APPLIED CHEMISTRY 1

(CBCGS,DEC-2016)

Q1](a)What is the role of polymer in medicine and surgery ?Explain with the help of any three examples? (3)

***Ans**:-Materials which are not causing adverse effect on blood and other tissues can be used in diagnostic, surgical and can be implanted in the body. They can be developed from metals, ceramics and polymers. Uses of polymers in the field of medicine and surgery are increasing day by day. Characteristics of biomedical polymers are:*

1.should be bio-compatible, can be fabricated into desire shape or form without being degraded.

2.can be easily sterilized with no alteration in properties, should have optimum physical and chemical properties.

Examples are as follows:

POLYMER	***APPLICATION***
1. PMMA.	*Contact lenses.*
2. silicon rubber, polyurethane.	*Heart walls, drain tubes.*
3. Polyvinyl chloride.	*Disposable syringes.*
4. polyalkyl sulphone.	*Membrane oxygenator.*

Q1](b)Distinguish between alkaline and non alkaline hardness? (3)

Ans:-

TEMPORARY OR ALKALINE HARDNESS.	***PERMANENET OR NON-ALKALINE HARDNESS***
***1**.Caused by the process of dissolved bicarbonates of calcium , magnesium and other heavy metals and the carbonates of iron. salts responsible for temporary hardness are* $\mathrm{Ca(HCO_3)_2}$, $\mathrm{Mg(HCO_3)_2}$.	***1**.It is due to presence of dissolved chlorides and sulphates of calcium, magnesium, iron and other heavy metals.*
***2**. Temporary Hardness can be removed by boiling water.*	***2**.Permanent Hardness cannot be removed by boiling the water.*
***3**.Temporary hardness is called as carbonates or alkaline hardness.*	***3**.It is also known as non-carbonates or non-alkaline hardness.*
***4**.Boiling:* $\mathrm{Ca(HCO_3)_2 \rightarrow CaCO_3 + CO_2 + H_2O}$.	***4**.Can be removed by using chemical and not by boiling e.g. Lime soda method.*

$Mg(HCO_3)_2 \rightarrow Mg(OH)_2 + 2CO_2$.	$CaCl_2 + Na_2CO_3 \rightarrow CaCO_3 + 2NaCl$.

Q1](c) State the limitations of phase rule? (3)

Ans:-*The limitations of phase rule are as follows:*

1. *It can be applied to system in equilibrium. It is not of much help when system attain equilibrium very slowly.*
2. *It applies only to single equilibrium state. It does not indicate other possible equilibrium in the system.*
3. *Phase rule consider only the number of phase ,but not their quantities .Even a minute quantity of phases when present accounts towards number of phases.*
4. *All phases must be present under the same condition of the temperature , pressure and gravitational forces.*
5. *Solid and liquid phases must not be in finely-divided state, otherwise deviations occur.*

Q1](d)What are carbon nanotubes? Explain different types of carbon nanotubes? (3)

Ans:-*Carbon nanotubes represents one of the best examples of the novel nanostructures derived by bottom-up chemical synthesis approaches. Nanotubes have the simplest chemical composition and atomic bonding configuration but exhibit perhaps the most extreme diversity and richness among nanomaterial in structure and structure-property relations. The different types of carbon nanotubes are as follows;*

1. *<u>SINGLE WALLED NANOTUBES.</u>*

   SWNTs are an important variety of carbon nanotube. In SWNTs have different chiralities of carbon nanotubes that include Armchair, Zigzag, Chiral. These can be easily twisted. SWNT synthesis requires catalyst.

2. *<u>MULTIWALLED NANOTUBES.</u>*

   Multi-walled nanotubes (MWNTs) consist of multiple rolled layers (concentric tubes) of graphene. This types of CNT's cannot be easily twisted. Purity of MWNT is high also can be easily produced without catalyst.

Q1] (e)When would solid lubricants are used? (3)

Ans:- *Dry lubricants or solid lubricants are material which can reduce the friction without a liquid medium .they are used where,*

1. *Operating conditions are such that a lubricating film cannot be formed or maintained.*

2. *Contaminations of liquid or semi-solid lubricant , with dust or dirt is not desirable ;e.g., open gears.*
3. *Combustible lubricants must be avoided due to the high operating temperature and pressure.*
4. *Heavy machinery working on a crude job at very high loads and slow speed.*
5. *Where the parts to be lubricated are not easily accessible.*

Q1](f) 6ml of waste water was refluxed with 25ml of $K_2Cr_2O_7$ ***solution and after refluxing the excess unreacted dichromate required 20ml of 0.1N FAS solution. A blank of distilled water on refluxing with 25 ml of*** $K_2Cr_2O_7$ ***solution required 35ml of 0.1N FAS solution .Calculate the COD of the waste water sample. (3)***

Ans:-*Given data:-* *Vb=35ml,* *Vt=20ml,*

N=0.1N, *Y=6ml.*

To find:- *COD(Chemical Oxygen Demand).*

Formula:- $COD=\frac{(Vb-Vt)\times N\times 8000}{Y}$ *mg/L*

Solution:- $COD=\frac{(35-20)\times 0.1\times 8000}{6}$ *mg/L*

COD=2000mg/L.

Q2] (a)Calculate the quantity of the pure lime and soda required for softening of 40000 litres of water containing the following impurities.

$Ca(hCO_3)_2$ = 16ppm , $Mg(HCO_3)_2$ = 7ppm,$CaSO_4$ = 13ppm ,$Mg(Cl)_2$ = 10ppm, NaCl = 2ppm. ***(6)***

Ans:- *Conversion into* $CaCO_3$ *EQUIVALENT AS FOLLOWS:*

impurities(mg/lit)	*Multiplication factor*	$CaCO_3$ *equivalent (mg/lit)*	*Requirement*
$Ca(HCO_3)_2$*=16*	$\frac{100}{162}$	$16\times\frac{100}{162}=9.88$	*L*
$Mg(HCO_3)_2$*=7*	$\frac{100}{146}$	$7\times\frac{100}{146}=4.80$	*2 × L*
$CaSO_4$*=13*	$\frac{100}{136}$	$13\times\frac{100}{136}=9.56$	*S*

$MgCl_2$ *=10*	$\frac{100}{95}$	$10 \times \frac{100}{95} = 10.53$	*L+S*

NaCl does not react with lime and soda.

Calculation of lime,

$$\textit{Lime} = \frac{74}{100} \times \left[CaCO_3 \text{equivalent of } Ca(HCO_3)_2 + 2 \times Mg(HCO_3)_2 + MgCl_2\right] \times \frac{\text{Volume of water}}{1000} \times \frac{100}{\%\text{Purity}}.$$

$$= \frac{74}{100}[9.88 + (2 \times 4.8) + 10.53] \times \frac{40{,}000}{1000} \times \frac{100}{100}.$$

$$= \frac{74}{100}[30.01] \times 40 \times 1.$$

=888.3gms.

Calculations of Soda,

$$\textit{Soda} = \frac{106}{100}[CaCO_3 \text{equivalent of } CaSO_4 + MgCl_2] \times \frac{\text{Volume of water}}{1000} \times \frac{100}{\%\text{Purity}}.$$

$$= \frac{106}{100}[9.56 + 10.53] \times \frac{40{,}000}{1000} \times \frac{100}{100}.$$

$$= \frac{106}{100}[20.09] \times 40 \times 1.$$

=851.8gms.

Hence the Lime requirement is 888.3gms and the Soda requirement is 851.8gms.

Q2](b) i) Distinguish between thermoplastic and thermosetting? (3)

Ans:-

THERMOPLASTIC	*THERMOSETTING*
1.Formed by addition polymerization.	*1. Formed by condensation polymerization.*
2.Can be moulded and remoulded.	*2.Remoulding is not possible.*
3.They softens on heating because the linear chains can slip over each other very easily.	*3.They do not become soft on heating, because cross links retain the strength on heating. But prolonged heating causes charring.*
4.Soft , weak and less brittle.	*4. Hard , strong and brittle.*
5.Soluble in some organic solvents.	*5.Insoluble in almost all organic solvents.*
6.Relatively low molecular weight.	*6.Relatively high molecular weight.*
7.Example: PVC, PE, Teflon.	*7.Example: UF, PF, Nylon 6-6, etc.*

Q2] (b) ii) Define flash and fire points. (2)

Ans:-*Flash point:- Flash point is defined as the lowest temperature at which the lubricant gives off enough vapours to cause a momentary flash when a standard test flame is brought near it.*

Fire point:- Fire point is the lowest temperature at which the oil vapours catch fires for at least 5 seconds , on being lighted by a test flame.

Fire point is usually 5-40°C above the flash point. A good lubricant should have flash point at least above the working temperature . This ensures safety against the risk hazards. Thus flash point acts as a guide for the safe storage, transportation and use in machine.

Good lubricant oil should have high flash and fire point.

Q2] (c) Write the CVD method for preparation of carbon nanotubes. (4)

Ans:- *This is very good method from large scale production of carbon nanofiber SWNT, MWNT. Hydrocarbons (e.g., methane, ethane) are allowed to decompose over metal catalyst (e.g., Co, Fe) to produce CNT. Typical yield for CVD are approximately 30% . This process includes production of large amount of CNT's by CVD of acetylene over cobalt and iron. Ethylene can be used with reaction temperatures of 545°C for nickel catalyst CVD and 900°C for an uncatalyzed process that produces carbon nanostructure with open ends. Methane can also be used as carbon source for synthesization . catalytic decomposition of* H_2/CH_4 *mixture over cobalt , nickel, and iron is used to obtain yields of SWNTs at 1000°C. The usage of* H_2/CH_4 *atmosphere between a non-reducible oxide such as* Al_2O_3 *or* $MgAl_2O_4$ *and*

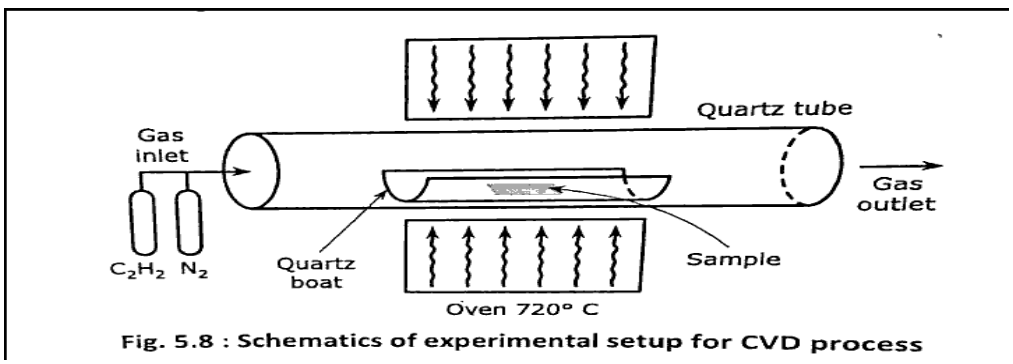


Fig. 5.8 : Schematics of experimental setup for CVD process

one or more transition metal oxides can produce the composite powders containing well dispersed CNTs. Thus , higher proportion of SWNTs and lower proportion of MWNTs can be achieved using the decomposition of CH_4 *over the nanoparticles. Thermal catalytic decomposition of hydrocarbon has become an active area of research and can be a promising route for the bulk production of CNTs. The removal of the catalyst support via an acid treatment which sometimes could destroy the original structure of the carbon nanotube is an issue in this synthesis route. However , alternative catalyst supports that are soluble in water have proven effective for nanotube growth.*

Q3] (a) What is meant by Fabrication of plastics? Explain injection (6)

moulding with the help of neat diagram .

Ans:-*Fabrication of plastic is the technique of giving any desired shape to the plastics by the use of mould. Because of the properties of polymers it is possible to mould them and change their shape using a number of different repetitions manufacturing processes. A proper method is to be selected depending upon the shape and type of resin being used. The most important of these are compression moulding, transfer moulding, extrusion and injection moulding.*

INJECTION MOULDING:

This method is only applicable to Thermoplastic resin. The moulding plastic powder is fed into a heated cylinder . From there it is injected into the tightly locked mould at a controlled rate by means of a screw arrangement or by a piston plunger. The mould is kept cold to allow the hot plastic to cure and become rigid. When the material have been cured sufficiently , half of the mould is opened to allow the injection of the finished article without any deformation . heating is done by oil or electricity.

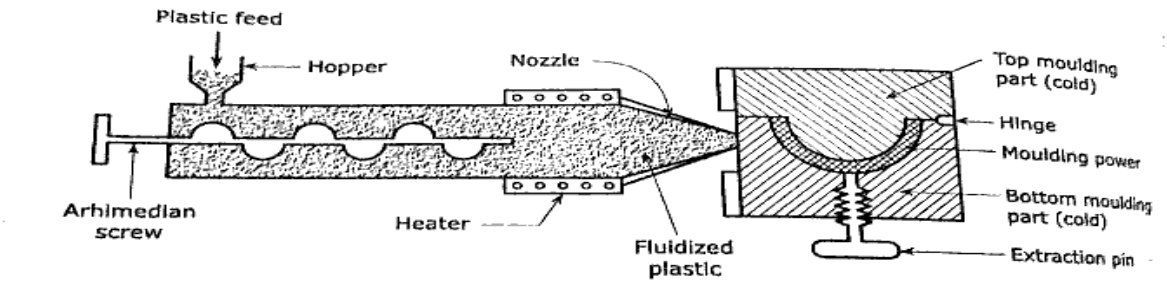


Fig. 2.10 : Injection moulding of plastics.

1.ADVANTAGE:-This method has high speed production, low mould cost , very low cost of material and low finishing cost. Hence it is the most widely used method for moulding of thermoplastics.

2:-DISADVANTAGE:-Since a large amount of cavities cannot be filled simultaneously , there is limitation of design of articles to be moulded.

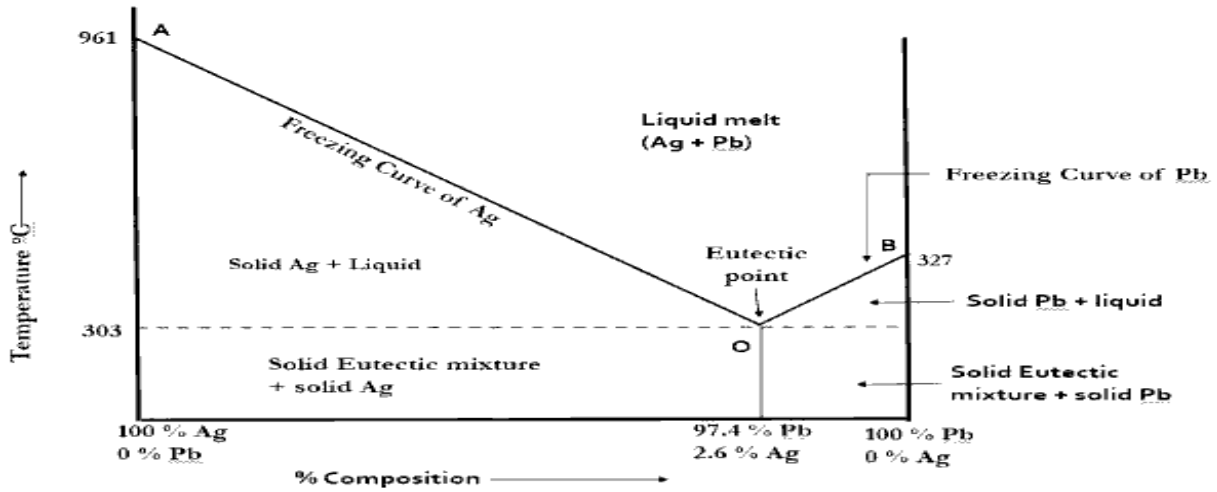
Q3](b) i) State the condensed phase rule. (3)

Ans:- *In some systems , an equilibrium exists between solid – liquid phases and gaseous phase is practically absent . Hence the effect of pressure on such system can be neglected . Then it is*

Necessary to take into account only two variables viz. temperature and concentration.

Such system showing solid – liquid equilibrium is called condensed system and phase rule applied to such system is as follows:-

F = C – P + 1 … known as condensed phase rule.



Q3](b) ii) How is gypsum useful in setting and hardening of cement? (2)

Ans:- C_3A *readily combines with water and liberates a large amount of heat. The added gypsum retards the dissolution of* C_3A *by forming insoluble calcium sulpho-aluminate* $3CaO.Al_2O_3.xCaSO_4.7H_2O$. *This reaction prevents high concentration of alumina in the cement solution which retards the early initial set of the cement.*

Q3](c) The hardness of 85000 litres of water sample was removed by passing it through a zeolite softener. The zeolite required 2000 litres of NaCl solution containing 190 mg/lit of NaCl for regeneration . calculate the hardness of sample. (4)

Ans:- *1 litres of NaCl solution = 190 mg of NaCl*

∴2000 litres of NaCl = 2000 × 190 gm of NaCl

= 3,80,000 gm of NaCl.

Quantity of NaCl in terms of $CaCO_3$ *equivalent hardness.*

$$= 3{,}80{,}000 \times \frac{50}{58.5} \text{ gm of } CaCO_3 \text{ equivalent}$$

= 3,24,786.3 gm of $CaCO_3$ *equivalent*

$$= 324.79 \times 10^3 \text{ gm of } CaCO_3 \text{ equivalent}$$

$$= 324.79 \times 10^6 \text{ gm of } CaCO_3 \text{ equivalent}$$

Hardness of 85000 litres of water = 324.79×10^6 *gm*

$$\therefore \text{Hardness of 1 litre} = \frac{324.79 \times 10^6}{85000} = 3821 \text{ mg/litre}$$

∴ Hardness of water = 3821 mg/lit

= 3821 ppm.

Q4] (a) How is activated sludge process carried out for the treatment of waste water? Explain with flow sheet diagram.
(6)

Ans:-*Sewage is the liquid which includes human and household waste water, industrial waste , ground waste and street and storm water. Hence due to the toxicity the sewage have to be treated because of the reasons like:*

1. *To prevent pollution of water into which the sewage is left off.*
2. *To prevent offensive odour in the water, and the destruction of fish and other aquatic life.*

SEWAGE TREATMENT BY ACTIVATED SLUDGE PROCESS.

1. *Preliminary Treatment.*

The principal objective of preliminary treatment is the removal of gross solids i.e., large floating and suspended solid matter , grit, oil, and greases if present in considerable quantities . For removing inorganic matter , sewage is allowed to pass through bar screen and mesh screen.

2.Primary Treatment.

For removing suspended matter efficiently and economically , sedimentation process is carried out .Sewage is treated with certain chemicals (e.g., alum, hydrated lime etc.) which form a floc that absorbs and entraps the suspended and colloidal particles present.

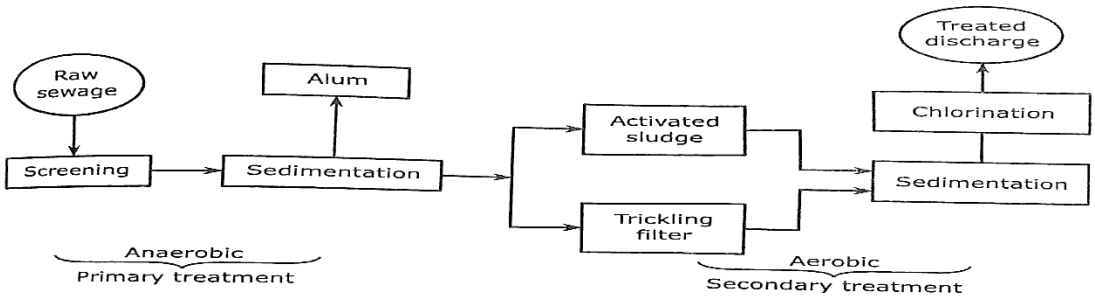


Fig. 1.15 : Flow diagram for sewage treatment.

3.Secondary or Biological Treatment .

It is an essential an aerobic chemical oxidation which includes filtration and activated sludge process. Sewage water is filtered through specially designed sprinkling filters to maintain aerobic conditions. Carbon of the organic matter is converted into CO_2*; and nitrogen into* NH_3 *and finally into nitrates and nitrites. Trickling filters are used for biological oxidation of sewage. Trickled sewage starts percolating downwards an the aerobic bacteria bring about the biological oxidation of organic matter of sewage.*

Hence the sludge formed is known as Activated Sludge. The further process includes mixing of sedimental sewage with proper quantity of activated sludge and mixture is then agitated for 4-5 hrs by blowing air. Suspended and dissolved organic matter is oxidised by aerobic bacteria . after all these process a part of sludge deposited is used for next oxidation batch and the remainder is either spread on land as fertile matter or used for biogas or dumped in

sea.

Q4](b) i)1.4 gm of oil required 1.8 ml of 0.01N KOH for neutralization. Calculate the acid value and mention whether the oil is suitable to be used or not. *(3)*

Ans:- *Given Data:- Weight of the oil = 1.4 gm .*

Normality of KOH = 0.01.

Volume of KOH = 1.8 ml.

To find:- Acid value of the oil.

Formula:- $\text{Acid value} = \frac{\text{Vol.of KOH} \times \text{Normality of KOH} \times 56}{\text{Weight of oil}}$.

Solution:- $\text{Acid value} = \frac{1.8 \times 0.01 \times 56}{1.4}$.

$= 0.72$ mg

∴Acid Value = 0.72 mg/gm of oil.

As the acid value is much higher than 0.1 , the oil is not suitable to be used.

Q4](b) ii) Write the applications of Fullerenes. *(2)*

Ans:- *The applications of Fullerene is as follows:*

1.It is used for the preparation of electronic and microelectronic devices.

2.It is used for the preparation of non-linear optical devices.

3. It is used for the preparation of batteries as charge carriers.

4.It is used for the preparation of super conductors.

5.It is used for the preparation of soft ferromagnet with zero remanence.

Q4] (c)What is the functions of fillers and plastisizers in the compounding of plastic?

(4)

Ans:- *1.FILLERS (or EXTENDERS).*

Fillers are added to a base polymer to lower the manufacturing cast of a product made from it. Functions of fillers are as follows:

- *Reducing the cost of plastic.*
- *Increases the tensile strength and hardness.*

- *Reduces the flexiblity.*
- *Decreases the shrinkage during moulding.*
- *Gives opacity to the product.*
- *Examples:-mica, talc, asbestos , saw dust ,chalk etc.*

2.PLASTICIZERS.

The Plasticizer molecule occupies between the polymeric chains and neutralizes the intermolecular forces of attraction and thus allows freedom of movement. The functions of plasticizers are as follows:-

- *Increases the plasticity of the plastics.*
- *Lowers the softening temperature and hence moulding and remoulding can be done at low temperature.*
- *Imparts flames proofness.*
- *Reduces resistance towards chemical , solvents etc.*
- *Examples:- esters of fatty acids, vegetables oils etc.*

Q5](a) Write the preparation , properties and uses of PMMA and Buna-S. (6)

Ans:- *1. POLYMETHYL METHACRYLATE (PMMA).*

- *PREPARATION.*

This is an important thermoplastic resin. It is obtained by polymerisation of methyl methacrylate which is an ester of methyl acrylic acid, $CH_2 = C(CH_3)COOH$ *, in presence of acetyl peroxide or hydrogen peroxide. It is an acrylic polymer.*

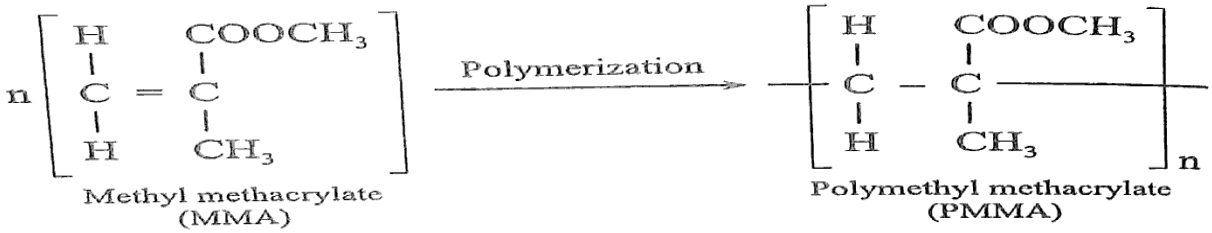


Fig. 2.15 : Polymerization of PMMA

- *PROPERTIES.*

1.It is hard, fairly rigid material with a high softening point of about 130-140°C.

2.It becomes rubber-like at a temperature above 65°C.

3. It has an outstanding shape-forming properties due to wide span of temperature from its rigid state to viscous.

4.It has high optical-transparency.

5.It has high resistance to sunlight and ability of transmission light accurately.

- *USES.*

1. *For making lenses ,optical parts of instruments , air craft , light fixtures, artificial eyes, wind screen , bone splints , decorative articles etc.*
2. *It is found in paint. Acrylic "latex" paints often contain PMMA suspended in water.*
3. *Used in making window glasses.*

2. *BUNA-S (or STYRENE RUBBER)*

- *PREPARATION:*

This is the most important type of synthetic rubber which is produced by copolymerization of butadiene ,$CH_2 = CH - CH = CH_2$(75% by weight) *and styrene ,*$C_6H_5CH = CH_2$(25% by weight).

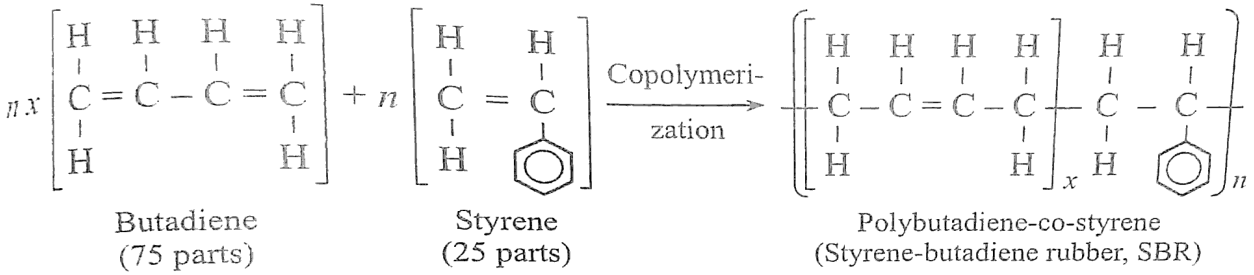


Fig. 2.31 : Preparation of Buna-S

- *PROPERTIES*

1.Styrene rubber resembles natural rubber in processing characteristics as well as quality of finished products.

2.It posses high abrasion-resistance, high load-bearing capacity and resilience

3.It swells in oils and solvents.

- *USES*

1.Mainly used for the manufacture of motor tyres.

2.Other uses of this elastomer are floor tiles , shoe soles, gaskets, foot-wear components, wire and cable insulations, carpet backing , adhesive , tank-lining, etc.

Q5](b) i)What are the advantages of ion exchange process? (3)

Ans:-*The advantages of ion exchange process is as follows:-*

1. *The process cab be used to soften highly acidic or alkaline water.*
2. *It produces water of very low hardness(2 ppm). So it is very good for treating water for use in high-pressure boilers.*
3. *Low maintenance cost.*
4. *Quick separation with efficient technique.*
5. *Re-usable.*

6. *Easily collectable and cost effective.*

Q5](b) ii)What is oiliness? What is its importance in lubrication? (2)

Ans:- *Oiliness of a lubricant is the measure of its capacity to stick on to the surface of machine parts under condition of pressure or load. When a lubricating oil of poor oiliness is applied under high pressure , it gets squeezed out from the surface and the lubrication stops. If the oil has good oiliness it can remain in place and can give lubrication even under pressure. Mineral oil has very poor oiliness whereas vegetable oils possess good oiliness. No direct test are available for measuring oiliness.*

Q5](c) What is the application of phase rule to one component water system? Explain with the help of diagram. (4)

Ans:- *Phase rule helps to study different equilibria and classify them accordingly. It indicates behaviour of the system under a particular set of conditions. Different systems with the same degree of freedom behave in a similar manner. Helps to find out under a set of conditions whether all substances involved in an equilibrium can exist or a particular phases ceases to exist or whether any transformation has taken place.*

<u>One component system with the phase diagram.</u>

In water there is only one component i.e., water and its three phases : ice, water, steam which are solid, liquid, and gaseous respectively. Figure below represents phase diagram or pressure v/s temperature diagram for the water system.

Three curves OA, OB, and OC represents the equilibrium conditions between two phases solid with vapour , vapour with liquid and liquid with solid phase of water.

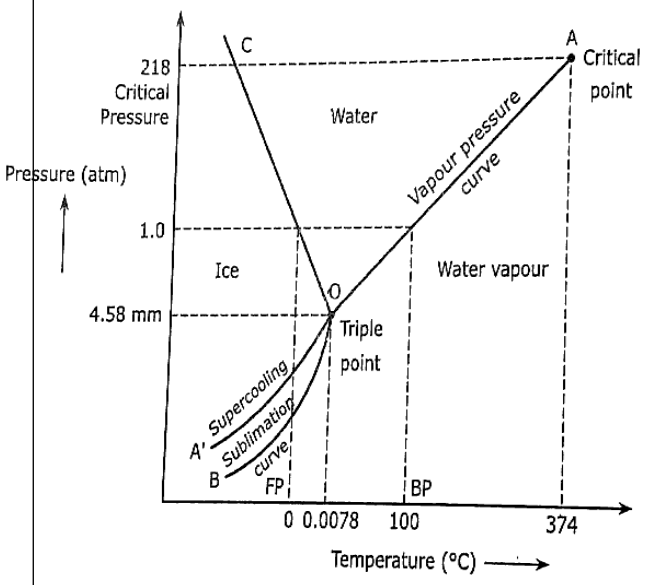


Fig. 4.1 : Phase diagram of water system

Curve OC represents the equilibrium between solid and liquid phase of the water. This curve is known as fusion pressure or melting point curve. Along this curve there are two phases in equilibrium that is ice and water. At atmospheric pressure, ice and water can be in equilibrium only at one temperature i.e., the freezing point of water.

We have C=1, P=2 thus,

F=C-P+2=1.

Curve OB represents the equilibrium between liquid and vapour. It is known as vaporization curve. Here also it is necessary to state either temperature or pressure. E.g., at atmospheric pressure , water and vapour can exist in equilibrium only at 1 temperature i.e., the boiling point of water. Water - vapour system has one degree of freedom F=C-P+2=1.

Q6] (a) Define lubricants and lubrication. Discuss the hydrodynamic lubrication (6)

in detail.

Ans:- *Any substance placed between two moving or sliding surfaces with a view to reduce the frictional resistance between them is known as lubricant.*

Lubricants may be used in solid, liquid or semi solid form. The process of reducing friction between two metallic sliding surfaces by the introduction of lubricants is called as lubrication.

HYDRODYNAMIC OR FLUID-FILM OR THICK -FILM LUBRICATION.

In this type of lubrication , the lubricant is forming a thick film having about 1000 A° thickness between the moving surfaces so that the direct surface to surface contact and welding of junction rarely occurs. The coefficient of friction is very low i.e., 0.001 to 0.03 under hydrodynamic lubrication.

When oil is introduced between the moving surfaces , some of the oil molecules are held up tightly at the surface due to adsorption. The remaining oil molecules are loosely arranged away from metal surfaces. Frictional resistance is only due to the internal resistance between the particles of lubricants moving over each other. Hence lubricant chosen should have the maximum viscosity .

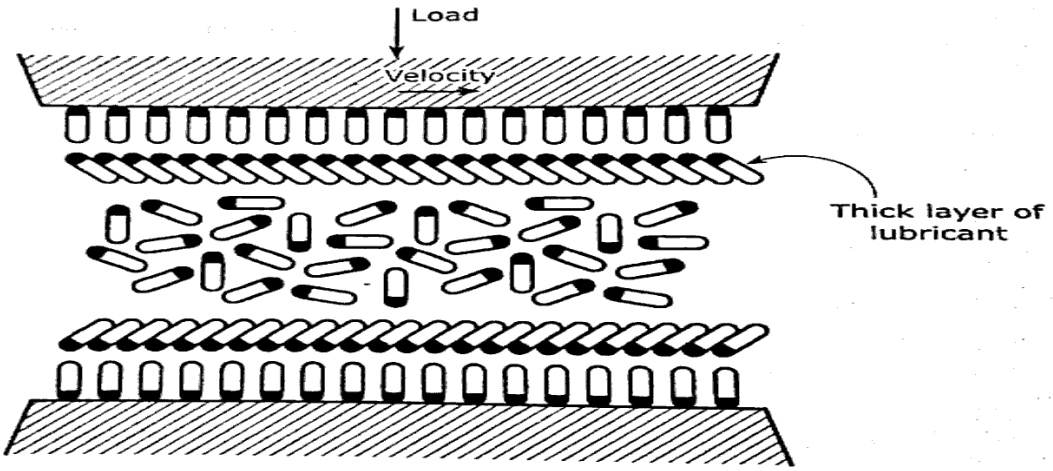


Fig. 3.1 : Thick-film lubircation.

Hydrodynamic lubrication occurs when the surfaces are rigid and retain the shape during operations. For hydrodynamic lubrication to occur ,two essential conditions are to be satisfied : (1)liquid must be viscous and, (2) the shape of the surface should be such that a wedge shaped film should be formed. Journal bearing consist of a shaft or journal that rotates freely in a supporting metal sleeve or shell with lubricating oil in the interface between them. During normal operations the shaft rotates at sufficient speed to force the oil between the conforming curved surfaces of the shaft and the shell thus creating the oil wedge and hydrodynamic film. This film allows these bearing to support extremely heavy loads. Watches , clock, sewing machine , fans, guns etc. requires hydrodynamic lubrication.

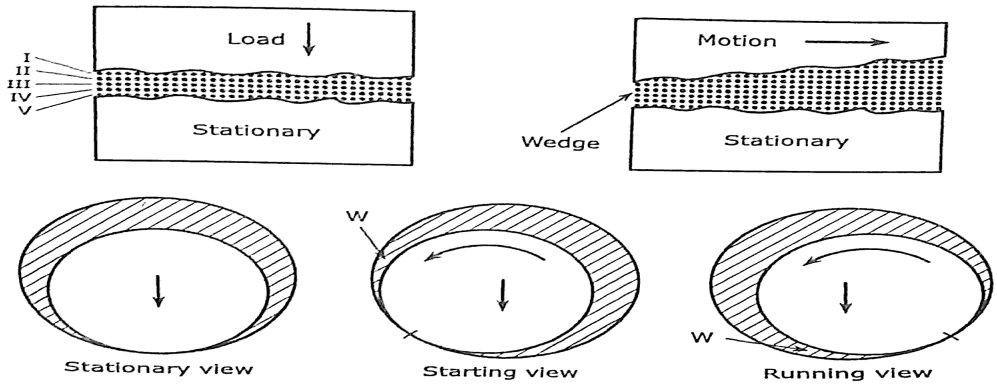


Fig. 3.2 : Thick-film lubrication

Q6](b) i) Define phase , component and degree of freedom. (3)

Ans:- *1. PHASE: A phase is defined as any homogenous , physically distinct and mechanically separable portion of a system , which is separated from other parts of the system by definite surface. Example:-*

- *In a freezing water system ice, water and water vapour are the three phases which are physically distinct and homogenous.*

2.COMPONENT: It is the smallest number of independent variable constituents taking part in the state of equilibrium , by means of which the composition of each phase can be expressed in the form of chemical equation .Example:-

- *In water system the phases present are ice, water and water vapour. The composition of each phase can be expressed by a single component,* H_2O*. Hence it is a one component system.*

3.DEGREE OF FREEDOM: It is defined as the smallest number of independent variables such as pressure , temperature and concentration that must be specified in order to define completely the state of a system. Example:

- *For a system consisting of water in contact with its vapour ,*

$$\text{Water}_l \leftrightarrow \text{Water vapour}_g$$

To define it completely , we have to state either temperature or pressure. Hence , the system is univariant or degree of freedom is one .

Q6] (b)ii) What are the industrial application of ultrafiltration ? (2)

Ans:- *The industrial application of ultrafiltration is as follows:*

1. *Industries such as chemical and pharmaceutical manufacturing , food and beverage processing etc employ ultrafiltration in order to recycle flow or add value to later products.*
2. *Blood dialysis also utilizes ultrafiltration.*

3. *In cheese manufacturing we use ultrafiltration.*
4. *Radiocarbon dating of bone collagen uses ultrafiltration.*
5. *Removal of pathogens from milk.*
6. *Fruit juice concentration and clarification.*

Q6](c) What is RCC? Write the advantages of it. (4)

Ans:-*Plain concrete has good compressive strength , but less ability to withstand tensile stresses. In such cases, to impart tensile strength steel bars or rods and metal meshes are embedded in the concrete. This is called as RCC. Here the concrete bears the compressive strength and the steel rods bears the tensile strength.*

APPLICATION:- Widely used in floor beams, girders, slabs, bridges, etc.

ADVANTAGES:- 1. RCC is easier to make and cast into any desired shapes, which can bear all types of loads.

2.It possesses greater rigidity , moisture , and fire-resistances.

3.Steel reinforcement also tends to distribute the shrinkage cracks, thus preventing the formation of large cracks.

4.Its maintenance cost is practically negligible .