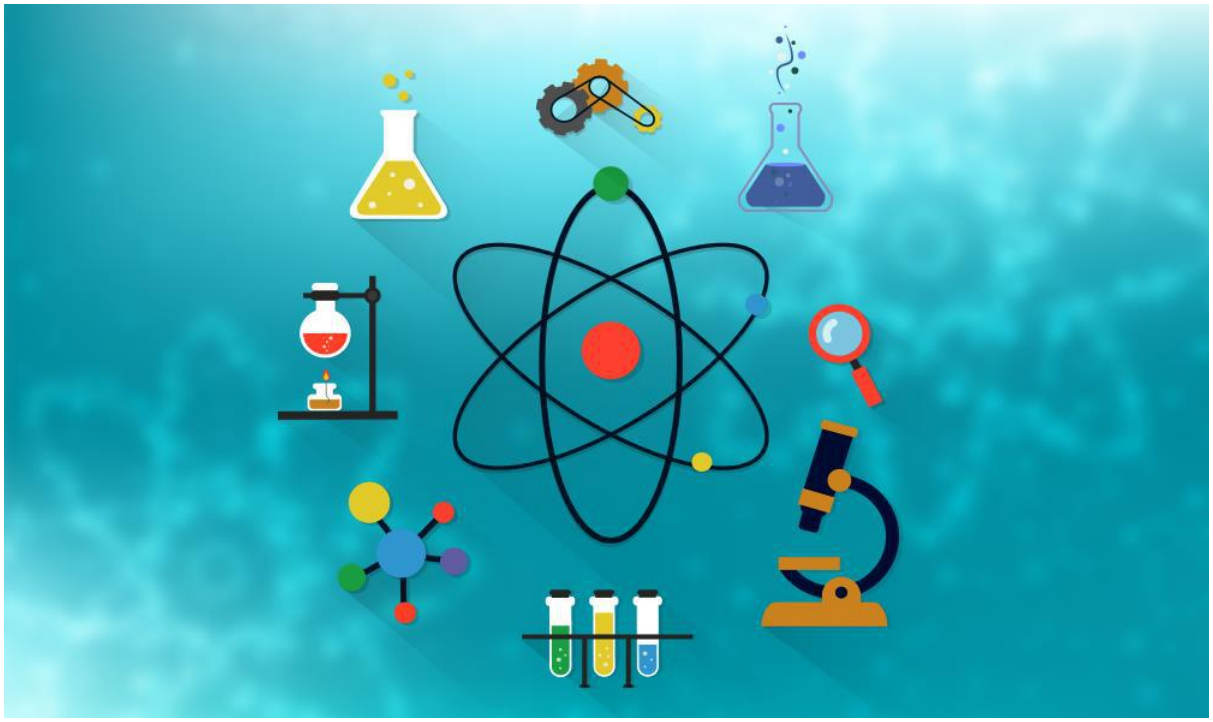
ENGINEERING CHEMISTRY – I

Q AND A



NAME :

ROLL NO:

CLASS:

UNIT I

Atomic Structure, Molecular mass, Acids and Bases

Part – A (Two marks)

1. **Define Atom, What are the fundamental particles of an atom?**
   Atom is the smallest particle of an element. Its fundamental particles are Electron, Proton, Neutron
2. **What is the charge and mass of proton?**
   Positive charge +1, mass = 1 a.m. u
   (a.m.u. = atomic mass unit = 1/12 the mass of a carbon-12 atom)
3. **What is the charge and mass of electron?**
   Negative charge -1, mass = 0 a.m.u
4. **What is the charge and mass of neutron?**
   Neutral, mass = 1 a.m.u
5. **What are the fundamental particles of an atom? What is the location of fundamental particles of an atom?**
   Fundamental particles of atom are : Proton, Neutron, Electron
   Location of Proton and Neutron : Nucleus of the atom
   Location of electron : Orbitals around nucleus
6. **What is atomic number, Give Example?**
   Atomic number of an atom is equal to its number of protons.
   Eg.) Carbon has atomic number 6, it has 6 protons
7. **What is mass number?**
   Mass number of an atom = number of protons + number of neutrons
   Eg) Mass number of carbon = 6 + 6 = 12
8. **What is the charge of an atom?**
   Charge of an atom = number of protons – number of electrons
9. **Give example for isotopes**
   $_{6}C^{12}$ $_{6}C^{14}$
10. **Give example for isobars**
    $_{19}K^{40}$ $_{20}Ca^{40}$
11. **Define oxidation with example**
    Chemical reaction involving loss of electron
    Sodium ⟶ Sodium ion + electron
12. **Define reduction with example**
    Chemical reaction involving gain of electron
    Chlorine + electron ⟶ Chloride ion
13. **Give example for electrovalent compound/ionic compound**
    Sodium chloride NaCl
14. **Define molecule, Give an example**
    Smallest unit of a chemical compound, which can take part in chemical reaction.
    Water H_2O

15. **Define molecular mass**

    It expresses how many times the molecule of a substance is heavier than 1/12th mass of an atom of carbon-12.

16. **Define mole**

    Molecular mass expressed in grams.

    Molecular mass of water = 18

    So, Mass of 1 mole of water = 18 grams.

17. **State Avogadro's hypothesis**

    Equal volume of all gases under the same condition of temperature and pressure contain equal number of molecules.

18. **Define Vapor density**

$$\text{Vapour Density} = \frac{\text{Mass of certain volume of gas}}{\text{Mass of same volume of hydrogen}} \text{ at STP}$$

19. **What is the relation between molecular mass and vapor density**

    Molecular mass = 2 X Vapor density

20. **State Arrhenius concept of acids and bases. Give examples**

    Acid: Gives hydrogen ion in aqueous solution

    HCl, HNO_3

    Base : Gives hydroxyl ions in aqueous solution

    NaOH, KOH

21. **Define Lowry Bronsted concept of acids and bases. Give examples**

    Acid: Proton donors

    Nitric acid HNO_3 , Sulphuric acid H_2SO_4

    Base: Proton acceptors

    water H_2O , Ammonia NH_3

22. **Define Lewis concept of acids and bases. Give example for Lewis acid and base**

    Acid: Electron pair acceptors

    Boron trifluoride BF_3 , Aluminium trichloride $AlCl_3$

    base: Electron pair donors

    Ammonia NH_3 , Water H_2O

23. **What is the nature of solution whose pH = 6? What is its pOH?**

    Solution with PH = 6 is Weak acid.

    pH + pOH = 14

    pOH= 14 –pH = 14 - 6 = 9

24. **What is the nature of solution whose pOH is 12? What is its pH?**

    Solution with pOH = 12 is weak base

    pH + pOH = 14

    pH=14-pOH = 14 -12=2

    pH =2 Strong Acid

25. **What is acidic buffer and basic buffer**

    Acidic buffer : Mixture of weak acid and its salt

    Basic buffer : Mixture of weak Base and its salt

26. What are the types of buffer solutions. Give examples

Acidic Buffer : Mixture of Sodium acetate and acetic acid

Basic buffer : Mixture of Ammonium chloride and ammonium hydroxide

27. What is indicator? Give examples for Indicator

Indicator indicates the end point in a titration

Eg: Phenolphthalein – Disappearance of pink color.

Methyl orange – Change from golden yellow to pink color.

Part – B (Three marks)

1. Define isotope and isobars with example

Isotopes : Atoms of same element with same atomic number , different mass number

$$_{6}C^{12} \quad _{6}C^{14}$$

Isobars : Atoms of different element with same mass number , different atomic number

$$_{19}K^{40} \quad _{20}Ca^{40}$$

2. Explain electronic concept of oxidation and reduction/Explain formation of cation and anion by oxidation and reduction

Oxidation:Chemical reaction involving loss of electron, cation is formed

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

Reduction: Chemical reaction involving gain of electron, anion is formed

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

3. Define Avagadros number , What is its value?

Number of atoms in one mole of any element (or)

Number of molecules in one mole of any compound

Value is 6.023×10^{23}

4. Define pH. Write its formula

Negative logarithm to base 10 of hydrogen ion concentration

$pOH = - \log_{10}[H^{+}]$

5. What is molecular formula? What are the advantages/significances of molecular formula

Short representation of a molecule. Eg) water H_2O

1) **Using molecular formula molecular mass can be calculated.Eg) 18 for water**
2) **Number of Different kinds of atoms can be found.**
   Eg) Water has one hydrogen and two oxygen atoms
3) **It shows the different atoms present Eg) Water has hydrogen and Oxygen**

6. What are the advantages of Lewis theory

1) **Explains acid base reaction by electron transfer**
2) **Explains acid base reaction in fused state**
3) **Explains acid base reaction in gaseous state**

7. **State why $AlCl_3$ or BF_3 is Lewis acid?**

   Lewis acid is a substance which accepts a pair of electrons

   $AlCl_3$ or BF_3 accepts a pair of electrons so they are Lewis acids

8. **Define conjugate acid and conjugate base. Give example**

   Conjugate acid : Differs from corresponding base by proton H_3O^+

   Conjugate base : Differes from corresponding acid by proton Cl^{--}

9. **Define pOH. Write its formula**

   Negative logarithm to base 10 of hydroxyl ion concentration

   $pOH = - \log_{10}[OH^-]$

10. **What is buffer solution? What are its types? Give Examples**

    Buffer solution maintains pH of a solution.

    Acidic buffer : Sodium acetate and acetic acid

    Basic buffer : Ammonium chloride and ammonia

11. **Define Covalent bond with example**

    A covalent bond is formed by mutual sharing of electrons between two atoms.

    Eg. Ammonia NH_3

12. **Define ionic bond with example**

    Ionic bond is formed by complete transfer of electrons from one atom to another
    Electrostatic force of attraction binds two ions.
    Eg NaCl

13. **State octet rule**

    Tendency of atoms to have eight electrons in the outer most shell is called Octet rule. They tend to gain inert gas configuration which is most stable.

Part – C (Five Marks)

1.Explain ionic bonding with example/ Explain formation of NaCl

Ionic Bond: Ionic bonds are formed between two atoms by the complete transfer of valence electrons from one atom to another.

Eg: NaCl and CaO are formed by ionic bonding.

Formation of sodium chloride:

- **Sodium** has atomic number 11. Electronic configuration is (2,8,1)
- **Chlorine** has atomic number 17.Electronic configuration is (2,8,7)
- Sodium loses one valence electron to attain stable configuration(2,8),It becomes Na^+
- Chlorine accepts that electron and reaches stable configuration (2,8,8),It becomes Cl^-
- The Na^+ and Cl^- are held together by electrostatic force of attraction

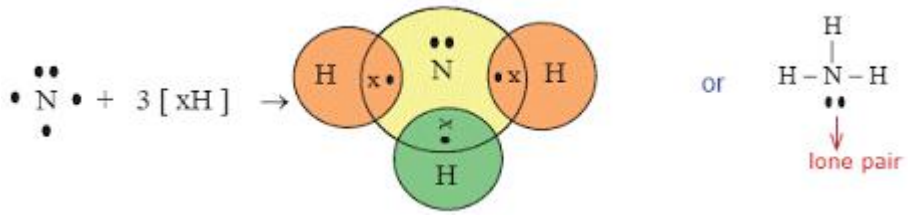
$$\underset{(2,8,1)}{Na} + \underset{(2,8,7)}{Cl} \longrightarrow \underset{(2,8)}{Na^+}\ \underset{(2,8,8)}{Cl^-}$$

2.Explain covalent bonding with example/Explain formation of NH_3

Covalent Bond: Covalent bond is formed between two atoms by mutual sharing of their valence electrons

Formation of Ammonia:

- **Hydrogen** atom has one valence electron in the outermost orbit
- **Nitrogen** atom has five valence electrons in the outermost orbit
- Ammonia is formed when three hydrogens and one nitrogen share valence electrons
- Nitrogen has 5 valence electrons. But only three electrons are used for covalent bonding with hydrogen.
- Thus both nitrogen and hydrogen reach stable configuration.



3.Derive the relationship between molecular mass and vapour density

Avagadros hypothesis

Equal volume of all gases under the same conditions of temperature and pressure contain equal number of molecules.

Relationship between vapour density and molecular mass

$$\text{Vapour density} = \frac{\text{Mass of certain volume of gas}}{\text{Mass of same volume of hydrogen}} \text{ at STP}$$

Let us consider there are 'n' molecules according to Avagadaro's hypothesis, So

$$\text{Vapour density} = \frac{\text{Mass of n molecule of gas}}{\text{Mass of n molecule of hydrogen}} \text{ at STP}$$

When n=1 , the number of atoms in one molecule of hydrogen =2 , so

$$\text{Vapour density} = \frac{\text{Mass of 1 molecule of gas}}{\text{Mass of 1 molecule of hydrogen}} \text{ at STP}$$

$$\text{Vapour density} = \frac{\text{Moecular mass}}{2} \text{ at STP}$$

2 X Vapour density = molecular mass

4.Explain Lowry-Bronsted concept of acids and bases:-

Acids : Acids compounds that are proton donors Eg: **HCl, HNO_3**

Bases : Bases are compounds that are proton acceptors. Eg**: NH_3, H_2O**

$$HCl + H_2O \longrightarrow H_3O^+ + Cl^-$$

In forward reaction HCl donates proton to H_2O. Hence HCl is acid and H_2O is base.
In reverse reaction H_3O^+ donates a proton to Cl^-. Hence H_3O^+ is acid and Cl^- is base.

Conjugate acid: Differs by a proton with corresponding base eg **NH_4^+, H_3O^+**

Conjugate base: Differs by a proton with corresponding acid eg **Cl^-, NO_3^-**

Advantages 1) Lowry Bronsted concept can be applied to acid base reactions in aquous and non aquous solutions.
2)But it cannot be applied to acid base reactions in fused state and vapour state.

5.Explain Lewis concept of acids and bases:-

Acid : Compounds which accepts a pair of electrons Eg **$AlCl_3$, BF_3**
Base : Compounds which donate a pair of electrons Eg **NH_3 , H_2O**

Nitrogen in NH_3 gives a pair of electrons for bonding to Boron in BF_3
Here NH_3 is acid and BF_3 is base.

Advantages of Lewis concept

1. It explains acidic nature of non-hydrogen compounds like **$AlCl_3$, BF_3**
2. It explains acid base reactions in fused state and gaseous state.
3. It is a general concept applicable to all acids and bases.
4. It is an electron concept

6.What are the industrial applications of pH?

S.No	Industry	pH range to be maintained	Effect if pH is not maintained
1	Sugar	8 – 9 for sugar cane juice	1. Sugar will not crystallise 2. Sugar colour becomes brown
2	Leather	2.5 – 3.5 for tannin	1. leather decomposes 2. gives rotten egg smell
3	Textile	Correct pH	1. Dyeing will not be uniform 2. Dyeing will not be permanent
4	Water treatment	6.5 – 7 for water	1. water will not be suitable for drinking 2. water will not be useful for many purposes
5	Agriculture	pH of soil is to be seen	1.fertilizer must be added after seeing pH of soil 2. otherwise yield will not be good
6	Human blood	7.2	Leads to death
7	Gastric juice	1.4 – 2	Vomiting and stomach disorder

UNIT II

Solution, Colloid, Nanotechnology

Part – A (Two marks)

1. **Define true solution, Give example**
   Homogeneous mixture of solute and solvent
   Eg) Sugar solution, salt solution
2. **What are the methods of expressing concentration of a solution?**
   Molarity, Molality, Normality, Mole fraction
3. **What is a molar solution, molal solution, deci normal solution**
   Molar solution 1M : One mole solute dissolved in one litre solution
   Molal solution 1m : One mole solute dissolved in one kilogram solvent
4. **Define percentage by mass**

$$\text{Percentage by mass} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \text{ X } 100$$

5. **Define colloid**

   Heterogeneous mixture of dispersed phase and dispersion medium

6. **Define lyophillic colloid and lyophobic colloid**
   Lyophilic colloid : Solvent loving colloid Eg) Starch
   Lyophobic colloid : Solvent hating colloid Eg) Colloidal gold
7. **What is the use of Cottrel's electro static precipitator**
   Used to get rid of carbon particles from smoke, Smoke is precipitated
8. **Define nano particle, What is the size of nano particle**

   Particles of nano meter size are called nano particles. Size is 1 X 10^{-9} m

Part – B (Three marks)

1. **Define molarity**
   Number of moles of solute in one litre of solution

$$\text{Molarity} = \frac{\text{Number of moles of solute}}{\text{Volume of solution in litre}}$$

2. **Define molality**
   Number of moles of solute in one kilogram of solvent

$$\text{Molarity} = \frac{\text{Number of moles of solute}}{\text{Mass of solvent in kilogram}}$$

3. **Define normality**
   Number of gram equivalents of solute in one litre of solution

$$\text{Molarity} = \frac{\text{Equivalent mass of solute}}{\text{Volume of solution in litre}}$$

4. **Define mole fraction**
   Ration of Number of moles of substance to total moles in solution

$$\text{Molefraction of solute} = \frac{\text{Number of moles of solute}}{\text{Total number of moles in solution}}$$

$$\text{Molefraction of solvent} = \frac{\text{Number of moles of solvent}}{\text{Total number of moles in solution}}$$

5. **Write any three differences between true solution and colloid**

Property	True Solution	Colloid
Tyndall Effect	Does not show	Shows
Brownian movement	Does not show	Shows
Coagulation	Does not show	Shows

6. **What is Tyndal effect?**

   Scattering of light by colloidal particles.

   True solution and colloid are placed in a dark room. Light is passed.

   Path of light is visible in colloid.

   Because of Scattering of light by colloidal particles.

7. **What is Brownian movement?**

   Zig zag motion of colloidal particles.

   One drop of colloid is placed under microscope.

   When seen, a zig zag motion of particles is seen.

8. **What is Electrophoresis? Give example**

   Migration of colloidal particles under influence of electric field

   Arsenius sulphide moves to positive electrode and is precipitated.

9. **What is Coagulation?**

   Coagulation is precipitation of colloidal particles.

   Coagulation is done by 1)addition of electrolyte

   2)by addition of opposite charge colloid

   3)by introducing electrode

10. **What is tanning of leather?**

    Tanning is hardening of leather by coagulation.

    Animal skin (positive) is soaked in Tannin (Negative) and it becomes hard.

11. **How does soap clean the dirty cloth?**

    Soap is a colloid. When soap is applied on cloth and water is poured it forms foam.

    Thus greasy and sticky dirt is removed.

12. **What is the importance of nano particles?**

    High conduction property, Hole free, Reliable, Sustainable

Part – C (Five Marks)

1.What are the differences between lyophilic colloid and lyophobic colloid

Property	**Lyophilic Colloid**	**Lyophobic Coilloid**
Solvent Loving Nature	Solvent loving	Solvent hating
Preaparation	Easy	Difficult
Seperation	Difficult	Easy
Viscosity	Higher than that of dispersion medium	Same as that of dispersion medium
Surface Tension	Lower than that of dispersion medium	Same as that of dispersion medium
Stabilizer	Not needed	Needed
Example	Starch Solution	Gold in water

2. What is meant by coagulation of colloid? Explain any three application of the coagulation of colloid in industries

Coagulation : The precipitation of colloids by addition of electrolyte is called coagulation

Three Industrial Applications

1.Purification of water for Drinking purpose

The colloidal impurities like clay in water are removed by addition of alum

2.Rubber Industry

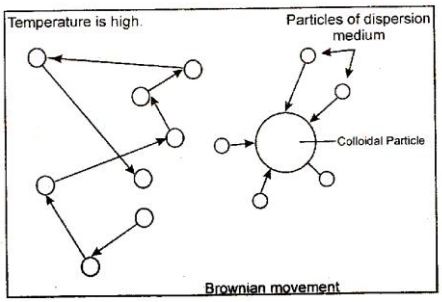
Latex is coagulated by acetic acid for making rubber

3.Cleaning action of soap

When soap is mixed with water it gives colloidal solution and it removes dirt from cloth.

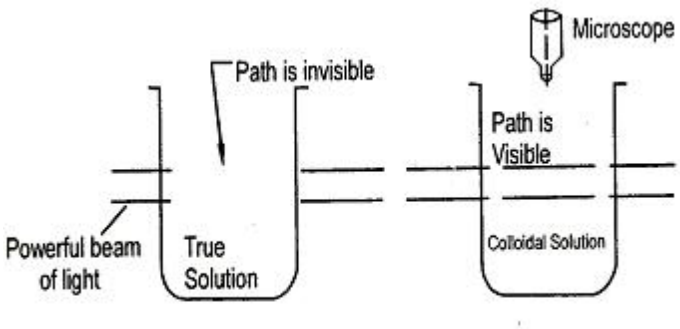
3. Explain Brownian movement, Tyndall effect, electrophoresis and coagulation

Brownian Movement



- The zig- zag motion of colloids is called Brownian movement.
- It can be seen when Colloid is viewed under microscope.
- It is due to collision of dispersed phase particles with dispersion medium particles

Tyndall Effect:

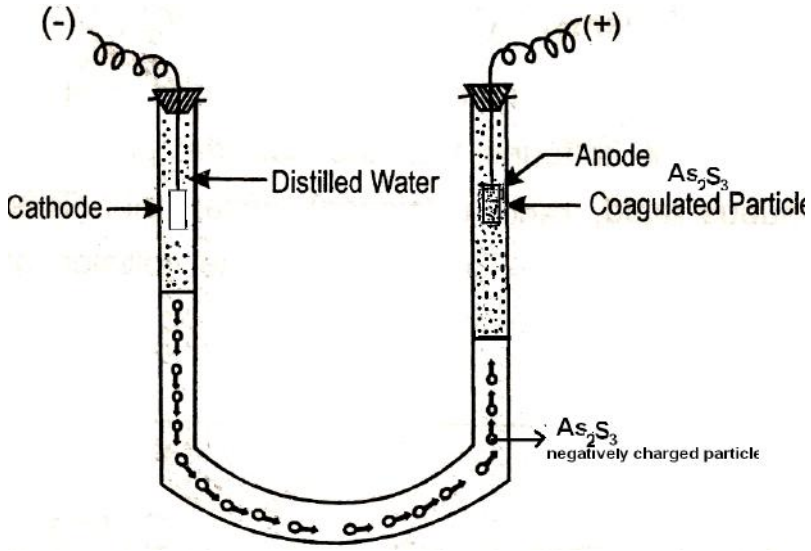


The scattering of light by colloidal particles is called Tyndall effect.

If colloid is kept in dark room and light is passed through it, then the path of light can be seen because the light is scattered by colloidal particles

Electrophorsis:

The migration of colloidal particles under the influence of electric field is called **electrophoresis.**



Colloid is taken in U tube and two electrodes are introduced and it is connected to battery. Now the colloidal particles move to oppositely charged electrodes.

Coagulation

The precipitation of colloidal particles is called coagulation. It can be done by

1 Addition of electrolyte

2 Addition of oppositely charged colloid

3 Addition of electrode

4. Give any five industrial applications of colloids

Colloids are useful in industries like

1 Medicine

Colloidal gold and calcium are used to treat rickets, tuberculosis

2 Phtography

Photo graphic plates are coated with gelatin containing colloidal silver bromide

3 Purification of water for Drinking purpose

The colloidal impurities like clay in water are removed by addition of alum

4 Rubber Industry

Latex is coagulated by acetic acid for making rubber

5 Cleaning action of soap

When soap is mixed with water it gives colloidal solution and it removes dirt from cloth. Grease forms emulsion with soap and removes dirt.

5. Explain applications of nano-technology in medicine

Nano particles are used to

- Identify disease causing micro organisms
- To deliver drugs to specific parts of body
- To reproduce tissues

- To repair tissues
- In treatment of cancer

6. Explain applications of nano technology in electronics

Nano particles are used to

- Create high storage memory devices
- To reduce size of transistors
- In video display units
- In high speed computers
- To create nano Ram
- In DRAM devices

7. Explain applications of nano-technology in Biomaterials

Nano particles are used in the following

- As substitutes for bone
- In bio-sensors to indentify bacteria
- In hip and knees
- In lung tissues
- In heart tissues
- To carry medicine to specific parts of body

8.What are the differences between true solution and colloid?

Property	True Solution	Colloid
Phase	One	Two
Tyndal Effect	No Tyndal Effect	Shows Tyndal effect
Brownian movement	No Brownian movement	Shows Brownian movement
Electrophoresis	No Electrophoresis	Shows Electrophoresis
Coagulation	No Coagulation	Shows Coagulation

UNIT III

Technology of Water, Catalysis, Glass

(Part A) Two marks

1. **Write any two reasons for depletion of underground water**
   Deforestation, Urbanization, Industrial growth, global warming
2. **What is rain water harvesting**
   Collection of rain water for future use.
   Rain water collected from terrace , open spaces.
3. **What is the reason for hardness of water.**
   Hardness is due to the presence of dissolved salts and metal ions in water.
   Salts like carbonate and sulphates. Metals ions like zinc, iron etc
4. **Define soft water and hard water.**
   Hard water does not form lather with soap immediately.
   Soft water forms lather with soap immediately..
5. **What are the methods(units) of expressing hardness of water ?**
   ppm(parts per million) and milligram/litre
6. **What is ppm and mg/lit?**
   Parts per million:
   Number of parts of calcium carbonate in one million parts of water
   Mg/lit:
   Number of milligrams of calcium carbonate in one litre of hard water
7. **What is EDTA? What indicator is used in EDTA titration.**
   EDTA: Ethylene Diamine Tetra Acetic Acid
   Indicator : Eriochrome Black T
8. **What are resins? What are its types**
   Acidic resin : Has hydrogen ions
   Basic resin : Has hydroxyl ions
9. **What is used to regenerate acidic resin and basic resin?**
   Acidic resin Regenerated with : Hydrochloric acid
   basic resin Regenerated with : Sodium hydroxide
10. **What are the disadvantages of using hard water in boilers**
    Boiler scale formation, Corrosion of boiler metal
    Foaming and priming
11. **How chlorine which is added to water kills bacteria?**
    Chlorine forms hypochlorus acid in water. This acid kills bacteria.
12. **Define catalyst , Give an example**
    Catalyst is a substance which alters the rate of a reaction without undergoing any chemical change.
    Eg) In Haber's process Iron is used as catalyst
13. **Define promoter and catalyst poison ?**
    Promoter increases activity of a catalyst.
    Catalyst poison destroys the activity of a catalyst.

14. **Give example for positive catalyst and negative catalyst**

    Iron in Haber's process iron is positive catalyst.

    In rusting of iron glycerol is negative catalyst.

15. **Give example for promoter and catalyst poison**

    Promoter : In Haber's process Molybdenum promotes activity of iron catalyst

    Catalyst poison : In Haber's process Hydrogen sulphide destroys activity of iron catalyst.

16. **What is glass? Mention some of its properties**

    Glass is a super cooled liquid.

    Glass is amorphous, brittle, hard and transparent.

17. **What are the raw materials for glass manufacture?**

    Silica, Sodium carbonate, Calcium carbonate

18. **Why soda ash is added into molten silica in manufacture of glass?**

    Silica has high melting point.

    In order to reduce melting point of silica , soda ash is added

(Part B) Three marks

1. **What are the advantages of rain water harvesting?**

   Increases ground water level

   Prevents flooding in rainy season

   Soil erosion is avoided

2. **Write any three disadvantages of hard water**

   Not useful for drinking

   Not useful for cooking

   Not useful for washing clothes

3. **What is carbonate and non carbonate hardness/What is temporary hardness and permanent hardness?**

Hardness	Carbonate	Noncarbonate
Nature	Can be removed by boiling water	Permanent
Caused by magnesium and calcium	carbonates	sulphates and chlorides

4. **What is reverse osmosis?**

   Two solutions are separated by semi permeable membrane.

   In concentrated side hydrostatic pressure greater than osmotic pressure is applied.

   Solvent molecule moves from concentrated solution to dilute solution.

5. **What is sterilization? What are the methods of sterilization?**

   Sterilization is the process of killing bacteria in water.

   Physical method : Water is kept in sun light to kill bacteria.

   Chemical method : Chlorine or bleaching powder is added to water to kill bacteria

6. **What are boiler scales? What are its disadvantages?**

   When hard water is boiled in boilers, salts like Calcium hydroxide, calcium sulphate, calcium phosphate etc are deposited on sides of boiler. It is called boiler scales.

   Disadvantages : Fuel is wasted, Corrodes boiler metal, blocks safety valves.

7. **What is foaming and priming?**

   Foaming : Formation of bubbles in boiler. Steam loses efficiency.

   Priming: Violent boiling of water. Steam loses efficiency.

8. **Define catalyst. What are the types of catalysts? Explain**

   Catalyst: Alters the speed of a chemical reaction, without taking part in reaction.

   Positive catalyst: Increases rate of a chemical reaction.

   Eg :Iron in Haber's process

   Negative catalyst: Decreases rate of a chemical reaction.

9. **Explain homogeneous and heterogeneous catalysis with example**

   Homogeneous catalysis: Catalyst and reactant are in same phase

   Eg) In manufacture of sulphuric acid by lead chamber process reactants and catalyst are in gaseous phase

$$\underset{\text{Gas}}{\text{Sulphur dioxide}} + \underset{\text{Gas}}{\text{Oxygen}} + \underset{\text{Gas}}{\text{water(steam)}} \xrightarrow{\text{NO (Gas)}} \text{Sulphuric acid}$$

10. **Explain homogeneous and heterogeneous catalysis with example**

    Heterogeneous catalysis: Catalyst and reactant are in different phase

    Eg) In Haber's process reactants are in gaseous state, catalyst is in solid state

$$\underset{\text{Gas}}{\text{Nitrogen}} + \underset{\text{Gas}}{\text{Hydrogen}} \xrightarrow{\text{Iron (Soild)}} \text{Ammonia}$$

11. **Explain promoter with example**

    Promoter: Increases the activity of a catalyst. Acts like a catalyst for a catalyst

    Eg: In Haber's process Molybdenum increases activity of catalyst iron

12. **Briefly explain optical glass(Flint glass)**

    Potassium and lead silicates are used to make optical glass.

    It is transparent and clear.

    Used in making prisms, lenses.

13. **Briefly explain wind shield glass(Shatter proof glass)**

    Celluloid is placed between sheets of glass.

    When Broken pieces of glass, sticks to plastic.

    Used in automobiles and bullet proof screens.

14. **Briefly explain chromatic glass**

    Silver iodide is added to glass.

    glass becomes dark on exposure to light, becomes light in shade.

    Used in spectacles(eye glass)

Unit III

(Part C) 5 marks

1.How is hardness of water estimated by EDTA method?

EDTA- Ethylene Diamine Tetra Acetic Acid

Principle: 1..Indicator is blue in color. Indicator-Metal ion complex is formed in water.It is in wine red color.

3.When EDTA is added, it forms EDTA-metal ion complex.. So at end point wine red color changes into steel blue color.

Procedure:

1.A burette is filled with EDTA , 20ml hard water is pipetted out into conical flask

3. Eriochrome blackT indicator is added to conical flask. Now color turns wine red.

4.EDTA is added from Burette,color changes from wine red to steel blue.

5. Now reading is noted and hardness of sample water can be calculated.

Calculation:

Volume of EDTA used = x ml

Volume of hard water used = 20 ml

1 ml of .01M EDTA = 1 mg of $CaCO_3$

There fore

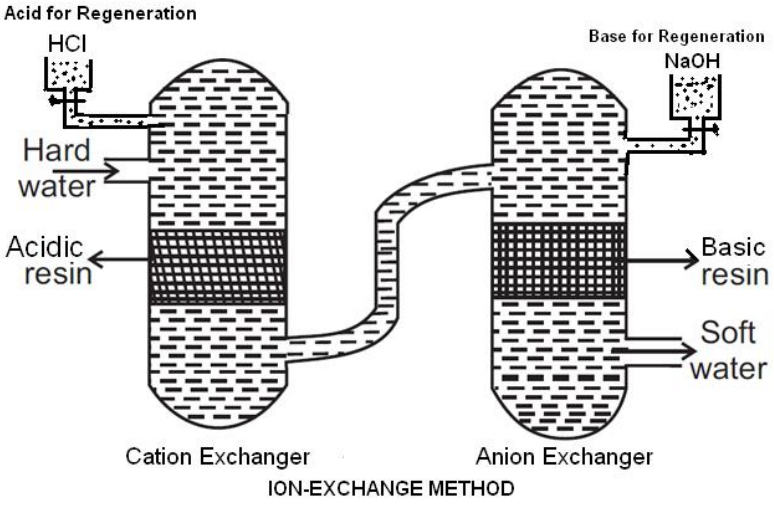
x ml of 0.01M EDTA = x mg of $CaCo_3$

20ml of hard water contains x mg of $CaCo_3$

Total hardness of water = X 1000

=50 x mg/lit

2.Describe ion exchange process for removing hardness:-



ION-EXCHANGE METHOD

Ion Exchange process is used for softening of hard water. In this process resins are used.

Resins: Compounds having hydrogen ions or hydroxyl ions.

Acidic Resins have replaceable hydrogen ions
Basic Resins have replaceable hydroxyl ions.

Process:-

In this process there are two cylinders. One cylinder has acidic resin and another cylinder has basic resin.

When hard water goes through cylinder 1 with acidic resin, cationic impurities are removed. When hard water then goes through cylinder 2 with basic resin, anionic impurities are removed.

Hence cationic and anionic ions responsible for giving hardness to water are removed. So hard water becomes soft water

Reaction in Cylinder 1

Cationic impurities are removed

$$2RH + Ca^{2+} \longrightarrow R_2Ca + 2H^+$$

Reaction in cylinder 2

Anionic impurities are removed

$$R'OH + Cl^- \longrightarrow R'Cl + OH^-$$

Thus all cationic and anionic impurities are removed and hard water becomes deionised

Regeneration

When resins are exhausted the cylinders are regenerated by

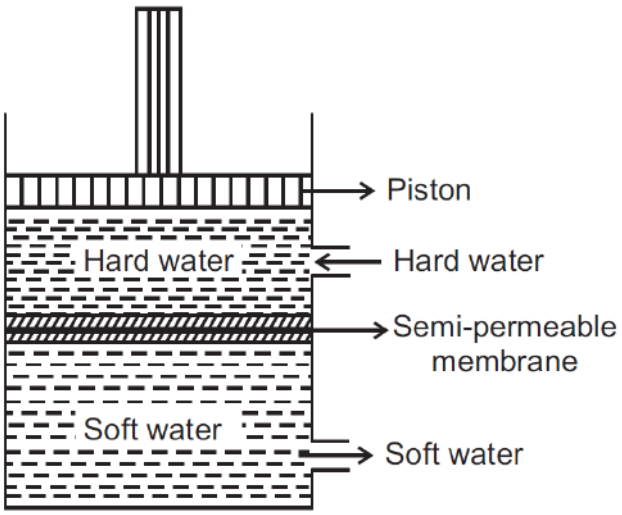
Passing HCl in cylinder 1

$$R_2Ca + 2HCl \longrightarrow 2RH + CaCl_2$$

Passing NaOH in cylinder 2

$$R'Cl + NaOH \longrightarrow R'OH + NaCl$$

3.Describe reverse osmosis processs for desalination of water:-



Reverse Osmosis: Two solutions with different concentrations are separated by semi permeable membrane. Hydrostatic pressure is applied in excess of osmotic pressure. solvents from concentrated solution will go through the membrane to dilute solution side.

In this process membranes made with cellulose acetate, polyamide or poly acrylo nitrile are used. This membrane separates hard water and pure water. When applied pressure exceeds osmotic pressure pure water from the hard water side passes through membrane to pure water side due to reverse osmosis. Thus pure water can be collected from the outlet.

4.What are boiler scales? Give their harmful effects.

Boiler scales are formed when water with impurities is boiled in boilers , so these get deposited on the walls of boilers. Salts responsible are calcium sulphate, calcium carbonate and calcium phosphate.

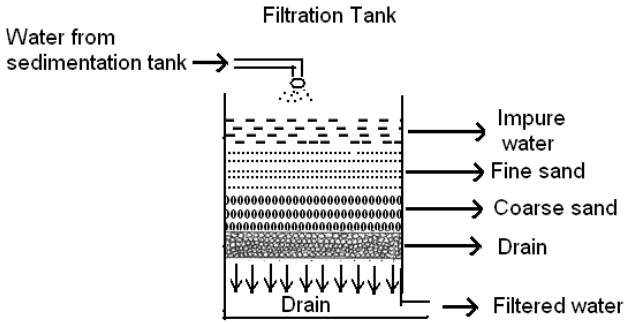
Harmful effects of boiler scales

1. Large amount of fuel is wasted
2. Boiler scale corrodes the metal
3. Swelling may take place
4. New scales are produced if there are cracks in the metal
5. Explosion may occur if scales block safety valves

5.How is water purified for drinking purpose?

The natural water in purified with following steps

1. Sedimentation
2. Filtration
3. Sterilisation



Sedimentation

- ✓ Water is sent into sedimentation tanks
- ✓ Alum or Ferrous sulphate is added.
- ✓ Thus the impurities are coagulated.

Filtration

- ✓ Suspended impurities are removed by gravity filter or pressure filter.
- ✓ Water is fed into this filter and filtered.

Sterilisation

This is killing of harmful bacteria in water.

This is done by physical method or chemical method.

Physical method.

Water is boiled for about 15 minutes to destroy bacteria in water.

Water can be exposed to sunlight to kill bacteria.

Chemical method

Chlorine is added to water. It forms hypochlorous acid.

Bleaching powder and ozone are also used to kill bacteria.

6. What are the disadvantages of using hard water in boilers?

1. Boiler Scales. Salt deposit in walls of boiler like calcium sulphate, Calcium hydroxide etc. It is because of boiling hard water.Calcium sulphate, Calcium hydroxide etc

Harmful effects of boiler scales

1. Large amount of fuel is wasted 2. Boiler scale corrodes the metal
3. Swelling may take place 4. New scales are produced if there are cracks in the metal

2. Corrosion of boiler metal

Causes	Treatment
Dissolved oxygen	**deaeration**
Dissolved carbon dioxide	**Lime**
Mineral acids	**Neutralise with bases**

3. Caustic embrittlement

Corrosion occurs at cracks and joints. Its due to sodium hydroxide. It can be removed using lime.

4. Foaming

Bubbles are carried along steam. Reduces efficiency of steam. It is due to improper boiler design.

7. Explain the different types of catalysts with examples

Catalyst : Substance that changes the rate of a chemical reaction.
It will not undergo any chemical change.

Type	Nature	Process	Catalyst
Positive catalyst	Increases the rate of chemical reaction	Manufacture of Ammonia	Iron
Negative Catalyst	Decreases the rate of chemical reaction	Decomposition of hydrogen peroxdie	Glycerine

8. Explain the different types of catalysis with example

Catalysis : Process of adding catalyst to change speed of a chemical reaction.

Type	Nature	Process	Reactant	Catalyst
Homogeneous catalysis	Catalyst and reactant are in same phase	Manufacture of sulphuric acid	$2SO_2$ gas + O_2 gas + $2H_2O$ gas	NO gas
Heteroeneous Catalysis	Catalyst and reactant are in different phase	Haber's process	N_2 Gas + $3H_2$ Gas	Iron Solid

9. Explain the applications of catalysis in Industries.

S.No	Process	Manufacture of	Catalyst
1	**Haber**	Ammonia	Iron
2	**Contact**	Sulphuric acid	Asbestos
3	**Lead Chamber**	Sulphuric acid	Nitric oxide
4	**Oswald**	Nitric acid	Platinum
5	**Hydrogenation**	Hydrogenation of oil	Nickel
6	**Fermentation**	Ethyl alcohol	invertase

10. Explain the characteristics of catalysts

1. Catalyst cannot alter the products
2. Catalyst is specific in action
3. Only a small amount of catalyst is needed
4. Catalyst cannot initiate a chemical reaction
5. Catalyst can speed up a chemical reaction
6. Catalyst cannot alter Equllibrium of a reaction

11. Write a note on manufacture of glass

Raw Materials: Sodium carbonate, Sodium nitrate, Silica

1. Raw materials are powdered, mixed and poured in tank furnace
2. Temperature of furnace is 1700^{o} C
3. Raw materials are heated and soda ash is added to lower melting point.
4. Raw materials melt, carbon dioxide escapes, mixture changes into silicates.
5. This mixture is slowly cooled to room temperature.
6. Thus glass is manufactured.

12. Write a note on a) Optical glass b) Wind Shield glass c)Photo chromatic glass

a) Optical glass

1. Potassium and lead silicates are used to make optical glass
2. Soft, clear and transparent.
3. Used to make lens, prism etc.

Wind Sheild glass

1. Plastic held between sheets of glass
2. Glass sticks to plastic on breakage
3. Used in car,bus etc and in bullet proof glass

Photo chromatic glass

1. Silver iodide is added to glass
2. Becomes dark in bright light
3. Used for making eye glass, vehicles

UNIT IV

Electro Chemistry, Electrochemical Cell, Energy Sources

(Part A) Two mark

1. **Define electrolyte with example**

   Electrolyte is a solution that dissociates into positive and negative ions when electricity is passed into it. Eg Hydrochloric acid

2. **Define electrolysis**

   Electrolysis is the process by which electrolyte dissociates into positive and negative ions by passing electricity.

   Eg) Hydrochloric acid dissociates into hydrogen ions and chloride ions

3. **What is electroplating**

   Coating of noble metal over less noble metal by the principle of electrolysis

   Eg Coating silver over copper spoon

4. **What is chrome plating? What is anode and electrolyte in chrome plating?**

Chrome plating	**Coating chromium over base metal**
Anode	**Lead plate**
Electrolyte	**a mixture of Chromic acid and sulphuric acid**

5. **Write any two applications of electroless plating**

   Electroless nickel plating is used in electronic appliances

   Electroless copper plating is used in PCB

6. **Write any two uses of electro chemical series**

   Calculation of standard emf of cell

   Determination of equilibrium constant for the reaction

7. **Write short representation of Daniel cell**

   $Zn/Zn^{2+} \,||\, Cu/Cu^{2+}$ or $Zn/ZnSO_4 \,||\, Cu/CuSO_4$

8. **Write short representation of lead acid storage cell.**

   $Pb|PbSO_4(s)|HSO_4(40\%)|PbO_2(s)|Pb$

9. **What is a battery? What are its types**

   Battery is store house of energy.

   Battery types are primary, Secondary battery, Fuel battery, Solar cells

10. **What is dry cell, Write uses of dry cell?**

    Dry cell does not have fluid component.

    Used in calculators, transistor radio, torch lights

11. **Write uses of lead acid storage cell/secondary battery**

    Used in cars, buses, trucks, telephone exchanges.

12. **Give uses of solar cell, give example**

    A device that converts solar energy into electrical energy is called solar cell

Eg) Silicon solar cell

(Part B) Three marks

1. **Explain strong and weak electrolyte with example**

Type	Strong Electrolyte	Weak electrolyte
Dissociation into ions When current is passed	Complete	Partial
Example	Sodium hydroxide, Sodium chloride	Acetic acid, Sodium carbonate

2. **What are the factors affecting stability of coating**
   1. **Current density** **2. Time of passing current**
   3. **Temperature** **4.Concentration of electrolyte**
3. **What is the use of electroplating?**
   1. **To make metal corrosion resistant**
   2. **To make metal abrasion resistant**
   3. **For better appearance of metal**
4. **What are the advantages of electroless plating over electroplating**
   No electric current is required
   Complicated parts can be plated uniformly
   Electroless plating can be carried out on insulators
5. **Write any three industrial applications of electrolysis**
   Electroplating
   Extraction of metals
   Electro Refining of crude metals
6. **Define electro chemical cell with example**
   Electro chemical cell is a device in which chemical energy from redox reaction is utilized to get electrical energy.
   Eg) Daniel cell
7. **Define single electrode potential**
   The tendency of an electrode to lose or gain electrons when it is in contact with its solution is called single electrode potential.
8. **Define electro chemical series with its significance**
   Electro chemical series is the arrangement of metals in increasing order of standard electrode potentials.
   1. **Metals with higher E_0 value are corrosion resistant Eg. Copper**
   2. **Metals with low E_0 value act as anodes**
   3. **Metals with high E_0 value act as cathodes**
9. **Define electrolytic concentration cell. Give an example**
   In electrolytic concentration cells there are two half cells. These differ in concentration. Electrical energy is produced on transfer of electrons from high concentration to low concentration.
   Eg) Zinc ion concentration cell

10. **Define primary battery. Give example**

    Primary battery can be used only once. Eg. Dry cell

    Used in watches, radio

11. **Define secondary battery. Give example**

    Secondary battery can be recharged and used again and again.

    Eg) Lead acid storage cell

    Used in cars, buses, trucks, telephone exchanges.

12. **Define fuel cell. Give example**

    Converts chemical energy from a fuel into electrical energy.

    Eg) Hydrogen oxygen fuel cell

    Used in

13. **Write uses of solar cell**

    Used in street lights, calculators, watches, radios, solar heaters, solar pumps.

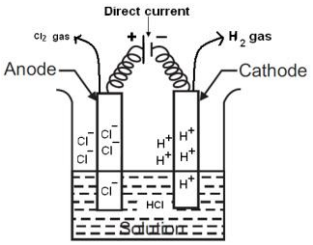
14. **What are non conventional energy sources**

    Energy generated using Wind, tides, solar, geo thermal heat, biomass

Unit IV

(Part C) 5 Marks

1.Explain electrolysis with example.



Electrolysis :Decomposition of electrolyte by passing electric current

Method : Hydrochloric acid is mixed with water and taken in electrolytic cell. Two carbon electrodes are introduced. On passing electric current following reactions take place.

Cathodic reaction : At cathode gain of electrons takes place. It is reduction

$$H^+ + e^- \longrightarrow H \text{ (reduction)}$$

$$2H \longrightarrow H_2$$

Anodic reaction : At anode loss of electrons takes place. Its is oxidation

$$Cl \longrightarrow Cl + e^-$$

$$2Cl \longrightarrow Cl_2$$

2. Explain electroplating with example.

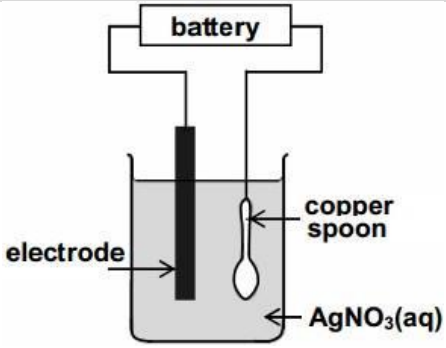
Electroplating is coating of one metal over another metal by the principle of electrolysis.

Method :

Cathode : Base metal, metal which is to be coated

Anode: Coat metal

Electrolyte : Acidified salt solution of coat metal is taken as electrolyte

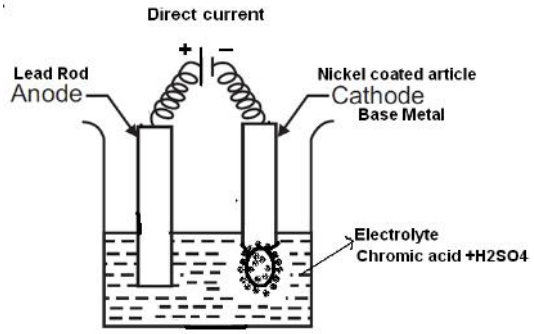


On passing electric current through the electrodes coat metal is deposited over base metal
For example
To electroplate silver over copper spoon
Cathode : Copper Spoon
Anode : Silver
Electrolyte : Acidified Silver nitrate solution
On passing electric current through the electrodes silver is deposited over copper spoon

3. Explain chromeplating

Chromeplating is coating of chromium over base metal by the principle of electrolysis.
Method :

Cathode : Base metal, metal which is to be coated with chromium
Anode: Plate of lead
Electrolyte : Chromic acid and sulphuric acid



On passing electric current through the electrodes chromium deposited over base metal
For uniform coating the articles are first plated with nickel and then chrome plating is done

4.Explain the methods for preparation of metal surface for electroplating

Some of the methods for preparation of metal surface for electroplating are

Flame or thermal cleaning

It involves heating metal to high temperature. It removes moisture and organic impurities

Mechanical cleaning

This removes rust, coatings using wire brushes, grinding wheels etc

Solvent cleaning

This removes oil, grease and fatty substances using toluene, xylene etc

Sand Blasting

Sand is sprayed on metal surface under pressure to remove oxides, paints etc

Rinsing

The article is rinsed with water or water is sprayed on the article

5.What is electroless plating?Explain with example

Electroless Plating

Electroless plating is a technique of depositing a noble metal(from its salt solution) on a catalytically active surface of a less noble metal by employing a suitable reducing agent without using electrical current.

Eg: Electroless Nickel plating

Electroless Nickel Plating:

Pre treated object : Stainless steel
Immersed in nickel chloride
Reducing agent : Sodium hypophosphite
During the process Nickel is coated over the object

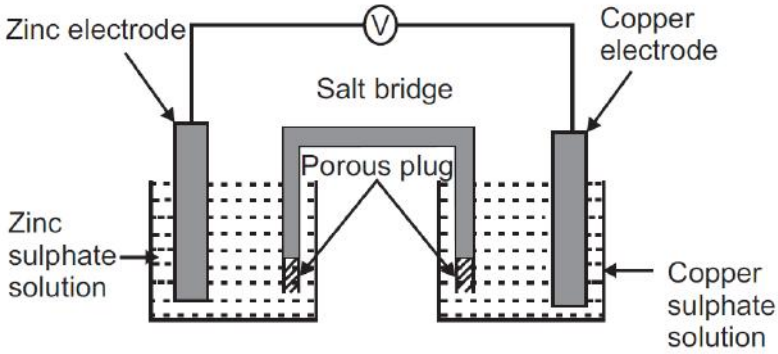
6.What are the advantages of electroless plating over electro plating?

1. No electric current is needed
2. Plating on semiconductors can be done
3. Plating on insulators like plastics, glass can be done
4. Complicated parts can be easily coated
5. This type of coating has good chemical and mechanical properties

7.What are the applications of electroless plating?

1.Electroless Nickel plating used in electronic appliances
2.Electroless Nickel plating used in domestic fields
3.Electroless Nickel coated polymers are used in decorative applications
4.Electroless copper is used in electronic instruments
5.Electroless copper is used in PCB

8. Explain the working of Daniel cell



Construction and working of Daniel cell

Daniel cell cosnsists of two glass tanks. Two half cells are

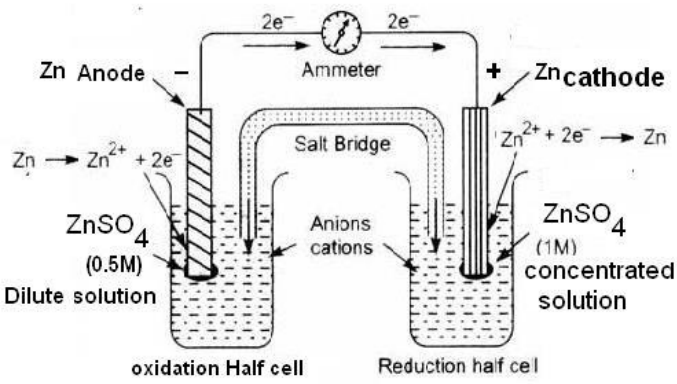
1.In one tank zinc rod dipped in zinc sulphate solution.
2.In second tank copper rod is dipped in copper sulphate solution.
3.Zinc is anode. Copper is anode.
4.The electrodes are connected by a wire through voltameter.
5.During cell reaction, electrons flow from zinc to copper.

Anodic Reaction $Zn \longrightarrow Zn^{2+} + 2e^-$

Cathodic Reaction $Cu^{2+} + 2e^- \longrightarrow Cu$

Overall Reaction $Zn + Cu^{2+} \longrightarrow Cu + Zn^{2+}$

9. Explain the construction and working of an electrolytic concentration cell



Electrolytic concentration cell

1.Two half cells with electrolytes of different concentration.
2.Electrodes are the same.
3.Transfer of substance from solution of higher concentration to lower concentration.
4.Thus electrical flow is made.

Zinc | Zinc Sulphate(dilute) || Salt Bridge || Zinc sulphate(concentrated) | Zinc

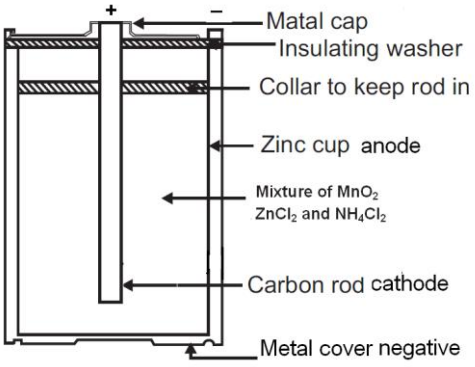
Anodic Reaction $Zn \longrightarrow Zn^{2+} + 2e^-$

Cathodic reaction $Zn^{2+} + 2e^- \longrightarrow Zn$

10. Explain the construction and working of dry cell

A cell without fluid component is called dry cell.

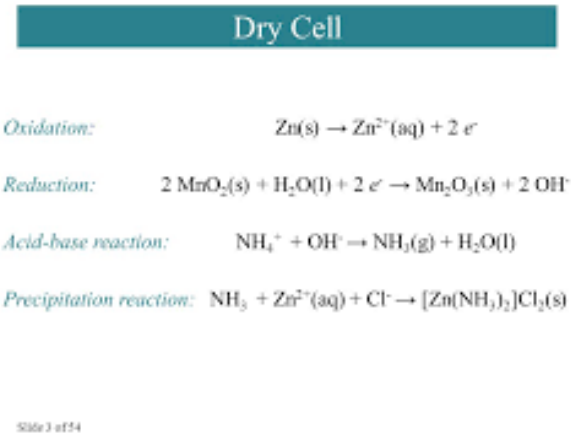
Eg: Daniel cell, Alkaline battery



Construction and working of dry cell:

Anode: Zinc container with electrolytes Ammonium chloride, Zinc chloride and manganese dioxide.

Cathode: Graphite rod. Immersed in electrolyte in centre of the cell.



Dry cell is a primary battery which gives 1.5V. It is cheap to make.

Disadvantages:

If current is drawn fastly, drop in voltage occurs.

Zinc dissolves slowly when not in use

Uses

Dry cells are used in flash lights, trasnsistors, calculators etc.

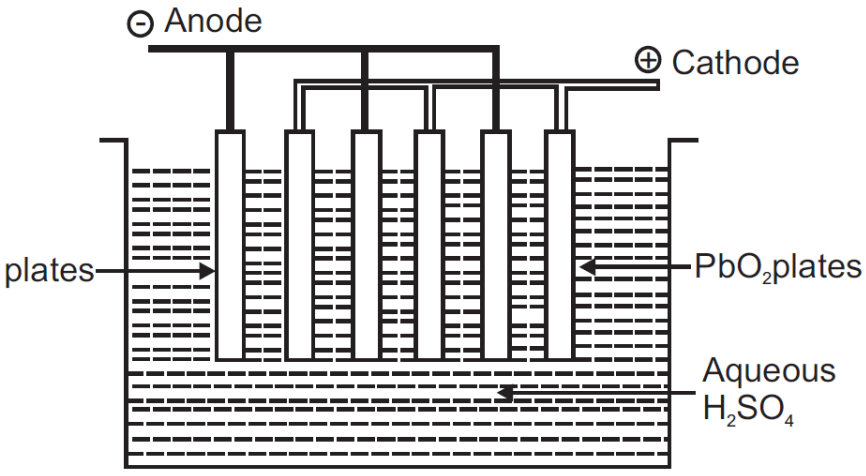
11. Explain the construction and working of Lead acid storage battery

Cathode: Lead dioxide
Anode: Lead sponge
Electrolyte: 20 Sulphuric acid

Construction and working of lead-acid storage cell:

A lead acid storage cell consists of many voltaic cells , 3 to 6 connected in series to get 6 to 12 V battery. In each cell lead plate is anode, lead dioxide is cathode. The plates are separated by glass or fibre.

The entire combination is immersed in dilute sulphuric acid.



Discharging:

Current is drawn from cell.

Electrodes are converted to lead sulphate.

Sulphuric acid is diluted

Anodic Reaction:

Oxidation takes place. Lead is converted to lead oxide.

Cathodic reaction:

Reduction takes place.

Lead dioxide is converted to lead sulphate.

Charging:

The cell is recharged by applying current in opposite direction.

Water is consumed, Sulphuric acid is regenerated

Lead and Lead dioxide get deposited on anode and cathode

$$PbO_2 + 2H \rightarrow PbO + H_2O$$

$$\frac{PbO + H_2SO_4 \rightarrow PbSO_4 + H_2O}{PbO_2 + H_2SO_4 + 2H \rightarrow PbSO_4 + 2H_2O}$$

Uses: used in automobiles, in hospitals as backup power supply, telephone exchanges etc.

12. Write a note on construction of solar cell

Contruction:

Solar cell consists of p-type and n-type semi conductors. They are held close.

Working:

1.Solar rays fall on top of p-type semiconductor

2.Electrons in valence band go to conduction band

3.They cross p-n junction into n-type semiconductor.

4.Potential difference between two layers is caused

5.flow of electrons takes place.

6.When p and n layers connected to external circuit, current is generated

UNIT V

Corrosion, Methods of preventing corrosion, Organic coating

(Part A) Two mark

1. **Define corrosion, What are the types of corrosion?**
   Slow and continuous destruction of metal or alloy by the environment
   Types of corrosion
   1)Chemical corrosion (or) Dry Corrosion
   2) Electrochemical corrosion (or) Wet corrosion
2. **What is dry corrosion?**
   Dry corrosion happens due to direct attack of gases like carbon di oxide, sulphur di oxide etc.. in the atmosphere on metal.
3. **The junction parts in iron knitted fence gets corroded, Why?**
   The junction parts of iron knitted fence corroded because oxygen is less there.
4. **What is galvanization. What are the types of galvanization.**
   Galvanization is Coating of zinc over iron
   Types of galvanization are Hot dipping, Sherardising, metal spraying.
5. **Write examples of sacrificial anodes**
   Zinc, Magnesium, Aluminium
6. **What are the cathodic protection methods?**
   1)Sacrificial anode method
   2)Impressed voltage method
7. **What is Tinning? What is the use of Tinned articles?**
   Process of coating iron or steel with Tin to prevent corrosion.
   Tinned utensils are used to store food, oils etc
8. **What is anodizing? What are the uses of anodized aluminium**
   Coating aluminium oxide over aluminium (or) aluminium alloys
   Uses of anodized aluminium are Window frame, decorative article, fridge tray etc..
9. **Define paint. Write any two components of paint.**
   Paint is a dispersion of pigment in drying oil.
   Two components are Drier, Thinner
10. **Write two uses of luminescent paint.**
    Road traffic signs, Advertising signs
11. **Write two uses of fire Aluminium paint.**
    Used in hot water pipes, oil tanks
12. **What is varnish? What are the types of varnish?**
    Varnish is colloidal suspension of resin in oil or spirit
    Types of varnish are Spirit varnish and oil varnish.
13. **What is pigment? Give example**
    Pigments are coloring agents for paint
    Eg. Red pigment : Red lead, cadmium read
14. **What are anti skinning agents? Give example**
    Anti skinning agents Prevent skinning of paints

Eg) Poly hydroxyl phenol

(Part B) Three marks

1. **What are the methods to prevent corrosion?**
   1)Control of environment 2)Alloying
   3)Surface coating 4)Metal coating

2. **What are the factors that influence the rate of corrosion?**
   Increase in temperature increases corrosion
   Impurity in environment increases corrosion
   Stress in metallic area increase corrosion
   If anodic area is less, corrosion is quick

3. **Define galvanization. Explain its types**
   Galvanization is coating of zinc over iron. So iron is protected from corrosion.

Hot Dip Galvanising	**Steel or iron article dipped in molten zinc**	**Bolts, nails etc**
Cold Dip Galvanising	**Iron article passed in zinc bath**	**Iron wire, iron strips**
Sherardising	**Iron article heated with zinc powder**	**Screws, bolts etc**
Metal spraying	**Molten zinc is sprayed over iron article**	**Tanks, Ships , bridges**

4. **Explain how iron is prevented from corrosion by alloying?**
   Iron can be prevented from corrosion by mixing it with other metals.
   Mixture of iron , nickel, titanium etc.. is called stainless steel. It does not corrode.
5. **What is anodizing. Explain the anodizing method**
   Anodising is coating of aluminium or aluminium alloy with aluminium oxide
   Method : Aluminium acts as anode, chromic acid is the electrolyte. On passing electric current, surface of aluminium is coated with aluminium oxide.
   Anodised aluminium is resistant to corrosion and abrasion. It is used to build airplane, window frames, decorative articles.

6. **Define Tinning and explain how tinning is done/ method**
   Coating of Tin over iron is called Tinning. Iron is soaked in molten Tin to get coating. Tinning is done for Copper, Bronze vessels. Food kept in such vessels won't get spoiled.
7. **What are the differences between paint and varnish?**

Paint	**Varnish**
Has Pigment	**No pigment**
Coating is not transparent	**Coating is transparent**
Suitable for metals, wood	**Suitable for wood only**
Pigment dissolved in drying oil	**Resin dissolved in oil or spirit**

Unit V

(Part – C) 5 Marks

1.Explain galvanisation and any three methods of galvanisation

Galvanization : Galvanization is coating of zinc over iron

Method	Procedure
Hot Dip Galvanizing	Iron article is dipped in molten zinc for getting thin layer of zinc coating
Cold dip galvanizing	Iron articles are passed through zinc bath
Metal spraying	Molten zinc is sprayed over iron by using spray gun

2.Explain anodising method for prevention of corrosion
Anodising: Anodising is the process of coating aluminium oxide on the surface of aluminium or its alloys.
Method:

Anode: Aluminium article **Cathode:** Suitable metal **Electrolyte:** Chromic acid
The electrolyte oxidises aluminium at anode to aluminium oxide. So a coating of aluminium oxide is formed on it.

The anodised coating provides electrical resistance to metal. It is also resistant to corrosion and abrasion.

The oxide coating may be coloured with dyes and pigments.

Anodised aluminium is used in

Aircraft parts, Window frames,ice trays,Machine parts,Fancy articles

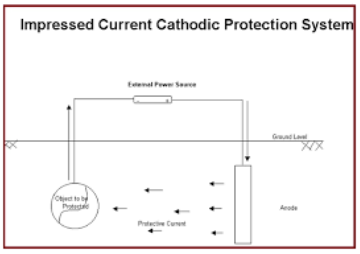
3.Explain cathodic protection method to prevent corrosion
Cathodic Protection : The area which is to be protected from corrosion is made as the cathode of electrochemical cell
Methods of Cathodic Protection:

1.Sacrificial anode method 2.Impressed voltage method

1.Sacrificial Anode Method:

In this method more active anodic metal which is coated over cathodic metal undergoes corrosion. So the cathodic metal is protected.
Eg : Coating of zinc over iron like in ships, underground cables, buried pipe lines

2.Impressed voltage method:



Since corrosion takes place at anode the object to be protected is made cathode.

Object to be protected from corrosion is connected to the negative terminal of DC source and the scrap iron is connected to the positive terminal of DC source. So the scrap iron only gets corroded.
Eg : this method is used to protect water tank, condensers etc.

4.Write a note on special paints

Type of Paint	Contains	Property
Heat Resistant paint	Metallic powder like aluminium, zinc	Can withstand heat
Fire Retardant Paint	Binders which break at high temperature	Produce non burning gases like carbon dioxide , ammonia etc
Luminescence Paint	Pigments like zinc sulphide, cadmium sulphide etc	Absorb UV radiation and emit radiation in visible region

5.What are the components of paint? Explain their function

Component of paint	Function	Example
Pigment	Gives color to paint	Black pigment – Carbon Black Yellow Pigment – Chrome Yellow
Thinners	To Dilute paint and to make it easy to apply	Kerosene Turpentine
Anti Skinning agent	Prevent skinning of paint	Poly hydroxyl phenols
Plasticizers	Increase elasticity of film	Tertiary amyl alcohol
Fillers	Increase volume of paint	Gypsum, China Clay

6.What are varnishes? How are they prepared?

Varnish : is a dispersion of resin in oil or spirit. It is mainly applied to wood.

Types of varnish:

1.Spirit Varnish
2.Oil varnish

<u>Spirit Varnish</u> : Resin is dissolved in spirit.

1.Shellac and spirit are placed in drum
2.Other components like plasticizer are added
3.Resin is added and agitated
4.It is filtered and used

<u>Oil Varnish</u>: Resin is dissolved in linseed oil or castor oil

1.Resin is heated to 300^{o} C. 25% resin is lost in fumes.
2.Linseed oil with driers and resin is heated to 200^{o}C
3.This is added to hot resin with stirring.
4.Wood spirit is added after cooling
5.It is filtered and used