

B.Tech.

Second Semester Examination, 2009-2010

Engineering Chemistry (CH-101-F)

Note : Attempt any *five* questions in all, selecting one question from each Section. Question No. 1. is compulsory. All questions carry equal marks.

Q. 1. (a) What is condensed phase rule?

Ans. When the pressure of the system remains constant (i.e., in which vapour pressure is not considered), then the phase rule equation becomes,

$$F = C - P + 1$$

Q. 1. (b) What is an inhibitor? Give an example.

Ans. A negative catalyst, since it slows down chemical reaction. For e.g., glycerol slows down the decomposition by hydrogen peroxide.

Q. 1. (c) Why does hard water consume lot of soap?

Ans. Hard water contains soluble salts of calcium & magnesium. When hard water is used for washing & bathing purpose it does not lather freely with soap, but produces sticky ppt. of calcium & magnesium soaps. The formation of such insoluble ppt consumes soap, till hardness is completely precipitated. Hence this causes wastage of lot of soap being used.

Q. 1. (d) What are ion exchange resins?

Ans. Ion exchange resins are insoluble, crosslinked, long chain organic polymer with microporous structure & functional group attached to the chains are responsible for ion-exchanging properties.

Q. 1. (e) What is the effect of pH on corrosion?

Ans. The lower the pH (or more acidic), greater is the corrosion.

Q. 1. (f) Explain cloud & pour point.

Ans. When an oil is cooled slowly the temperature at which it becomes cloudy or hazy in appearance is called its cloud point while the temperature at which oil ceases to flow or pour is called pour point.

Q. 1. (g) Differentiate between Homo-polymer and co-polymer.

Ans. A homopolymer consists of identical monomer units; while a copolymer consists of monomer units of different chemical structures.

Q. 1. (h) Define degree of polymerisation.

Ans. The number of repeating units [of monomers] in a chain of a polymer is the degree of polymerisation.

Q. 1. (i) What is hypsochromic shift?

Ans. Hypsochromic Shift : The shift of an absorption maximum towards the blue end or shorter wavelength is known as hypsochromic shift. This is also known as blue shift.

Q. 1. (j) What is molecular Spectra?

Ans. The spectra of interaction of electromagnetic radiations with matter is molecular spectra.

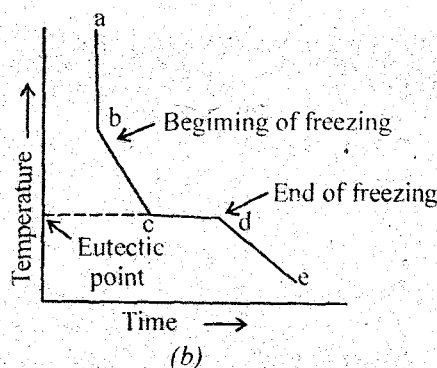
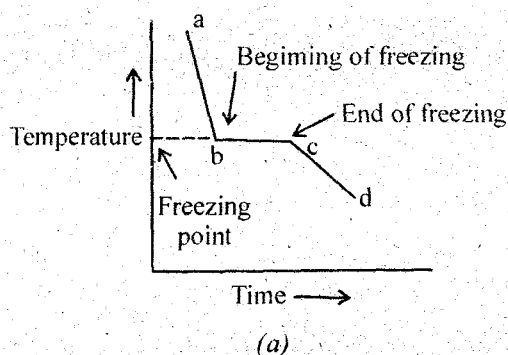
Section-I

Q. 2. (a) What is thermal analysis? Draw and explain the cooling curve of a pure substance and mixture.

Ans. Thermal Analysis : The shape of 't' : freezing points curves for any system, especially those

involving metals can be determined by thermal analysis—a method involving a study of cooling curves of various compositions of a system during solidification. The form of cooling curve indicates the composition of the solid. The principle of the method can be understood by the following considerations :

- (i) When a pure substance in the fused or liquid state is allowed to cool slowly & the temperature noted at definite times, the graphic representation of the rate of cooling will be continuous curve. When a freezing point is reached & solid makes its appearance it is indicated by a break in the continuity of cooling curve & temperature will remain constant until the liquid is completely solidified. Thereafter the fall in temperature will again become continuous.
- (ii) If a mixture of two solids in the fused state be cooled slowly & the cooling curve is obtained in a similar manner. We likewise obtain a continuous cooling curve, so long as mixture is in liquid state. When a solid phase begins to form, the rate of cooling abruptly alters & the cooling curve exhibits a break. However, the temperature does not remain constant as in the previous case of cooling of a pure substance. The temperature decreases continuously but at a different rate and if the mixture forms an eutectic, the fall of temperature continues till the eutectic point is reached. The system now becomes invariant from the point of view of the phase rule & the temperature remains constant until solidification is complete. Thereafter fall of temperature becomes uniform, but the rate of fall is quite different from previous one.



Cooling Curves

Q. 2. (b) Derive the Gibb's phase rule equation.

Ans. Gibb's Phase Rule Equation : Consider a heterogeneous system having P phases & C components. Now according to the definition the degree of freedom (F) of the system is minimum number of independent variable which must be fixed arbitrarily to define the system completely. But the number of these variable is equal to the total number of variables minus the number of relation between them at equilibrium, since each relation diminishes the number of independent variable by one.

Now, let us calculate the total number of independent variables :

(a) Temperature : At equilibrium, each phase is same so there is only one temperature variable for entire system.

(b) Pressure : At equilibrium, each phase has same pressure, so there is only one variable pressure for entire system.

(c) Concentration : Concentration of each component is generally expressed in terms of mole fraction. As a rule, the number of composition variable required for each phase are $(C-1)$, since the composition of all components may be expressed by stating the mole fraction of all except one of the components.

Hence, total number of variables,

$$= 1 \text{ (for temperature)} + 1 \text{ (for pressure)} + P(C-1) \text{ (for composition)} \\ = P(C-1) + 2$$

Now let us calculate the number of relations at equilibrium. We know that for a system in a thermodynamic equilibrium, the chemical potential (μ), which is related to concentrations of component i.e., we have at equilibrium.

$$[\mu_i]_\alpha = [\mu_i]_\beta = [\mu_i]_\gamma$$

Consequently, there are two equilibrium relationships for each component if there are 3 phases. Hence for P phases, the number of such relationships for each component are $(P-1)$, consequently for C components such relationship will be $C(P-1)$.

\therefore Degree of freedom, $F = \text{total number of variable} - (\text{independent})$

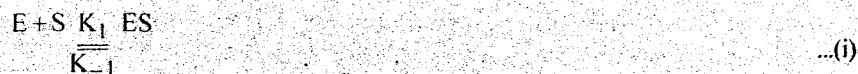
Number of relationships between these variable.

$$= [P(C-1) + 2] - [C(P-1)] \\ = C - P + 2$$

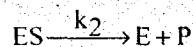
This is nothing but mathematical statement of phase rule.

Q.3. (a) Give an detail the mechanism of enzyme action.

Ans. Mechanism of Enzyme Action : The enzymes can increase the rate of bio-chemical reactions by factors ranging from 10^6 to 10^{12} . Moreover, they are highly selective & specific. They act only on certain molecules, called substrates; while leaving the rest of system unaffected. The high turnover numbers suggest that the substrate molecule cannot be very tightly bound to the enzyme. If they were, they might block the active sites. Reaction would be then slow, because the active site is not quickly cleared out. Most enzyme system behave as though there were an equilibrium between the substrate (S) & active site (E) :



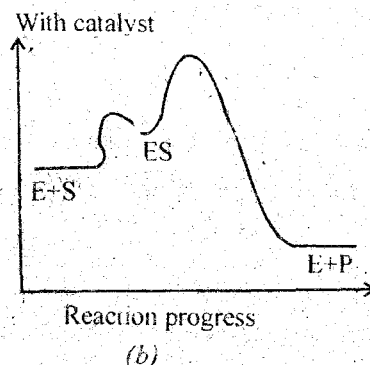
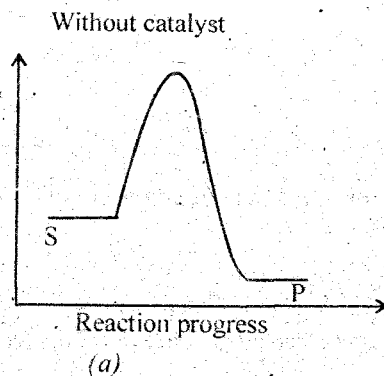
The symbol ES represents a species in which the substrate is attached in some way to the enzyme. This enzyme substrate complex then reacts to give product (P) & free the active site (E).



The substrate molecules moves off & onto the active site very rapidly compared with the rate at which they undergo reaction to form products (P) i.e., the equilibrium (i) is rapidly established between the enzyme & substrate, it is found that the rate of product formation increases, because the rate depends on the concentration of ES :

$$\text{Rate} = \frac{\Delta[P]}{\Delta t} = k_2 [ES]$$

However, with still further increase in the concentration of S, since a sizable fraction of the active sites are occupied, does not result in the same degree of increase in [ES].



(a) An uncatalyzed reaction (b) The same reaction catalysed by an enzyme. The plot in (b) assume that the catalysed reaction has a two step mechanism, in which second step ($ES \rightarrow E + P$) is rate determining.

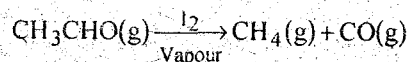
Q. 3. (b) Write short notes on :

(i) **Homogeneous and Heterogeneous catalysis,**

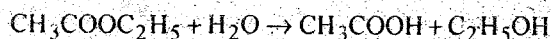
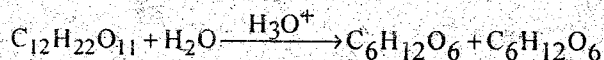
(ii) **Action of Promoter in a catalyst.**

Ans. (i) Homogeneous Catalysis : In this, the catalyst is present in the same phase as the reacting substances. Some common examples are :

(a) **In Gas Phase :** Decomposition of acetaldehyde is catalysed by iodine vapours.

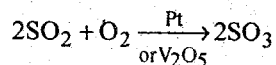


(b) **In Liquid Phase :** In acid base catalysis, e.g., inversion of cane sugar & hydrolysis of water.



Heterogeneous Catalysis : In such reactions, the catalyst is present in different phase from the reacting substances. Some common example of such catalyst are :

(i) In contact process for manufacture of H_2SO_4 , sulphur dioxide is directly oxidised to sulphur trioxide by atmospheric oxygen in the presence of platinum or vanadium pentaoxide as catalyst.

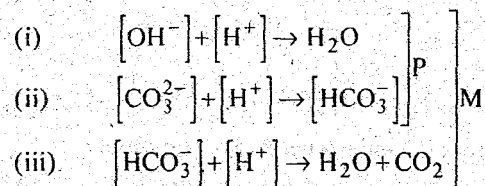


(ii) **Action of Promoter :** The addition of small amount of foreign substance, which are not themselves catalytically active sometimes, increase the activity of catalyst. Such substance which catalyze the catalyst are called promoters e.g., in NH_3 manufacture by Haber's process finely divided Fe acts as a catalyst while molybdenum (a mixture of $\text{Al}_2\text{O}_3 + \text{K}_2\text{O}$) act as a promoter.

Section-II

Q. 4. (a) Define Alkalinity of water. How is it determined?

Ans. Alkalinity : The alkalinity of water is attributed to the presence of the (i) Caustic alkalinity (due to OH^- & CO_3^{2-} ions) & (ii) temporary hardness (due to HCO_3^- ions). These can be estimated separately by titration against standard acid, using phenolphthalein & methyl orange as indicators. The determination is based on the following reactions :



The titration of water sample against a standard acid upto phenolphthalein end point marks the completion of reactions (i) & (ii) only. This amount of acid used thus corresponds to hydroxide plus one half of the normal carbonate present. On the other hand, titration of water sample against a standard acid to methyl orange end point marks the completion of reaction (i), (ii) & (iii). Hence the amount of acid used after the phenolphthalein end point corresponds to one-half of normal carbonate plus all the bicarbonates while total amount used represent the total alkalinity.

Procedure : Pipette out 100 ml of the water sample in a clean titration flask. Add to it 2 to 3 drops of a phenolphthalein indicator. Run in N/50 H_2SO_4 (from a burette), till the pink colour is just discharged. Then to the same solution, add 2 or 3 drops of methyl orange. Continue the titration till the pink colour reappear.

Q. 4. (b) Calculate the temporary hardness and permanent hardness of a sample of water containing $\text{Mg}(\text{HW}_3)_2 = 7.3 \text{ mg/l}$ $\text{Ca}(\text{HW}_3)_2 = 16.2 \text{ mg/l}$, $\text{MgCl}_2 = 9.5 \text{ mg/l}$ $\text{CaSO}_4 = 13.6 \text{ mg/l}$.

$$\begin{aligned} \text{Ans. Temporary hardness} &= \text{Ca}(\text{HW}_3)_2 + \text{Mg}(\text{HW}_3)_2 \\ &= 16.2 \times \frac{100}{162} + 7.3 \times \frac{100}{146} \\ &= 10 + 5 \end{aligned}$$

$$\boxed{\text{Temp. hard} = 15 \text{ ppm}}$$

$$\begin{aligned} \text{Permanent hardness} &= \text{CaSO}_4 + \text{MgSO}_4 \\ &= 13.6 \times \frac{100}{136} + 9.5 \times \frac{100}{120} \\ &= 10 + 7.9 \end{aligned}$$

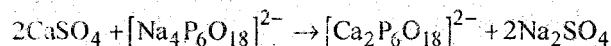
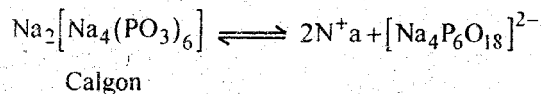
$$\boxed{\text{P.Hard} = 17.9 \text{ ppm}}$$

Q. 4. (c) Write short note on colloidal and calgon conditioning.

Ans. Colloidal Conditioning : In low-pressure boilers, scale formation can be avoided by adding organic

substances like kerosene, tannin, agar-agar (a gel) etc., which get coated over the scale forming precipitates, thereby yielding non-sticky & loose deposits which can easily be removed by pre-determined blow down operation.

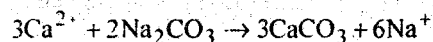
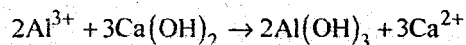
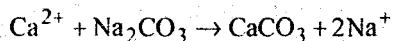
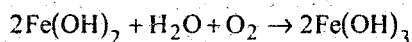
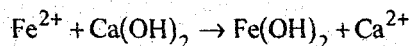
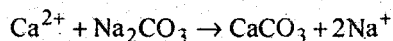
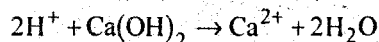
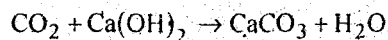
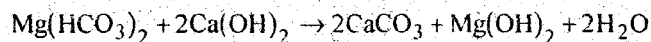
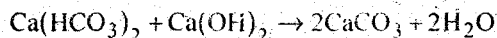
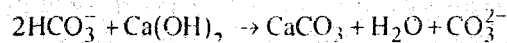
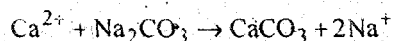
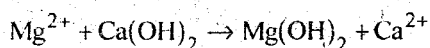
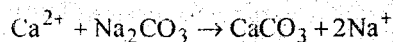
Calgon Conditioning : It involves in adding calgon [sodium hexa meta phosphate $(\text{NaPO}_3)_6$] to boiler water. It prevents the scale & sludge formation by forming soluble complex compound with CaSO_4 .

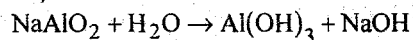


Q. 5. (a) Discuss the function of lime and soda in lime soda process give equation.

Ans. Lime-Soda Process : In this method, the soluble calcium & magnesium salts in water are chemically converted into insoluble compounds, by adding calculate amount of lime $[\text{Ca}(\text{OH})_2]$ & soda $[\text{Na}_2\text{CO}_3]$.

Calcium carbonate $[\text{CaCO}_3]$ and magnesium hydroxide $[\text{Mg}(\text{OH})_2]$, so precipitated are filtered off.





2NaOH is equal to $\text{Ca}(\text{OH})_2$.

Q. 5. (b) Discuss the following :

(i) Break point chlorination,

(ii) Electrodialysis.

Ans. (i) Break Point Chlorination : It involves in addition of sufficient amount of chlorine to oxidise :

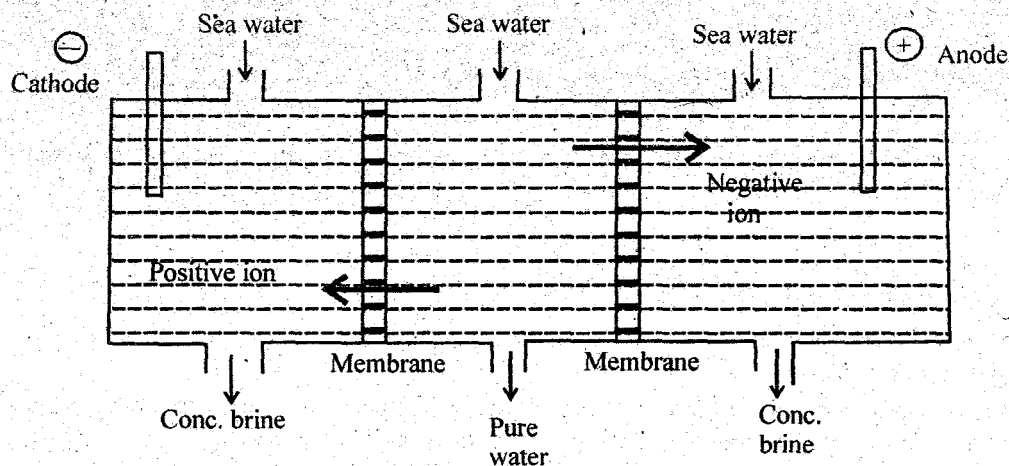
(a) Organic matter (b) reducing substance & (c) free ammonia is raw water; leaving behind mainly free chlorine, which process disinfecting action against disease producing (pathogenic bacteria).

When the dosage is applied chlorine to water rich in organic compound or ammonia is gradually increased, the results obtained can be depicted graphically in which appearance of following four stage occur :

The addition of chlorine at the tip or break called break point chlorination. This indicates the point at which free residual chlorine begins to appear. Usually all tastes, odours disappear at break point, resulting in appearance of water free from bad taste & odours. Moreover, because of highly persistent & powerful disinfection possessed by available free chlorine any type of pathogenic organism present in water are destroyed, thereby making disinfection highly efficient.

(ii) Electrodialysis : It is the method in which the ions (of the salt present) are pulled out of the salt water by passing direct current, using electrodes & thin rigid plastic membrane pair (natural or synthetic). When direct electric current is passed through saline water, the sodium ions (Na^+) start moving towards negative pole (cathode) while chlorine ions (Cl^-) start moving towards the positive pole (anode), through the membrane.

As a result, the concentration of brine decreases in the central compartment; while it increases in two side compartments. Desalinated brine or pure water is removed from the central compartment from time to time; while concentrated brine (in the side compartments) is replaced by fresh brine or sea water.



Section-III

Q. 6. (a) Discuss the mechanism of Electrochemical corrosion.

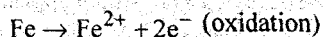
Ans. Electrochemical Corrosion (Mechanism) : This type of corrosion involves flow of electron-current between the anodic & cathodic areas. The anodic reaction (i.e., at anodic area) involves in dissolution of metal as corresponding metallic ions with the liberation of free electrons.

At anodic area : $M \rightarrow M^{n+} + ne^{-}$

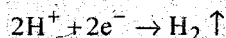
On the other hand, the cathodic reaction consumes with either by,

(a) Evolution of H_2 (b) Absorption of oxygen, depending on the nature of corrosive environment.

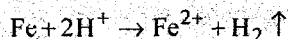
(a) Evolution of Hydrogen Type : Corrosion occurs usually in acidic environments. Considering metal like Fe, the anodic reaction is dissolution of iron as ferrous ion with liberation of electrons.



These electrons flow through the metal from anode to cathode, where H^{+} ions (of acidic solution) are eliminated as hydrogen gas.



The overall reaction is,



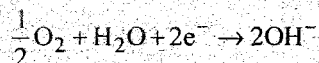
Thus, this type of corrosion causes "displacement of hydrogen ions" from the acidic solution by metal ions.

(b) Absorption of Oxygen : Rusting of iron in neutral aqueous solution of electrolytes (like NaCl) in the presence of atmospheric oxygen is a common e.g., of this type of corrosion.

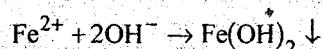
At anodic areas of the metal (iron) dissolves as ferrous ions with liberation of electrons.



The liberated electrons flow from anodic to cathodic areas through iron metal, where electron are intercepted by the dissolved oxygen as :



The Fe^{2+} ions (at anode) & OH^{-} ion (at cathode) diffuse & when they meet, ferrous hydroxide is precipitated.



Q. 6. (b) Write short notes on :

(i) Microbiological corrosion

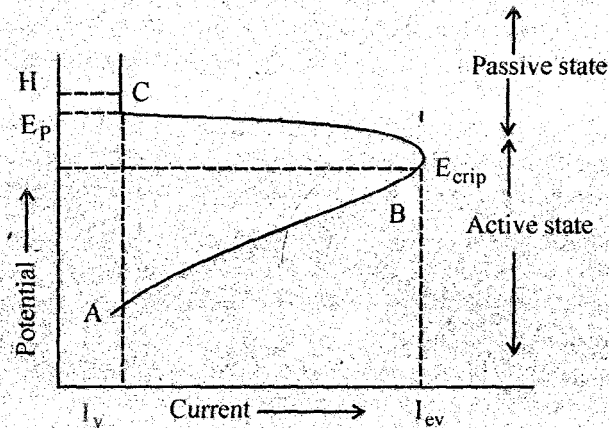
(ii) Anodic protection

Ans. (i) Microbiological Corrosion : The loss of material (metals or alloys) or its useful properties, by chemical or electrochemical interaction with its environment is known as corrosion.

Microbiological corrosion means loss in the form of biological that related to the human or life living things. That kind of corrosion take place in the living thing and a little corrosion takes place in called due to micro corrosion means less of the biological corrosion. In this type of corrosion loss in the biological or in the

form of botanical both are come under the micro-biological corrosions.

(ii) Anodic Protection : It may be pointed that metal like Ti & ferrous alloys like stainless steel cannot afford cathodic protection, since these readily get passivated. The basic principle of anodic protection is the growth of protective oxide surface film by application of anodic current on the metal/alloy appliance in a suitable oxidising atmosphere. The required potential for protecting the metal/alloy can be obtained from its potential-current curve. At an appropriate predetermined applied potential values. The change in the observed potential versus changes in the current are plotted. Initial curve AB indicates increase in current, thereby indicating the corrosion of metal/alloy at the anode. When the current assumes critical value (I_{crit}) onset of development of protective surface oxide film is indicated. The potential (E_{crit}) at critical value of current is known as critical passivation potential for metal/alloy. Above E_{crit} , along curve BC the current flowing drops to a very small value, called the passivation current which may be defined as the min. protective current density needed to maintain passivation in the metal/alloy. Corresponding value of potential is called passivation potential (E_p). At this stage min. corrosion of metal/alloy will take place, because the latter is already in a fully passive state.



Q. 7. (a) Discuss the mechanism of hydrodynamic lubrication. Under what conditions are greases preferred to lubricating oil.

Ans. Hydrodynamic Lubrication : In this, the moving/sliding surfaces are separated from each other by a thick film of fluid so that direct surface to surface contact & welding of junctions rarely occurs. The lubricant film covers the irregularities of sliding surfaces & forms a thick layer in between them, so that there no direct contact between material surfaces. This consequently reduces wear. The resistance to movement of sliding parts is only due to internal resistance between particles of the lubricant moving over each other. Therefore the lubricant chosen should have the min. viscosity under working conditions & at the same time, it should remain in place & separate the surfaces. In such system, friction depends on the viscosity, thickness of the lubricant, the relative velocity & area of the moving surfaces. The coefficient of friction in such cases is as low as 0.001 to 0.03. Hydrodynamic friction occurs in the case of a shaft running at fair speed as well as in well lubricated bearing with not too high load.

Greases have higher shear than oils and therefore can support much heavier loads at lower speed. They also do not require as much attention unlike the lubricating liquids. But greases have a tendency to separate

into oils & soap. Grease are used :

- (i) In situations where oil cannot remain in place, due to high load, low speed, sudden jerks etc.
- (ii) In bearing & gears that works at high temperature.
- (iii) In situations where bearing needs to be sealed against entry of dust, grit or moisture because greases are less liable to contamination by these.

Q. 7. (b) Why additives are used in lubricants. Give some example.

Ans. When a moving surfaces are under very high pressure & speed, a high local temperature is attained & under such conditions, liquid lubricants fail to stick & may decompose & even vapourize. To meet these extreme pressure conditions, special additives are added to mineral oil. These are called "extreme-pressure additive." These additives form a metal surfaces more durable films, capable of withstanding very high loads & high temperature. Important additives are organic compounds having active radicals or groups as chlorine (as in chlorinated ester), sulphur (as in sulphurized oils) or phosphorus (as in tricercyl). These compound react with metallic surface, at prevailing high temperature to form metallic chloride, sulphide or phosphide.

Q. 7. (c) Define viscosity Index and Saponification value.

Ans. Viscosity Index : Viscosity of liquids decreases with increasing temperature & consequently, the lubricating oil becomes thinner as the operating temperature increases. Hence viscosity of good lubricating oil should not change much with change in temperature, so that it can be used continuously under varying conditions of temperature. The rate at which the viscosity of an oil changes with temperature is measured by an arbitrary scale, known as viscosity index. If viscosity of an oil falls rapidly as temperature is raised, it has low viscosity index.

Saponification Value : It is the amount of milligrams of KOH required to saponify 1g of oil. Mineral oil do not saponify at all, but vegetable & animal oils do. Consequently this test help us to ascertain whether oil under reference is animal & vegetable oil or mineral or a compounded oil containing mineral & vegetable oil.

Section-IV

Q. 8. (a) Discuss the effect of structure on properties of polymer.

Ans. Effect of Structure on Properties :

(i) Strength : In straight & branched chain polymers, the individual chains are held together by weak intermolecular forces of attraction the strength of which increases with the chain-length or molecular weight. Such polymer exhibit mechanical strength only when chain length is greater than 150 to 200 atoms in a line. Polymers of low molecular-weights are quite soft & gummy, but they are brittle impact at low temperature. On the other hand, higher chain polymers are tougher & more heat resistant.

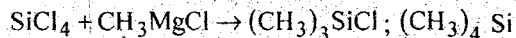
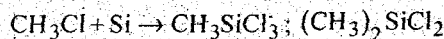
(ii) Plastic Deformation : It is found in materials known as thermoplastic whose structure is deformed to plastic stage on application of heat or pressure or both. This property of such materials has been used during processing them into desired-shape articles. Since the secondary intermolecular forces are weaker than primary covalent forces within them, therefore permanent deformation occurs as slippage.

(iii) Physical State of Polymers : Relative arrangement of the polymers with respect to each other may result in an amorphous or crystalline state of polymer. An amorphous state is characterized by completely random arrangement of molecules; while a crystalline consist of definite crystalline region (called crystallite) embedded in an amorphous random matrix. Polymers with a long repeating unit or with a low degree of symmetry do not crystallize easily & therefore generally form amorphous structures.

Q. 8. (b) What are silicones and how are they prepared? Discuss the important properties and uses.

Ans. Silicones : Silicones resins contain alternate silicon-oxygen structure, which has organic radicals attached to silicon atom.

Preparation : Reacting silicon with alkyl halide or silicon halide with Grignard reagent.

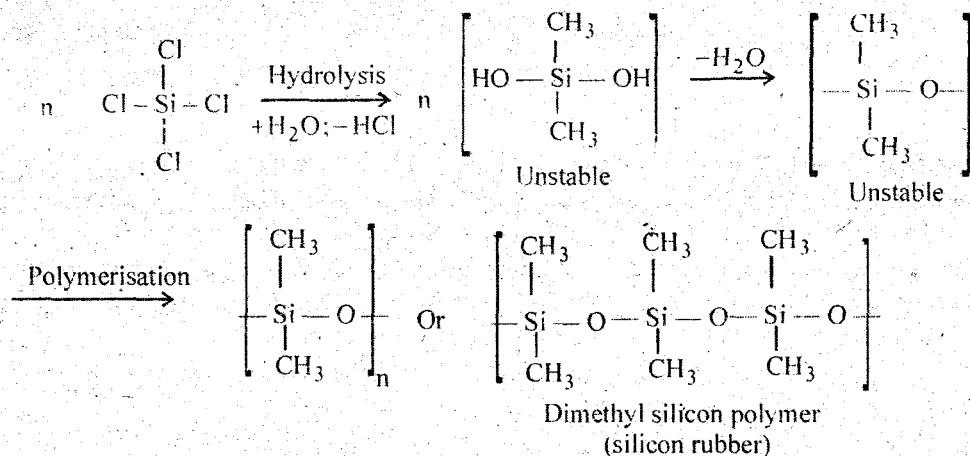


Tetrachloride	Silicon Methyl magnesium (Grignard reagent)	Organo-silicon chloride
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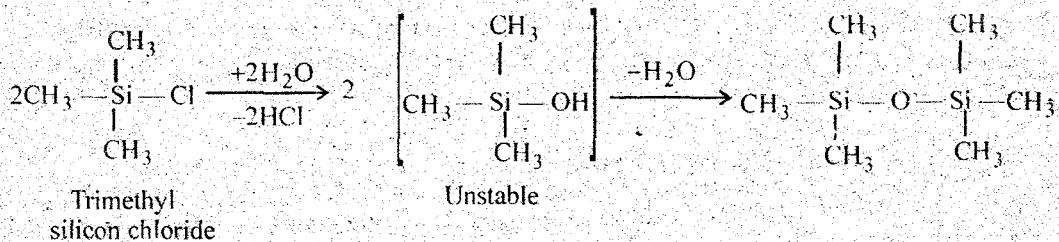
The reaction product (a mixture of different organo silicon chloride) is fractionally distilled to get different organo-silicon chlorides, which are then polymerized by carefully controlled hydrolysis.

(i) **Dimethyl-Silicon Dichloride** : It is bifunctional & can yield very long chain polymers.

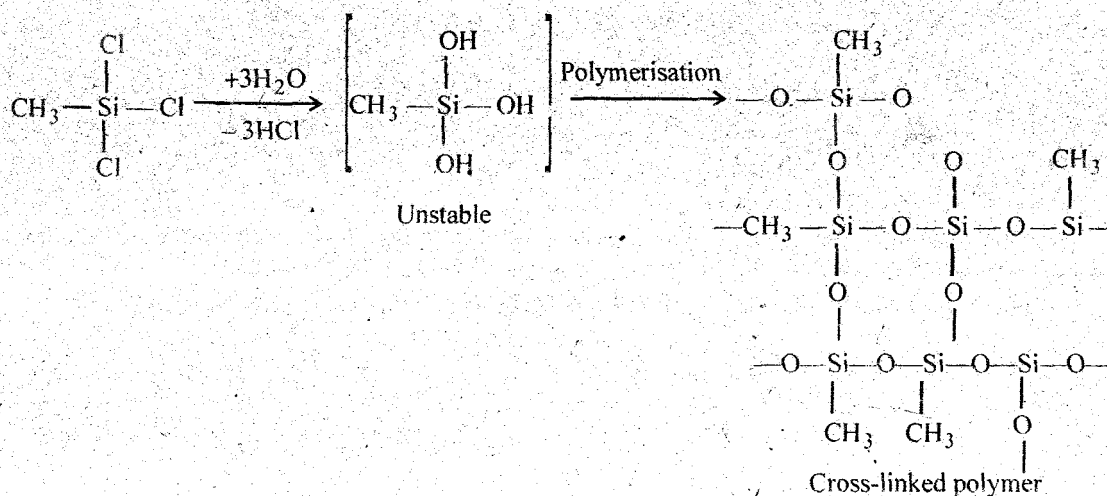
e.g.,



(ii) Trimethyl silicon chloride is monofunctional & hence a chain-stopper. This is therefore used in proportions to limit the chain length.



(iii) Monomethyl silicon chloride is trifunctional & gives cross-linked to the final polymer. Its proportion used in polymerisation determine the amount of cross-linking that can be obtained.



Characteristics of Silicones :

- Depending on the proportion of various alkyl silicon halides used during their preparation, silicones may be liquid, viscous liquid, semisolid, rubber like & solid.
- Because of silicon-oxygen links they exhibit outstanding stability at high temperature, good water-resistance, good oxidation stability but their chemical resistance generally lower than that of plastic.

Q. 9. (a) Discuss the principle and working of a spectra photometer.

Ans. Principle of Photoelectron Spectrometer : When a photon ionizes a sample, the energy is conserved i.e., the energy of incident photon ($= h\nu$) must be,

$$= \text{Ionization energy (I) of the sample} + \text{Kinetic energy of photoelectron ejected.}$$

i.e.
$$h\nu = I + \frac{1}{2} m_e v^2$$

This basic equation however can be refined in two ways :

- A photoelectron may originate from number of different orbitals & each one requires a different energy. Consequently, a series of different kinetic energies of the photoelectrons will be obtained each one satisfying the equation :

$$h\nu = I_1 + \frac{1}{2} m_e v^2$$

Where I_1 is ionisation energy for ejection of an electron from an orbital ψ . Thus, by measuring the kinetic energies of the photoelectrons & knowing ν (frequency) employed, various ionization energies can be determined.

- The ejection of an electron may leave an ion in a vibrationally excited state. Evidently entire excess energy of the photon does not appear as kinetic energy of the photoelectron & hence

$$h\nu = \frac{1}{2} m_e v^2 + I_i + E_{vib}^*$$

Where E_{vib} = Energy used to excite the ions into vibration.

Working : It consist of source of ionizing radiation such as helium discharge lamp for UPs & an XPs, an electrostatic analyzer & an electron detector. The kinetic energy of the ejected photoelectrons are measured using an electrostatic deflector which produce different deflection in the paths of photoelectrons as they pass between the charged plates. As the field strength is increased, electrons of different speeds (or kinetic energies) reach the detector. Consequently, the electron flux can be recorded & plotted against kinetic energy to obtain the photoelectron spectrum.

Q. 9. (b) What is the importance of Finger Print region in IR Spectroscopy?

Ans. Finger Print Region : The region below 1500 cm^{-1} is very useful for establishing the identity of a compound. Two identical compounds under similar conditions and is same medium, differ in their IR spectra in the region below 1500 cm^{-1} is.

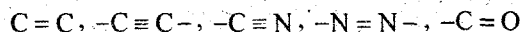
- (i) Rich in many absorption caused by bending vibrations.
- (ii) Rich in many absorptions resulting from the stretching vibrations C—C, C—O and C—N bonds.
- (iii) Rich in absorption bands and shoulder's because the number of bending vibrations are usually more than the number of stretching vibration.

It is called finger-print region, analogous to DNA in human being.

Q. 9. (c) Discuss Chromophore and Auxochrome.

Ans. Chromophores : The part of molecule having n or π electrons is essentially responsible for absorption & these fragments are known as chromophores.

Simple Chromophores :



Undergoes $\pi \rightarrow \pi^*$ transitions in the short wavelength regions of ultraviolet radiations.

Auxochromes : Polar group such as $-\text{OH}$, OR , $-\text{NH}_2$, $-\text{SH}$ & $-\text{X}$ (halogen) having unshared pair of electrons & may show absorption above 190 nm. Such groupings are called auxochromes when conjugated with chromophores since they modify the position of absorption band relative to that of parent chromophore alone.