,
- Cathode- Pure copper metal sheet
- Anode – Thick blocks of impure copper.

Electrolyte : Aqueous solution of copper sulphate containing 1% H2SO4 acid improve conductivity.
Reaction : Anode Cu Cu ++ + 2e-

Cathode $Cu^{++} + 2e^-$ Cu

On passing electric current cations deposits on cathode and anode dissolves in solution. The weight of anode decreases.

Copper obtained 99.99% pure and anode mud contain impurities of Zn ,As ,Fe and S.



Q.36) Electro refining of metal is……..

(a) Purification of metal (b) extraction of metal

(c)Fabrication of metal (d) metallurgy of metal

Q.37.) Electroplating is done to achieve……

(a) Decoration (b) Corrosion resistance

(c) Improving conduction **(d) all of the above**

Faraday's laws of Electrolysis

- Some terms related to Electrolysis laws.

1. Coulomb: It is defined as the quantity of electricity which pass through a circuit when a current of one ampere is passed through a circuit for one second.
   1 Coulomb = 1 Ampere × 1 Second i.e. Q = C× t
2. Faraday: It is defined as the quantity of electricity required to deposited or liberate one gram equivalent of a substance from its solution.

1 Faraday = 96500 Coulombs = 1 gm substance deposited or liberated

3. Ampere: It is the quantity of electric current obtained one coulomb electricity is passed for one second.

There are two laws of Electrolysis

- **Faraday's First law of Electrolysis :** This laws state that " The amount of substance deposited or liberated at an electrode during electrolysis is directly proportional to the quantity of electricity passed through electrolyte"

  Mathematical Expression, $W \alpha Q$ ------- but $Q = I \times t$

  $W \alpha I \times t$ ---- I = Current and t = time

  $W = Z \times I \times t$ ----- Z = Proportionality constant

  as ECE Electrochemical equivalent (ECE)

- **Faraday's Second law of Electrolysis :** This laws state that " When same quantity of electricity is passed through two or more different electrolytes connected in a series then amount of the substances deposited at the electrodes are directly proportional to their chemical equivalent "

If Z1 , Z2 are electrochemical equivalent of the two substances and E1 E2 are respective chemical

equivalent

$W_1 \alpha E_1$ and $W_2 \alpha E_2$

$$\frac{W1}{W2} = \frac{E_1}{E_2}$$

From 1st law of electrolysis , W=Zct

$W_1 = Z_1 ct$ $W_2 = Z_2 ct$

$$\frac{Z_1 ct}{Z_2 ct} = \frac{E_1}{E_2}$$

$$\frac{Z_1}{Z_2} = \frac{E_1}{E_2}$$

Z α E

Q.38) 1 Faraday is…….

(a) 1 Coulomb (b) 1000 Coulomb

(c) 5900 Coulomb **(d) 96500 Coulomb**

NUMERICALS

Q.39.) A Current of 0.25 ampere while flowing for one hr. Through a solution of copper shuphate deposited 0.2936 g.of copper find electrochemical equivalent & chemical equivalent of copper .

(a) 0.0032622 & 31.48 g (b) 0.0032622 & 314.8 g

(c) 0.032622 & 31.48 g (d) 32.622 & 31.48 g

Q.40.) Calculate the time in seconds in which 0.3 gm .of copper is liberated from copper suplphate solution. When current of 0.5 ampere is passed.(Eq.weight of cu-31.6g)

(a) 1190sec (**b) 1199 sec.**

(c) 1196 sec. (d) 1197sec.

Q.41.) A current of 1.5 amperes was passed through a solution of a salt of a metal for 15 min. when 0.783 g of metal was deposited calculate the equivalent weight of metal.

(a) 0.0058g/c (**b) 0.00058g/c.**

(c) 0.058g/c (d) 5.8g/c

Q.42) When electric current was passed through a solution of Silver nitrate for 45 min., 8.0 gm. of silver was deposited at cathode. Calculate the strength of the current. (E.C.E of Ag).

(a) 2.53 amp. (**b) 2.65amp.**

(c) 2.75amp (d) 26.5amp

Q.43) Current of 5 amperes flowing for 0.5hr.deposited 3.048g of a metal at the cathode. Calculate the equivalent weight of metal. (1 Faraday =96500coulomb)

(**a) 32.68g** (b) 3.268g

(c) 0.3268g (d) 0.003268g

Q.44) Calculate the weight of metallic chromium deposited from a solution of chromium chloride by a current of 0.2ampere passing for 100 min. (At. wt. of Cr-52)

(a) 2.255g (**b) 0.2g**

(c) 2.155g (d) 0.002155g

Q.45) A given quantity of electricity is passed through two cell containing copper sulphate & silver

nitrate solution respectively. if 0.99 g of silver & 0.29 g of cooper are deposited, find the equivalent weight of silver when that of copper is 31.6

(a) 100g
(**b) 107.8g.**
(c) 1.078g
(d) 0.1078g

Chapter No – 06
Paints, Varnishes, Insulators, Polymers, Adhesives and Lubricants

Total Marks - 14

Paints-

Paint is a mechanical dispersion mixture of one or more pigments in vehicle.
The vehicle in paint has the function of binding together the pigment parts in the paint.
The pigment provide both color and handing power.
when the paint is applied on a metal surface the thinner evaporates from the paint surface and drying oil oxidize forming a dry pigment film.
Purpose of Applying Paint-

1. **Protection**- Its coating protect the metallic surface from rusting or corrosion and wooden surface can be protected from fungus and insect.
2. **Beautification** -paint is applied on a surface of metal or wood to impart beautiful appearance to them.

Characteristics of good paint-

1. It should be able to resist that most ferric corrosion.
2. Paint should have Desire consistency.
3. It should have high heading power.
4. Its film should be washable.
5. Its film should be should not crack or shrink on drawing when paint is applied on metal it should resist corrosion.

Ingredients of paints-

1. pigments
2. medium
3. Drying oil
4. Thinner
5. dryer extenders
6. Plasticizer

1. **Pigments -**Pigments it is a solid substance which forms paint when mix with drying oil. example-red lead, chromium oxide, carbon black etc.

Function of pigments-

1. Provide opacity and color to the paint film .
2. Give an aesthetical appeal to the paint film.
3. Give strength to the paint film.
4. Give protection to the paint film by reflecting harmful ultraviolet rays.
5. Provide resistance to the paint film against moisture and weather.

Drying oil for medium-These are film forming constituent of paint
Example- Drying oil, Linseed oil ,Tune oil, Dehydrated Custard oil

Function of Drying oil

1. It is a main film forming constituent
2. It provide durability and waterproof finish to the film

Thinners

Thinners these are volatile liquid substance which evaporates easily after application of paint added to the paint to reduce viscosity of the paint so that they can be easily applied to the metal surface

Example -Spirit ,Naphtha, Kerosene, Benzene, Turpentine

Function of thinner

1. They are suspended pigment
2. They dissolve film forming materials.

Driers

These are oxygen carrying catalyst.

The commonly used driers are heavy metallic soap such as naphthenates,linoleates. resonates and tungstates heavy metals like Cobalt, Mn, lead ,zinc.

Function of dryers

1.They improve the drying quality of paint Film.Theyact as oxygen carrying catalyst.

2.They accelerate the drying of oil film by oxidation, polymerization and evaporation .

Extenders

These are the inert metallic material which improves the properties of the paint although they have low opacity.

EX-Commonly used extenders are calcium carbonate (CaCo3), Caso4, talc, asbestos, gypsum, clay, Chalk, silica, mgsio3 , Slate powder.

Function of extenders

1. They reduced cost of the of a paint. They increased durability of a paint .
2. They help to reduce the cracking of drying paint keep the paint in a suspension.

Plasticizer

Plasticizer are used in a Paints

1. To give elasticity to the paint film
2. To prevent cracking of the film.

Example plasticizers are Triphenyl phosphate, Tricresyl phosphate,Diamyl phthalate, and Tributyl phthalate and dibutyl tartarate.

Q.1) The main purpose of painting an iron grill is …….

(a) to protect it from corrosion (b) to reduce its life and durability

(c) to decrease the weather resistance (d) to improve its beauty and appearance

Q.2) A good paint must have…….

(a) high covering power (b) brushing characteristics light

(c) reflecting property **(d) all of the above**

Q.3) ……. Is not constitute of paint.

(a) fillers (b) pigment

(c) gypsum (d) drying oil

Q.4) A mixture of drying oil , resin and volatile solvent is known as ……

(a) polymer (b) plastic

(c) paint (d) varnish

Q.5) The composition of paint that provides the hiding power is ……..

(a) pigment (b) solvent

(c) vehicle (d) none of these

Q.7) White lead in paint acts as ……

(a) thinner (b) drying oil

(c) pigment (d) drier

Q.8) Thinner are added to paint to ……

(a) improve drying quality (b) reduce the cost

(c) reduce the consistency (d) provide water proofness

Q.9) A paint contains ……

(a) pigment only (b) drying oil only

(c) pigment + drier only **(d) all of these**

Q.10) Opacity and desired colour to paint are provided by …….

(a) extenders (b) drier

(c) pigments (d) thinner

Varnish-

1.Varnish are transparent, homogeneous, viscous liquid prepared by dissolving natural or synthetic resin in oil or thinners or both .

2.It is used as a protective and decorative coating of suitable surface .

3.It film Desire by evaporation oxidation and polymerization of its constituent leaving behind a hard, transfer and glossy lustrous and leaving behind a hard,transparent,glossy,lustrous and durable film.

Types of varnish there are two main types

Types of varnish there are two main types of furnace

1.Oil Varnish (or Oleo resinous Varnish)- It is a homogeneous solution of one or more natural or synthetic racing in a drying oil and a volatile solvent.

The presence of oil reduces the natural brittleness of the pure resin film. This type of varnish dries up by the evaporation of the volatile solvent, followed by oxidation and polymerization of drying oil.

2.Spirit varnish- It is a homogeneous solution of one or more natural or synthetic resin in a completely volatile solvent

Such a varnish dries up by the evaporation of solvent.

spirit varnish dries up very rapidly leaving behind a brittle film which has a tendency to crack or peel off.

Q.11) Varnish is used to give ……

(a) transparent finish (b) red colour finish

(c) opaque finish (d) fire resistant finish

Q.12) Spirit varnish is a solution of ……..

(a) oil + pigment (b) resin + pigment

(c)resin + solvent (d) pigment + drier

Q.13) A solution of shellac in alcohol is an example of ……..

(a) oil varnish (b) paint

(c)spirit varnish (d) none of these

Q.14) Both paint and oil varnish contain common constituent……..

(a) thinner (b) pigment

(c)drying oil (d) extender

Q.15) Following is not a thinner …….

(a) acetone (b) terpentine

(c)spirit **(d) castor oil**

Q.16) Varnish is a homogenous colloidal dispersion solution of …… in oil or thinner or in both.

(a) pigment **(b) resin**

(c)salt (d) gypsum

Insulator-

1.Insulator the material which prevent the flow of heat electricity or sound through them are known as

Insulators or insulating materials

2.The use of insulating material is of much important in various Industrial and Engineering operation where is heat and electric energy are utilize.

Properties of insulating Material-

1.It should have low thermal and electrical conductivity.

2. It should have low dielectric constant. It should have good moisture withstanding capacity

3.It should be fireproof and chemically inert

4. It should have low density

Classification of insulating material

Insulating material can be classified in two ways

1. Based on their state and material

2. Based on their thermal stability

Glass wool

Glass wool is an insulating materials.

It is a fibrous Wool like material which is made up of fine filaments of Glass like ordinary wool.

Preparation -Glass filaments are obtained by forcing molten mass of alkali free glass through a sieve hole having the average diameter of 0.0005cm continuously. The filaments of Glass so obtained are thrown over a rapidly revolving drum to get the material in would like form.

Properties

- Its density is low.
- its thermal conductivity is low
- its electrical conductivity is also low
- It is fireproof and non combustible
- Its average diameter of fibre is 0.0005 CM
- it is resistant to chemical and does not absorb moisture
- its tensile strength is about eight times more than Steel

Uses

- It is widely used as a thermal insulating material in domestic and industrial appliances such as Motors ,oven ,refrigerator walls and roofs of house because it is of heat proof ,fireproof, flexible and even insect proof.
- Being resistance to Chemicals glass wool is used is used as a filtering material for courage u liquid like acid and acidic solution in industry
- It is also used in air filters as a dust filtering material. It is used for sound and electrical insulation.
- It is used in manufacturing of fibers Glass by reinforcing it with plastic resins.

Q.17) The materials which are used to prevent the flow of heat are known as ……

(a) insulators (b) conductors
(c)semiconductors (d) paint

Q.18) Which one is not an insulating material ?

(a) glass wool (b) thermocole
(c)asbestos **(d) iron**

Glass wool

Glass wool is an insulating materials.

It is a fibrous Wool like material which is made up of fine filaments of Glass like ordinary wool.

Preparation -Glass filaments are obtained by forcing molten mass of alkali free glass through a sieve hole having the average diameter of 0.0005cm continuously. The filaments of Glass so obtained are thrown over a rapidly revolving drum to get the material in would like form.

Properties

- Its density is low.
- its thermal conductivity is low
- its electrical conductivity is also low
- It is fireproof and non combustible
- Its average diameter of fibre is 0.0005 CM
- it is resistant to chemical and does not absorb moisture
- its tensile strength is about eight times more than Steel

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Thermocole

Thermocole is a foam plastic obtained by blowing air through molten polystyrene or polyurethanes.

It is a spongy porous form like in structure due to large number of air cells it causes and outstanding insulating property.

Properties-

- Its density is low.
- It is spongy, porous and has foam like structure.
- It is called strong through extremely light.
- It is quite shockproof.
- It is chemically inert and resistance.
- Its thermal conductivity is low.
- Its electrical conductivity is also low.

USES-

- Being light and shockproof, thermocol is used as an ideal packing material for delicate electrical and electronic equipment's.
- due to an outstanding Thermal insulating Properties it is mainly used as a heat insulator in refrigeration and air conditioner
- It is used for decorative purposes
- It is used for protecting screen in radar

Q.19) Glass wool and thermocole are used as an insulators in ……

(a) fridge and microwave oven (b) laptop

(c)furnace (d)none of these

Q.20) Which statement is true for insulators ?

(a) they have high density and fire resistance

(b) they have low density

(c)they are not water proof

(d) they are not electric proof

Q.21) What materials would be safest to use as an insulators to cover electrical wires ?

(a) aluminium (b) tin

(c)rubber (d) water

Q.22) Copper wire is often wrapped in plastic , plastic is a good ……..

(a) electromagnet **(b) insulators**

(c)conductors (d) circuit

Q.23) A good thermal insulators should have …….

(a) high thermal conductivity (b) low thermal conductivity

(c)high electrical conductivity (d) low electrical conductivity

Q.24) Glass wool is made up of ……

(a) ordinary wool **(b) filaments of glass**

(c)filaments of mica (d) none of these

Q.25) Thermocole is ……

(a) monomer (b) polymer

(c)plastic **(d) both (b) and (c)**

Q.26) Following is not a solid insulating material……..

(a) porcelain (b) paper

(c)silicon rubber (d) dry air

Q.27) Insulators are classified on the basis of …….

(a) manufacturing (b) state of occurrence

(c)application **(d) all of the above**

Polymer

Plastics : Plastic is synthetic organic polymer. It can be moulded into any desired shape by applied heat and pressure in presences of catalyst

Monomers : Monomers are small molecules , mostly organic compound .

Polymers : Polymers are formed by joining of two or more similar or dissimilar molecules to form very large molecules or polymers

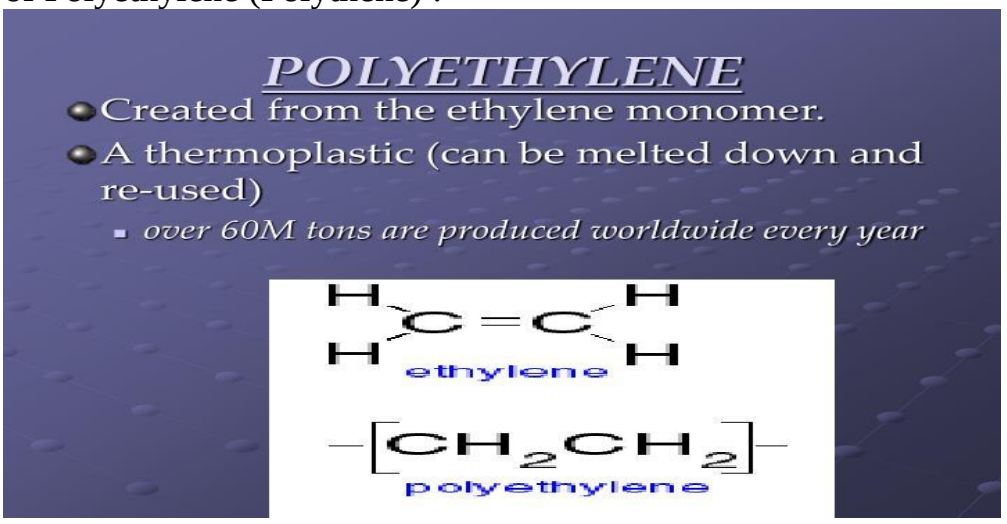
OR A polymer is a higher molecular weight compound formed by repeated linking of monomers.

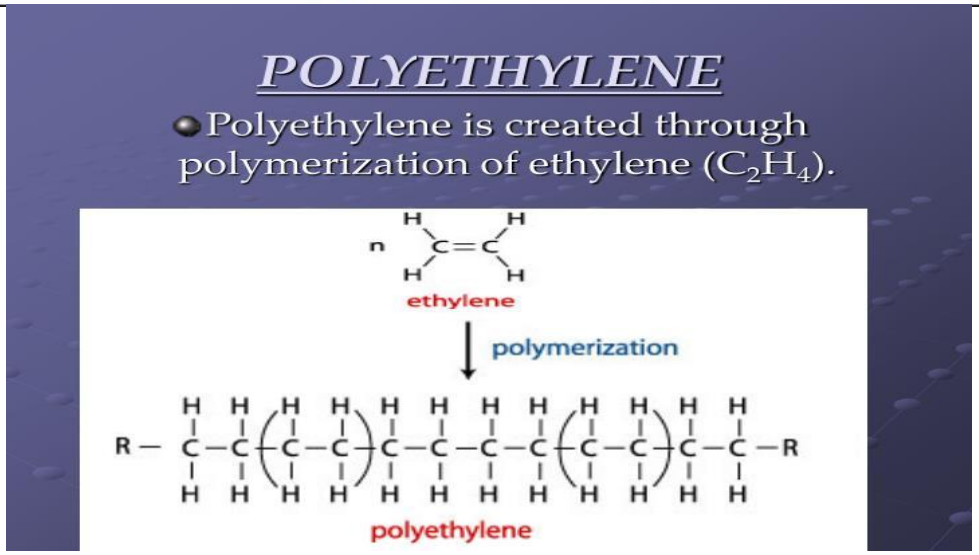
Polymerization : The process formation of polymer under a specific condition of temperature , pressure and catalyst is known as polymerization.

Classification of Polymer : There are various ways to classify polymer on the basis of source ,structure ,mode of forming , molecular forces etc.

Formation of Polymers :

1) Formation of Polyethylene (Polythene) :





Properties :

1.PE is rigid, waxy ,white translucent ,non-polar material.
2.High resistant to strong acids ,base and salt solutions.
3.Good insulator of electricity.
4.Due to highly symmetrical chain structure ,PE crystallizes very easily.

Applications :

1.Used for making high frequency insulator parts, bottles caps, kitchen and Domestics appliances ,toys ,Sheets for packing materials, Tubes ,pipes, Coated wires and cables, Bags for packing etc.

Packing Materials bottles etc.

Q.28) Plastics is a polymer formed by …….

(a) decantation (b) vulcanization
(c)polymerization (d) evaporation

Q.29) Which are the types of polymerization ?

(a) addition & condensation (b) evaporation & addition
(c) condensation & malleability (d) none of the these

Q.30) Structural unit of a high polymer are called……..

(a) fibers **(b) monomers**

(c) thermo units (d) fabrics

Q.31) Phenol-formaldehyde resin is commercially known as ……

(a) PVC (b) elastomer

(c)teflon **(d) bakelite**

Q.32) Bakelite is prepared by the condensation of …….

(a) benzene & formaldehyde **(b) phenol & formaldehyde**

(c)phenol & acetaldehyde (d) phenol & chloroform

Q.33) Phenol-formaldehyde is an example of …….

(a) linear chain polymer (b) elastomer

(c)cross-link polymer (d) all of the above

Q.34) Which one is a copolymer ?

(a) nylon **(b) teflon**

(c)PVC (d) polystrene

Q.35) What is the repeating unit in Teflon ?

(a) $F_2C = CF_2$ (b) $H_2C = CH_2$

(c) $H_2C = CH.Cl$ (d) $h_2C = CH.C_6H_5$

Q.36) Which one is not a thermoplastics **?**

(a) polyethylene (b) PVC

(c) bakelite (d) teflon

Q.37) Tetrafluoroethylene is a the monomer of …….

(a) Nylon 66 **(b) Teflon**

(c) PVC (d) Polyethylene

Q.38) Which of the following polymers contain nitrogen ?

(a) nylon (b) teflon

(c)PVC (d) polyethylene

Q.40) A polymer used mostly for forming textile fibres is …….

(a) PVC (b) nylon

(c) bakelite **(d) All of the above**

Q.41) Epoxy resin is an example of ……..

(a) copolymer (b) monomer

(c)homopolymer **(d) elastomer**

Q.42) Commercial name of epoxy resin is ……..

(a) alcohlol **(b) araldite**

(c)ammonia (d) ebonite

Adhesives-

An adhesivesis a substance used for sticking two unlike bodies together due to the molecular for existing in the area of contact.

An adhesive can be defined as any substance capable of holding materials Together by the surface attachment.

Characteristics-

- It should be odorless.
- It should not lose the adhesion property on storage.

- It should be resistance to heat, Chemicals and water.
- The bond formed by a adhesive should be rigid strong long lasting
- It should be economical in use.

Classification of adhesive-

1.Animal blue it is prepared by boiling animal bones and conducting tissue containing proteins. Animal glues has good adhesive strength, but posses poor resistance towards moisture and fungus.

uses-They are extremely used in manufacturing furniture radio cabinet cardboards card box.

2. Vegetable base Glue (topica paste, soybean glue Starchglue,casein

The vegetable glue have poor bond strength as compared to other glue but they are much cheaper. uses for manufacturing envelope stamp, notebook, binding book and other paper goods.

3. Inorganic adhesive- Inorganic adhesive likes sodium silicate obtained by heating soda Ash with sand mix with literature MnO_2 is suspended in a water to form a Gel which can be applied with a brush.

The bond is fungus resistance but moisture and heat reduce its strength.

Uses- for making packaging kit Paper box cardboard containers.

2. Synthetic adhesive

Synthetic adhesive are prepared by polymerization reaction.Hence they are polymer

Synthetic adhesive are further classified as

Thermoplastic Adhesive:

- These are polymers which soften and melt when heated.
- These are soluble and poor water resistance Adhesives.
- They can be reprocessed many times by heating or applying solvent.
- Important members of this group of adhesives are polyamides,cellulose derivatives (like nitrate and acetate) or acrylics, polyvinyls etc

Thermosetting adhesive-

Thermosetting adhesive Such resins have three dimensional crossing structure and possess great properties.

The process cross-linking structure cannot be softened byreheating ,hence such cannot be reprocessed.

The bond obtained within them in is insoluble infusible and possess good resistant to moisture heat, insect, fungi Important members of this family are phenol formaldehyde resin, urea formaldehyde resin, polyester,silicone resins.

USES-

Uses used for making waterproof plywood's, laminatesGlass on cloth .

Use for bonding articles in craft aircraft and ship building industries.

for bonding glass metallic and ceramic articles.

Elastomeric adhesive-

Elastomers are polymers Possessing high elasticity ,may be reversiblystretched at high degree.

In elastomers polymer chain are held Together by weak intermolecular force.

Natural rubber ,silicone,polybutadiene,polyurethane,Neoprene, aresome elastomeric adhesives

Lubricant-Any substance introduce between two moving or sliding surface to reduce the frictional resistance between them is known as a lubricant.

Q.42) Adhesive is a substance used ……
(a) for sticking two unlike bodies together
(b) for mixing metals and non - metals
(c)for purification of water
(d) for making alloy

Q.43) An example of vegetable glue is ……..
(a) soybean glue (b) casein glue
(c) both (a) and (b) (d) none of the above

Q.44) An example of inorganic adhsives is …….
(a) casein (b) plexi glass
(c)araldite (d) sodium silicate

Q.45) Araldite is …….
(a) vegetable glue (b) thermosetting resin
(c) thermoplastic resin (d) cellulose derivative

Q.46) An example of natural adhesive used in stamps , envelops etc. is……
(a) starch (b) asphalt
(c)araldite (d) wax

Q.47) Adherends means ……
(a) bodies held together by an adhesive
(b) bonding which hold two bodies together
(c) substance used to stick two bodies
(d) force between two bodies

Q.48) Which of the following is not a natural adhesive ?
(a) asphalt (b) shellac
(c) soyabean (d) resin

Q.49) Adhesive used for bonding metal is ……..
(**a) epoxy resin** (b) silicone resin
(c) both of these (d) none of these

Q.50) Which of the following give least adhesive strength ?
(a) animal glue **(b) starch**
(c) epoxy resin (d) silicone resin

Q.51) Adhesive used for bonding glass , metals , ceramics is ……
(a) animal glue (b) starch
(c) epoxy resin (d) sodium silicate

Lubrication-The process distance between moving or sliding surface by the introduction of lubricant in between them is called as a lubrication.

Function of lubricant-

1.Surface wear and tear and deformation, so the direct contact between the rubbing surface is avoided.

2.waste of energy in the form of heat, so it acts as a coolant for heat transfer on medium

1.Solid lubricants

1.Heavy machinery working on a crude job at a very high load and slow speeds.

2. The film of even lubricating greasescannot be maintained ,dueto operating high temperature.

3.when a liquid or Semi solid lubricant film cannot be maintained as in the case of the electric motors and generators.

4.Whereparts to be lubricated are not easily accessible.

5. for example solid lubricants are graphite ,Molybdenum disulfide sope, soapstone, wax,talc,chalk,mica,Teflon.

6.The important solid lubricant used are graphite and molecule disulphate at a place where film of liquid lubricant cannot be maintained due to high temperature .

Graphite-

1. Graphite is a is most popular among all the solid lubricants when it is applied between uneven surface it fills into valleys, thereby making surface more even .

2. Graphite is non-flammable soft, Soapy to touch.

Uses-

1. The suspension of graphite in water is known as aqua-dag which is used in the machinery where lubricant free form oil needed. For example food processing industry.

Molybdenum Disulphide(MoS_2)-

Properties-

1. It was very low coefficient of friction.
2. It is stable up to 400 ^{0}C in the presence of air above 400^{0}C it undergoes oxidation .
3. It can be used as a lubricant, either by direct sprinkling or applying its dispersion in solvent or grease known as a Molykotes.
4. It has high affinity for metal surface and is non corrosive in nature.
5. The thin film of Mos_2 is Resistant to water and chemical can be used in extreme operating condition.
6. EX- like graphite molybdenum disulphide is also used as lubricant at high temperature and extreme pressure conditions.

Liquid lubricants-

These are mainly lubricating oils the main function of lubricating oils is to reduce friction and wear between two sliding on moving metallic surface by maintaining a continuous fluid film in between them.

Besides this may also act as -

1. cooling medium
2. selling agent
3. Preventer of corrosion

The liquid lubricants are widely used for the lubrication of delicate and light machines which work at high speed but at a low pressure.Liquid lubricant are classified on the basis of their origin to the following class

1. vegetable oils
2. Mineral oil
3. blended oil
4. synthetic lubricating oils

Vegetable oil or Animal oil-

- Vegetable or animal oils are extracted from plants/ animals respectively. These oils are compound of higher fatty acids.
- Some example of these oils are castor oil,olive oil, coconut oil, palm oil, Neem ,hazelnut oil ,tallow, lard , cod liver oil.
- Pure fatty acids such as oleic acid, stearic acid etc. are also used as a lubricant.
- These oils possess high oiliness due to which oil gets adhered to the machine surface and helps to reduce the friction.

Mineral oil-

- Mineral oils are obtained by fractional distillation of crude oil.
- These oils normally have long hydrocarbon chain of 12 to 50 carbon atoms. The oils with lower number of carbon atoms are quite thick and hence are made suitable for use by mixing them with thin veg.oils.
- To overcome this, mineral oils are generally used by mixing with a little vegetable/ animal this mixture is known as Blended oil.
- The mineral oils like paraffin, naphthalene our most popularly used.

Blended oils-

- Blended oils are normally made by using vegetable/ animal and mineral oils.
- The blends can made in such a way that the properties of lubricant get improved to suit the service condition of machinery.
- In addition to the certain additives are added so that extreme pressure condition of Machines can also get suitable lubricants.

Synthetic lubricant oils

- Synthetic lubricant oils are chemically prepare compound and where the blended oil fail to work synthetic oils are used as a lubricant
- They are very effective in a severe extreme condition.
- example of synthetic oils are chlorofluoro hydrocarbons, silicone, glycol etc.
- These oils are used as a lubricant in jet engines rocket motors and submarine.
- These oils are very expensive.

Silicones-

- Silicon very good synthetic lubricants.
- Properties -
- They possess high viscosity index

Uses

Silicon are useful for low temperature lubrication of small parts because they get oxidize quickly above 200 ^{0}C and undergoes cracking process above at about 230 ^{0}C.

Q.52) Graphite is which type of lubricant ……

(a) Solid (b) liquid

(c)Semi-solid (d) gaseous

Q.53) Lubricating helps to get……

(a) Minimize wear in moving parts
(b) helps in keeping the machine part cool
(c) washes away & carries away dirt,from machine parts
(**d) all of the**

Q.54) A liquid lubricant should possess high ……
(a) volatity **(b) oiliness**
(c) Acidity (d) cost

Q.55) Grease is not used to lubricant……..
(a) Gears (b) bearings working at high temperature
(c) Delicate instruments (d) none of these

Q.56) A good lubricant should have…….
(a) moderate viscosity (b) low viscosity index
(c) low acidity (d) all of these

Q.57) Soap ,stone ,waxes ,talc are example of……
(a) solid lubricant (b)semi-solid lubricant
(c)liquid lubricant (d) gaseous lubricants

Q.58) Which one is a synthetic lubricant?
(a) vegetable oil **(b) mineral oil**
(c) animal oil (d) none of these

Q.59) Which one is not a vegetable oil
(a)tallow oil (b)coconut oil
(c) olive oil (d)palm oil

Q.60) Grease is prepared by saponification of……
(a)oil **(b) fatty acids with oil**
(c)soild lubricants (d)all of these