

B.E.

First Semester Examination, Dec.-2008

Chemistry (CH-101-E)

Note : Attempt any *FIVE* questions. All questions carry equal marks.

Q. 1. (a) The Latent heat of vapourisation of benzene at its boiling point (80°C) is 7413 cal mol⁻¹. What is vapour pressure of benzene at 27°C?

Ans. $T_1 = 80^\circ\text{C} = 80 + 273 = 353\text{K}$ $\Delta H = 7413\text{ cal mol}^{-1}$
 $T_2 = 27^\circ\text{C} = 27 + 273 = 300\text{K}$ $R = 1.987\text{ cal K}^{-1}\text{ mol}^{-1}$
 $P_1 = 760\text{ mm}$
 $P_2 = ?$

$$\log \frac{P_2}{P_1} = \frac{\Delta H_{\text{vap}}}{2.303R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$$
$$\log \frac{P_2}{760} = \frac{7413}{2303 \times 1.987} \left[\frac{1}{353} - \frac{1}{300} \right]$$
$$= \frac{7413}{2303 \times 1.987} \left[\frac{300 - 353}{300 \times 353} \right] = - \left[\frac{392889}{484604} \right]$$
$$\log P_2 = -0.8107 + \log 760 = -0.8107 + 2.880$$
$$\log P_2 = 2.070, P_2 = \text{anti log}(2.070) = 117.4\text{ mm Ans.}$$

Q. 1. (b) Derive an expression for Gibb's Helmholtz equation.

Ans. Gibbs free energy is given by

$$dG = VdP - SdT$$

At constant P,

$$dG = -SdT$$

$$\left(\frac{dG}{dT} \right)_P = -S \quad \dots(1)$$

$$G = H - TS \quad \dots(2)$$

Substitute value of S in equation (2)

$$G = H + T \left(\frac{dG}{dT} \right)_P$$

$$\Delta G = \Delta H + T \left[\frac{d\Delta G}{dT} \right]_P$$

This is known as Gibbs Helmholtz equation

Q. 1. (c) Prove that for an ideal gas

$$(i) \Delta S = C_v \ln \frac{T_2}{T_1} + R \ln \frac{V_2}{V_1}$$

$$(ii) \Delta S = C_p \ln \frac{T_2}{T_1} - R \ln \frac{P_2}{P_1}$$

Ans. The system absorb small amount of heat (dq_{rev}), increase in entropy is given by $dS = \frac{dq}{T}$

According to first law of thermodynamics

$$dq_{rev} = dE - dW \quad \dots(1)$$

But $dW = -PdV$

$$dE = C_v dT$$

Thus, equation (1) becomes,

$$dq = C_v dT + PdV$$

For an ideal gas equation $PV = RT$

$$dq = C_v dT + \frac{RT}{V} dV$$

$$TdS = C_v dT + \frac{RT}{V} dV$$

$$dS = C_v \frac{dT}{T} + \frac{RdV}{V}$$

Entropy change can be obtained by integrating between the limits,

$$\int_{S_1}^{S_2} dS = C_v \int_{T_1}^{T_2} \frac{dT}{T} + R \int_{V_1}^{V_2} \frac{dV}{V}$$

$$\begin{aligned} S_2 - S_1 = \Delta S &= C_v [\ln T]_{T_1}^{T_2} + R [\ln V]_{V_1}^{V_2} \\ &= C_v \ln \frac{T_2}{T_1} + R \ln \frac{V_2}{V_1} \quad \dots(2) \end{aligned}$$

2. Let P_1 be pressure in initial state & P_2 be final state,

$$P_1 V_1 = RT_1 \quad P_2 V_2 = RT_2$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

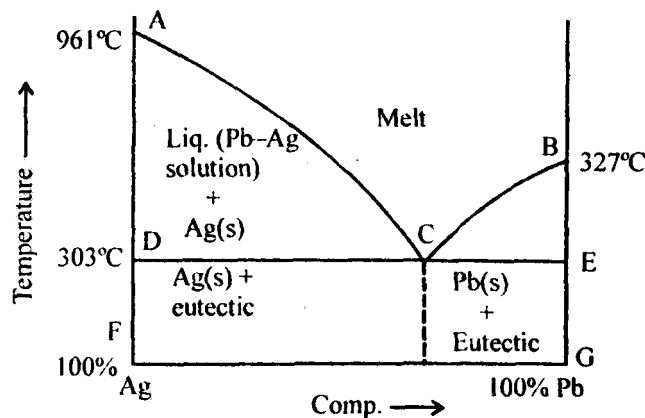
$$\frac{V_2}{V_1} = \frac{P_2}{T_2} \times \frac{T_1}{P_1}$$

Substitute the value $\frac{V_2}{V_1}$ in equation (2)

$$\begin{aligned}
 \Delta S &= C_v \ln \frac{T_2}{T_1} + R \ln \frac{P_1}{P_2} \cdot \frac{T_2}{T_1} \\
 &= C_v \ln \frac{T_2}{T_1} + R \ln \frac{P_1}{P_2} + R \ln \frac{T_2}{T_1} \\
 C_p - C_v &= R \quad \therefore \quad C_v = C_p - R \\
 \Delta S &= (C_p - R) \ln \frac{T_2}{T_1} + R \ln \frac{P_1}{P_2} + R \ln \frac{T_2}{T_1} \\
 &= C_p \ln \frac{T_2}{T_1} - R \ln \frac{T_2}{T_1} + R \ln \frac{P_1}{P_2} + R \ln \frac{T_2}{T_1} \\
 \Delta S &= C_p \ln \frac{T_2}{T_1} + R \ln \frac{P_1}{P_2} \quad \text{Hence proved.}
 \end{aligned}$$

Q. 2. (a) Describe the Lead-Silver phase diagram.

Ans. A brief discussion of phase diagram is given below :



Curves : Pb-Ag system consist of two curves AC & BC.

Curve AC is freezing point curve of silver. Pure Ag melts at 961°C (point A). When molten Pb is added to molten Ag, added Pb dissolves in Ag to form a Pb-Ag solution, melting point of Ag is lowered. The lowering will continue along the curve AC & Ag separate out as solid phase. The curve terminate at point C where

system has **min.**, freezing point (303°C). Along AC, $C = 2(\text{Pb} + \text{Ag})$, $P = 2(\text{Ag}_{(s)} + (\text{Pb-Ag}) \text{ solution})$. According to phase rule $F = C - P + 1 = 2 - 2 + 1 = 1$ system is invariant.

Curve BC : It is freezing curve of Pb pure Pb meets at 327°C. Addition of Ag lowers its m.pt along BC.

Since

$$C = 2(\text{Pb} + \text{Ag})$$

$$P = 2(\text{pb}_{(s)} + \text{solution})$$

$$F = C - P + 1 = 2 - 2 + 1 = 1 \text{ univariant}$$

Point C : At point C both curve AC & BC meets & has a composition Ag = 2.6% & Pb = 97.4% . At this point C, minimum melting temperature is obtained (303°C) & this temperature is called eutectic temperature.

At C $C = 2(\text{Pb} + \text{Ag})$ & $P = 3 \left[\text{Ag}_{(s)} + \text{Pb}_{(s)} + \text{solution}(\text{Pb} + \text{Ag}) \right]$

$\therefore F = C - P + 1 = 2 - 3 + 1 = 0$

System is invariant i.e., no component temperature & composition need to specify.

Application : The phase diagram of Pb-Ag system is useful in recovery of Ag from argentiferous lead.

The process used is called Pattinson's method & involves desilverisation of Pb.

Q. 2. (b) Derive phase rule equation $V_{12} = F = C - P + 2$.

Ans. The degree of freedom (F) is given by the difference between :

1. The number of variables required to specify the state of system and
2. The number of restrictions imposed by their inter-dependence,

i.e., $F = \text{equation (1)} - (2)$

Consider a system of C components ($C_1, C_2, C_3, \dots, C_n$) distributed between P phases ($\alpha, \beta, \gamma, \dots, P$)

Let's assume that passage of component from one phase to another phase does not constitute a chemical extension:

1. The state of each phase is completely specified by :

(a) Temperature (b) Pressure (c) Composition of each phase

Example : $(x_{1,\alpha}; x_{2,\alpha}; x_{3,\alpha}; \dots; x_{c,\alpha})$

$(x_{1,\beta}; x_{2,\beta}; x_{3,\beta}; \dots; x_{c,\beta})$

$(x_{1,p}; x_{2,p}; x_{3,p}; \dots; x_{c,p})$

Total number of variables are :

$(PC + 2) \quad \dots(1)$

2. All variables are not independent.

In each phase, the sum of mole fractions is unity i.e.,

$x_{1,\alpha} + x_{2,\alpha} + x_{3,\alpha} + \dots = 1$

$x_{1,\beta} + x_{2,\beta} + x_{3,\beta} + \dots = 1$

\vdots

$\sum_i x_{i,p} = 1 \quad (i = 1, 2, 3)$

There are P relations of such kind. ...II(a)

Moreover, for complete equilibrium to exist between the phases, the chemical potential of each species must be the same in each phase.

$\mu_{1,\alpha} = \mu_{1,\beta} = \mu_{1,\gamma} = \dots = \mu_{1,p}$

$\mu_{2,\alpha} = \mu_{2,\beta} = \mu_{2,\gamma} = \dots = \mu_{2,p}$

\vdots

$\mu_{c,\alpha} = \mu_{c,\beta} = \mu_{c,\gamma} = \dots = \mu_{c,p}$

For each component, there are (p-1) equations. Hence for c component, number of phase equation are

$$c(P-1) \quad \dots \text{ii(b)}$$

Now,

$$\begin{aligned} F &= (D - C_2) \\ &= 1 - (11(a) + 11(b)) \\ &= PC + 2 - [P + C(P-1)] \\ F &= C - P + 2 \end{aligned}$$

This is Gibbs phase rule.

Q. 3. (a) Define hardness of water. **What** are the units of hardness? Why hardness is expressed in terms of CaCO_3 .

Ans. Hardness of water is characteristic property which prevent water from forming lather with soap. It is defined as soap consuming capacity of water sample.

, Units of **Hardness of Water:**

1. **PPM** : Parts per million is defined as parts of CaCO_3 equivalent hardness per 10^6 part of water.

2. **Mg/L** : Number of milligram of CaCO_3 present in 1L of water.

$$1\text{PPM} = 1\text{mg/L}$$

3. **Clarke's Degree** : It is number of grains of CaCO_3 equivalent hardness per gallon of water.

$$1 \text{ grain} = \frac{1}{7000} \text{ lb}$$

4. **Degree French ("Fr)**: Part of CaCO_3 equivalent hardness per 10^5 parts of water.

Hardness is expressed in terms of CaCO_3 equivalent because :

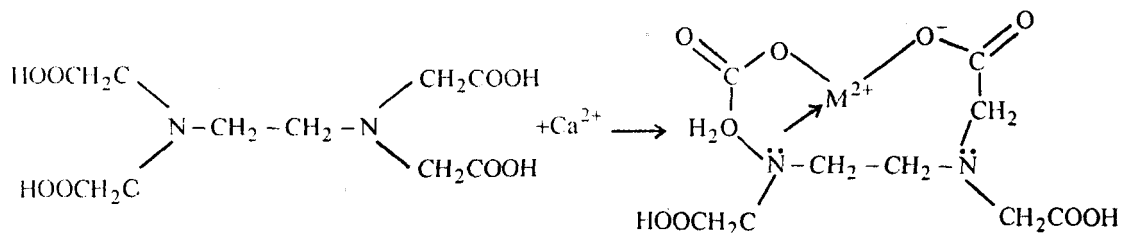
1. Its molecular mass is 100.

2. It is most insoluble salt that can be precipitated in H_2O treatment.

Q. 3. (b) Describe principle and procedure of **EDTA** method for **determination** of hardness.

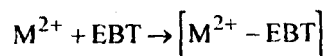
Ans. EDTA method is based on fact that hardness causing metal ion form complex with both eriochrome black-T(EBT) as well as EDTA, but EDTA complexes are more stable.

EDTA makes following type of stable complex with metal ion M^{2+} .

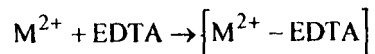


Water sample is buffered at $p^H = a - 1.0$.

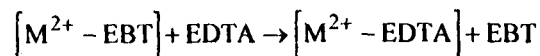
EBT is blue coloured azo dye & form unstable wine red coloured complex with M^{2+} at $pH = a - 1.0$.



On addition of EDTA, M form M-EDTA complex which are more stable than M-EBT complex.

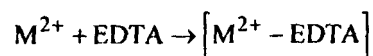


\therefore Now stable $[M^{2+} - EDTA]$ is formed & EBT is free liberated & give blue coloured end point.



Blue colored solution

Procedure: To a sample of water, added buffer (NH_4Cl-NH_4OH) solution to maintain $pH = 9-10$. Add small amount of indicator. A wine red color is obtained. The solution is titrated against EDTA till blue colour appears. End point is wine red to blue metal ion combines with EDTA as follows:



$$\begin{aligned} 1 \text{ gm equivalent of } M^{2+} &= 1 \text{ gm eq., of EDTA} \\ &= 1 \text{ gm eq., of } CaCO_3 \end{aligned}$$

$$\begin{aligned} 1 \text{ gm eq., of EDTA} &= \frac{1}{2} \text{ gm mole of EDTA} = 1 \text{ gm eq., of } CaCO_3 \\ &= 50 \text{ gm of } CaCO_3 \end{aligned}$$

$$1 \text{ gm mole of EDTA} = 100 \text{ gm of } CaCO_3 = 10^5 \text{ mg of } CaCO_3 \text{ Ans.}$$

Q. 3. (c) 100 ml of water sample require 20 ml of N/50 sulphuric acid for neutralization to phenolphthalein end point. After this methyl orange was added to this and further acid required was again 20 ml. Calculate alkalinity of water.

$$\text{Ans.} \quad P = 20 \text{ ml of } \frac{N}{50} H_2SO_4$$

$$M = 20 + 20 = 40 \text{ ml of } \frac{N}{50} H_2SO_4$$

Using phenolphthalein indicator alkali $N_1 V_1 = N_2 V_2$ (acid)

$$N_1 \times 100 = \frac{1}{50} \times 20$$

$$N_1 = \frac{20}{50 \times 100}$$

$$\text{Strength of solution (P)} = N_1 \times 50 \times 1000$$

$$= \frac{20}{50 \times 100} \times 50 \times 1000 = 200 \text{ mg / L} = 200 \text{ ppm}$$

Using methyi orange as indicator water acid.

$$N_1 V_1 = N_2 V_2$$

$$N_1 \times 100 = \frac{1}{50} \times 40$$

$$N_1 = \frac{1 \times 40}{50 \times 100}$$

$$\text{Strength of solution (M)} = N_1 \times 50 \times 1000$$

$$= \frac{1 \times 40 \times 1000}{50 \times 100} = 400 \text{ ppm}$$

$$\text{Now, } P = 1/2M = 200 = \frac{1}{2}(400) = 200$$

Alkalinity is due to carbonate ions

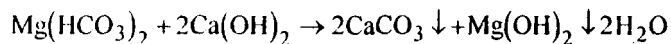
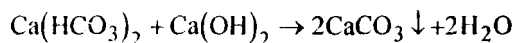
$$\text{CO}_3^{2-} = 2P = 2 \times 200 = 400 \text{ ppm Ans.}$$

Q. 4. (a) What are function of lime and soda in lime soda process, give equation?

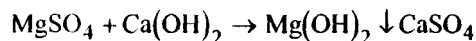
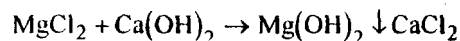
Ans. The lime soda process involves the chemical conversion of all the soluble hardness-causing salts by the addition of soda & lime into insoluble precipitate which could easily be removed by setting & filtration.

The reaction involved are :

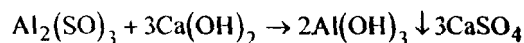
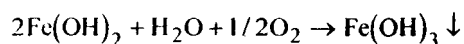
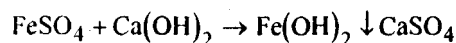
1. Removal of temperature Ca^{2+} & Mg^{2+} hardness.



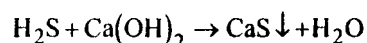
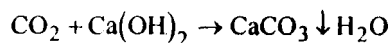
2. Removal of peam. Mg^{2+} hardness.



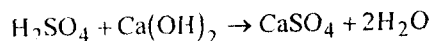
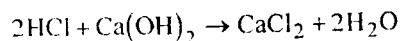
3. Removal of dissolved Fe & Mg salts,



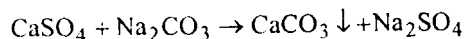
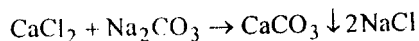
4. Removal of CO_2 & H_2S



5. Removal of mineral acid



Soda : During the removal of Mg^{2+} , Fe^{2+} , Al^{3+} , Fe etc. by lime, Ca^{2+} is introduced in water. This Permanent hardness is removed by soda. Reaction involved,



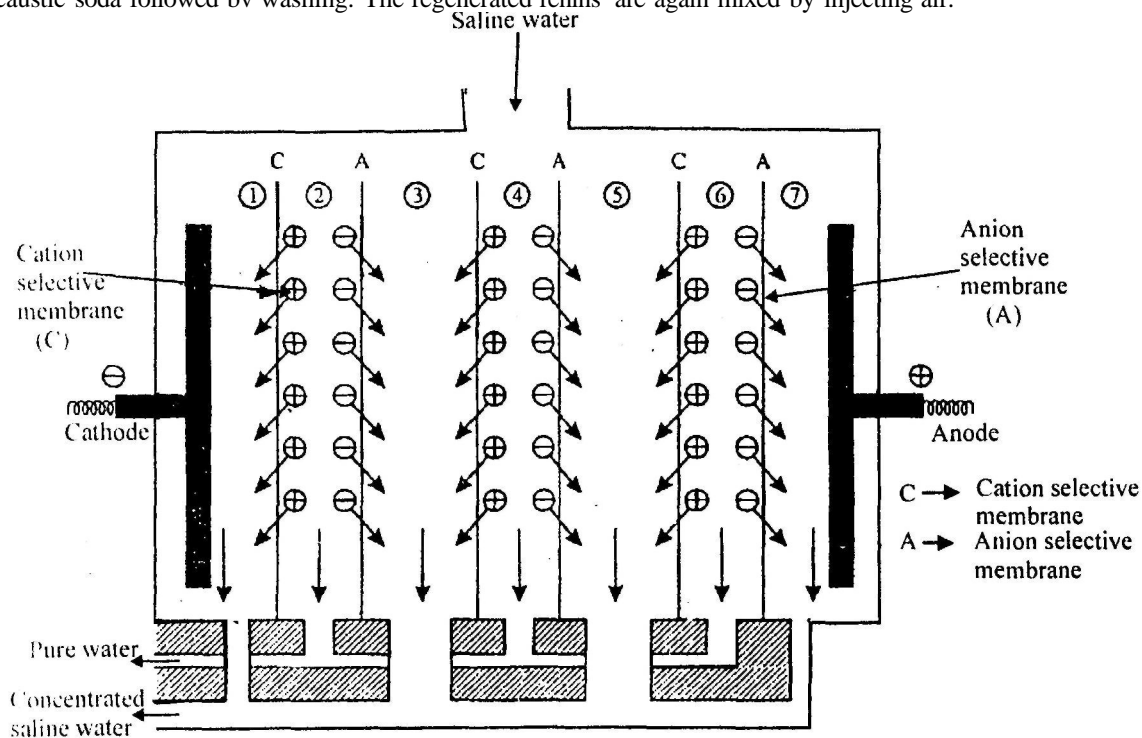
Q. 4. (b) Write short note on :

(i) Mixed-Bed-Demineralisation

(ii) Electrodialysis.

Ans. (i) Mixed-Bed-Demineralisation : In mixed bed demineralisation process, an intimate mixture of cation & anion exchanger is taken in a single vessel. When water is passed through this mixed bed, it comes in contact with two types of resin several times & net effect is same as that of passing the water through a number of cation & anion exchange. This process is very efficient & results in the production of deionised H_2O having less than 1 ppm of ions.

When resin is exhausted, mixed bed is back washed. On back washing, two resins get separated into two different layers. Cation exchanger is regenerated with H_2SO_4 solution & anion exchanger is regenerated with caustic soda followed by washing. The regenerated resins are again mixed by injecting air.



Electrodialysis : Involves the separation of dissolved salts from saline water in the form of ion under the influence of direct current using ion-selective membrane. Ion-selective membrane is permeable for only one kind of specific charge. The process is carried out in special type of cells called electro dialysis cell. It consist of large number of poured set of ion-selective membrane. Saline water under a pressure of 5- 6 kg/ m² is introduced from top of cell & is made to pass two membrane. An electric field is applied & ion start moving towards the oppositely charged electrode. The concentration of ion in alternate compartment 2,4,6 decreases in other 1,3,5 compartment increase. Thus, water collected from compartment 2,4,6 is pure & that of 1,3,5 are saline.

Q. 5. (a) Discuss the factor influencing corrosion.

Ans. Factor affecting the rate of corrosion :

1. Nature of metal.
2. Nature of corroding environment.

1. Nature of Metal:

(i) Position in Galvanic Series: Higher the position in serial, more is its activity & greater is its tendency to undergo corrosion.

(ii) Over-voltage : An anodic metal having smaller over voltage corrodes faster as compared to that having a higher overvoltage.

(iii) Purity of Metal : The presence of impurity in metal accelerate its corrosion.

(iv) Physical State of Metal: The rate of corrosion increase with a decrease in grain size.

(v) Nature of Oxide Film : In actuated atmosphere, all metal undergo oxidation.

2. Nature of Corroding of Environment:

1. Temperature : The extent & rate of corrosion usually increase with rise in temperature.

2. Presence of Moisture: The rusting of iron is quite slow in dry air but increases rapidly when humidity is 60-70%.

3. Corrosive Gases : The gases increases the acidity of liquid present above the metal surface & make it more conducting.

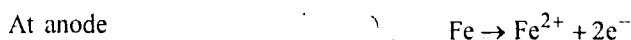
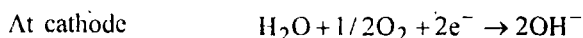
4. pH of the Medium : Acidic media are more corrosive than alkaline/neutral media.

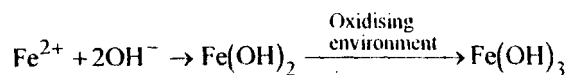
5. Nature of Ion Present: Many metals like Fe get corroded at a faster rate in the presence of NH_4^+ salts than in the presence of Na^+ salt of similar conc.

Q. 5. (b) What is concentration cell corrosion? Write the reaction involved in differential aeration corrosion. What are its important characteristics?

Ans. When a metal is exposed to an electrolyte of varying concentration/to varying aeration, it undergoes an electro chemical attack due to formation of miniature concentration cell on its surface & gets corroded. This type of corrosion is referred to as concentration cell corrosion.

The reaction involved in differential aeration corrosion are :





Important Characteristic of Differential Aeration Corrosion :

1. In differential aeration corrosion, oxygen deficient part act as anode & undergo corrosion.
2. Differential aeration corrosion is accelerated by accumulation of dirt, scale & other contamination.

Q.6. (a) Define and explain the term "Emulsion." Why graphite and MoS₂ are preferred as solid lubricants?

Ans. An emulsion is a colloidal dispersion of two immiscible liquid in which one liquid act as the dispersion medium & other as dispersed phase. Emulsions are of two type :

1. Oil in water (O/W) type.
2. Water in oil (W/O) type.

Emulsions are usually made by vacuously mixing of two liquid in the presence of stabilising substance called emulsified by using either a high speed mixing machine. In oil in water emulsion, oil act as the dispersed phase while water as dispersion medium. In water in oil, its just reverse.

Graphite & MoS₂ are used as solid lubricant as they reduce friction between metallic surface by forming film on the surfaces & they can bear compression as well as high temperature. They can be used as solid or as stable emulsion in oil.

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

- (i) Saponification value
- (ii) Synthetic Lubricants
- (iii) Viscosity Index.

Ans. (i) Saponification Value: Saponification number is defined as "the number of milligrams of potassium hydroxide to saponify the fatty material present in one gram of oil."

Determination : Saponification number is determined by refluxing a known quantity of oil with a known excess of potassium hydroxide solution and titrating the unused alkali against an acid.

Significance : This test gives an indication of the amount of animal and vegetable oils added to mineral oils to improve oiliness. Moreover, most of animal and vegetable oils possess their own characteristic saponification values. This test helps us to ascertain whether the oil under study is animal/vegetable or mineral or compounded oil.

(ii) Synthetic Lubricants : Lubricants able to work under extreme conditions & strong enough to bear a wide range of variable conditions has been synthesised making use of organic & Inorganic chemicals. Such artificially synthesised lubricants are known as synthetic lubricant.

(iii) Viscosity Index : The rate at which the viscosity of an oil changes with temperature is measured by an empirical number, known as the viscosity index (V.I.). A relatively small change in viscosity with temperature is indicated by high viscosity index. Whereas a low viscosity index means a relatively large change in viscosity with temperature.

Determination of Viscosity Index : Viscosity index of test oil is determined with the help of the types of standard oil viz., Pennsylvanian oils and Gulf oils having V.I.'s 100 and 0 resp.

The V.I. of test oil is given by the formula.

$$V.I. = \frac{L - u}{L - H} \times 100$$

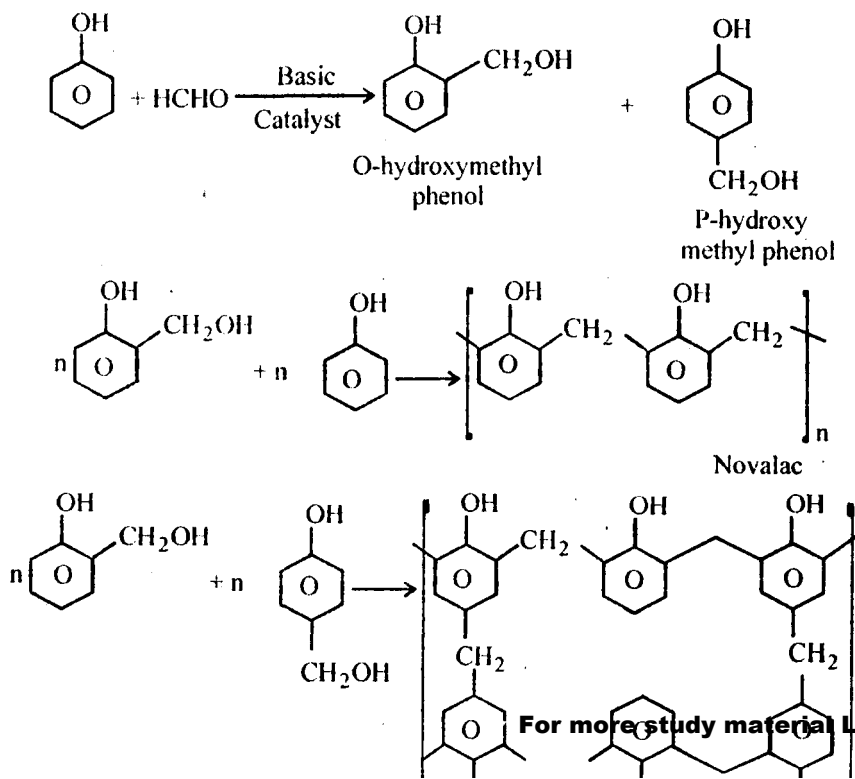
Viscosity Index and Molecular Structure of Oil: A high viscosity is exhibited by those lubricating oils which have linear or rod-like shaped molecules of higher molecular weights. This is due to the greater inter-molecular attraction.

Characteristic:

1. Synthetic lubricant work satisfactorily over a wide range of temperature.
2. They possess high flash point.
3. They possess high thermal stability. \therefore don't decompose under high temperature condition.
4. They are resistant to oxidation & hydrolysis.
5. May synthetic lubricants are excellent solvent for additive.
6. They have good viscosity-temperature characteristic. Some important synthetic lubricants are :
 1. Dibasic acid esters
 2. Polyalkylene glycols & derivatives
 3. Organo-phosphate esters
 4. Silicate esters.
 5. Silicones
 6. Chlorinated & fluorinated hydrocarbons.

Q. 7. (a) Give preparation, properties and uses of Phenol Formaldehyde (PP) Resins.

Ans. Phenol formaldehyde resin is prepared by reaction of phenol with formaldehyde in presence of an acidic/basic catalyst. The process involves the formation of methylene bridges in -O, O-P' or both -O+-P-P position. This result in formation of novalac, a linear polymer & then to cross-linked polymer's bakelite.



Properties:

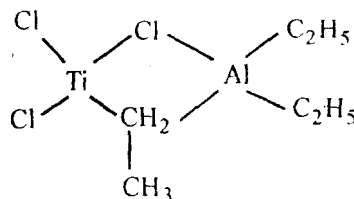
1. PF having low degree of polymerisation are soft
2. They have excellent adhesive properties.
3. PF with high degree of polymerisation are hard, rigid, scratch resistant & infesible.
4. They are resistant to non-oxidising acid, salts & many organic solvents.
5. They can withstand very high temperature.
6. They are excellent electric insulator.

Uses:

1. They are used for making moulded articles such is radio & TV ports, comps etc.
2. They are used for making decorative laminates, wall covering.
3. They are used for formation of electrical goods like switches plugs etc.
4. They are used as bounding glow, in varnishes.

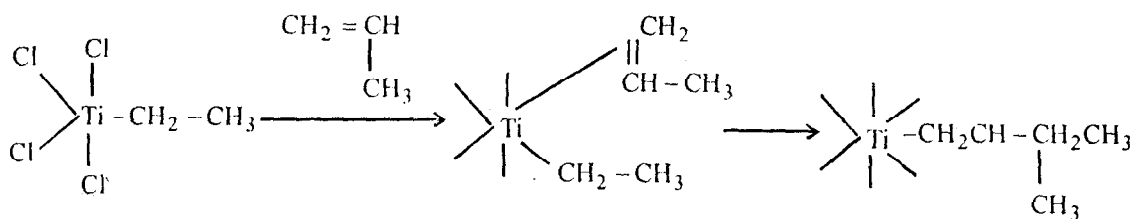
Q. 7. (b) What do you mean by co-ordination polymerisation?

Ans. These polymerisation reaction are catalysed by zeigler-Natta catalyst formed between triethyl aluminium $\text{Al}(\text{C}_2\text{H}_5)_3$ & TiCl_2 . In this ethyl group is co-ordinated to Ti, this is a active catalyst & its structure is

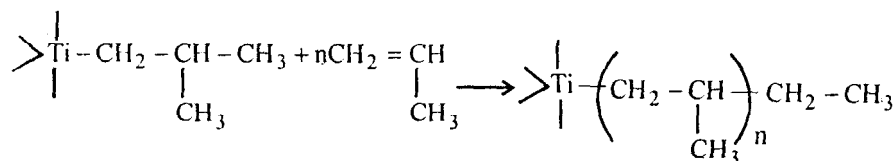


This access in following steps:

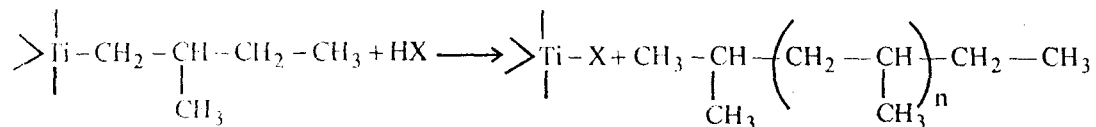
1. Initiation : The $\pi - e^-$ s of alkene overlap with empty orbital of Ti & insert between Ti-C bond.



2. Propagation : This intramolecular rearrangement generate a vacant site at Ti & one monomer adds in same fashion .



3. Termination : This can be done by addition of molecule containing active hydrogen like Hx.



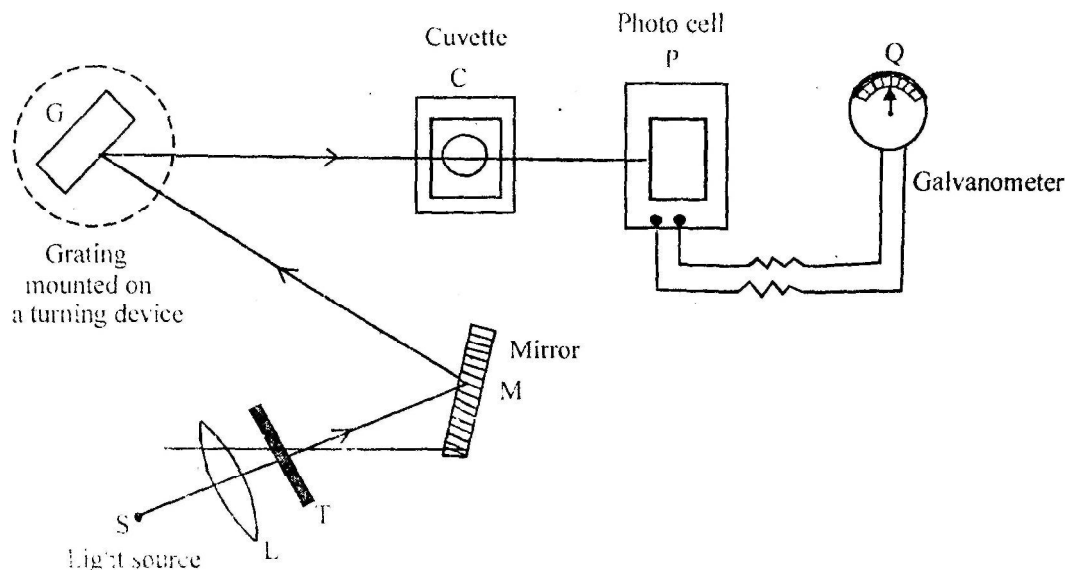
Q. 7. (c) Define polymer. Why all macromolecules are not polymer?

Ans. A polymer is a large molecule of high molecular mass formed by repeated combination of very large number of one or more type of small molecule called monomer. Due to their large size, they are also called macromolecules. Polymer is made of combination of monomer but macromolecular is not made of monomer. Polymer has functional group to continue the chains but macromolecule does not have any functional group.

Q. 8. (a) Discuss the principle and working of a spectro photometer.

Ans. When radiation are passed thio a transparent layer of a sample certain wavelength are removed by absorption. The energy is transferred to atoms/mol., thereby, get excited from ground state to excited state. The measurement of this decrease in intensity of radiation is the basis of spectrophotometry. The apparatus used is called spectro-photometer. They can be manual or automatic. They may be of single beam or double beam. Spectrophotometer involves measurement of intensity of absorbed light as a function of wavelength. It can made to operate in UV, visible & IR, using suitable source of radiant energy.

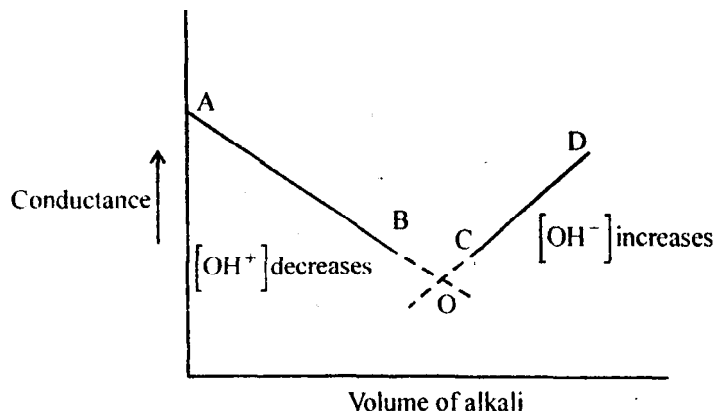
Principle & Working: It consist of source S. In U V region, hydrogen discharge tube is used & for visible region, an mcandesent tungsten lamp is used. The light from the light from source is made to pass through an optical system i.e., lens (L), a narrow slit (T), a reflecting mirror (M) a prism/grating (G). In visible region, lens & prism are made of ordinary glass. 1 iowever for L) V region, it consist of quartz. The crystals of NaCl, KBr etc., are used in IR region. The grating (G) spite the into its constituent wavelength. The desired wavelength light is passed through solution under study, placed in cuvette (C). The solution absorb a part of light passing through it & transmitted light is allowed to fall on photoelectric cell (P). The electric current generated is proportional to intensity of transmitted light & measured with galvanometer. The absorption curve of sample can be obtained by plotting the transmittance (I / I_0) against wavelength.



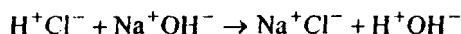
Q. 8. (b) Define conductometric titration. Describe conductometric titration of strong acid with strong base.

Ans. It is a method of volumetric analysis based on the change in conductance of solution, at the end point. It involves the measurement of electrical conductance of an aqueous solution containing an electrolyte & can be used to determine the end point of any titration which involves a sharp change in conductance at end point.

Strong Acid Against Strong Base:



During the conductometric titrations of strong acid (HCl) and a strong base (NaOH), acid is in vessel & alkali is in burette. Before the addition of alkali, conductance of acid solution is high due to presence of highly mobile H^+ ion (point A). As alkali is added, highly mobile H^+ neutralised by $[OH^-]$ ions to form water. The alkali metal ion Na^+ are slow moving, hence do not contribute to conductance.

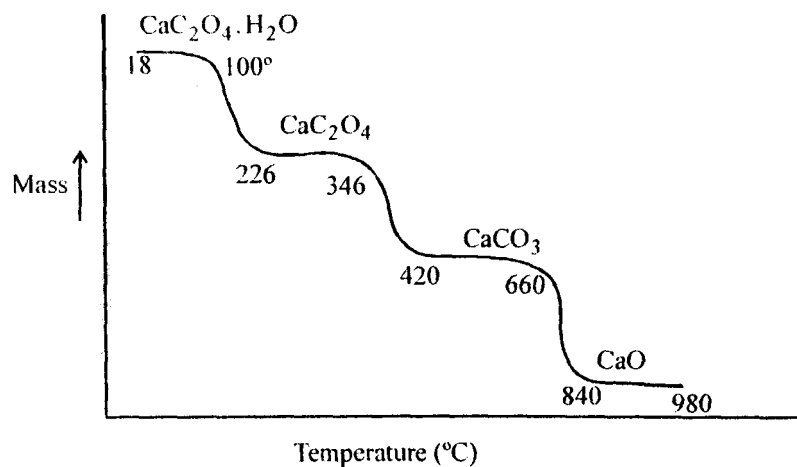


Conductance of solution decreases along curve A. When acid is completely neutralised by OH^- ion. (at point O), subsequent addition of alkali will add OH^- ion, hence conductance will increase along the curve (CD). The point, O is called neutralisation point & at this point conductance is minimum.

Q. 8. (c) Write short note on thermogravimetric Analysis (TGA).

Ans. TGA : The thermogravimetric analysis is a thermo analytical method & involves the measurement of change in the mass of system under examination with increase in temperature, preferably at a linear rate. A thermogram is plotted between mass vs. temp. (T). Instrument used for TGA is thermobalance. It consist of a sensitive recording balance, a furnace, furnace controller & a recording device. The furnace is programmed by a furnace controlling device to increase the temperature linearly at a rate of 0.5-0.25°C/min from 1200°C or more a thermogram consist of horizontal portion called plateaus & inflections in mass loss-temperature curve obtained of heating the sample.

A plateau indicate the constancy of mass & thus represent stable phase over temperature interval involves. An inflection represents the formation of intermediate compound. In above figure, there are 4 plateau & 3 inflection.



Application:

Some important applications are :

1. In quantitative analysis.
2. In testing purity of sample.
3. In study of organic compounds.
4. In study of polymers.
5. In study of building materials.