



R.C.Patel College Of Engineering & Polytechnic, Shirpur

Department of Applied Science & Humanities



Course Title- Basic Science(Chemistry)

Course Code - 311305

Department Name – Applied Science

Semester- First

Unit	Title	COs	Learning hours	R Level	U Level	A Level	Total Marks
3	Engineering Materials & Catalysis	CO6	12	03	05	06	14



* Unit content -

- 1] Paints 2] Varnish 3] Insulators 4] Polymers and monomers
- 5] Types of Polymerization 6] Adhesives
- 7] Lubricants 8] Catalysis 9] Catalyst.

* Course outcome -

use the appropriate engineering materials and catalyst appropriately.

* Theory Learning outcome -

- 3.1 Identify the ingredients of the given paints.
- 3.2 List out salient properties of the given paint & varnish.
- 3.3 Describe the polymerization properties of insulating materials for the given application.
- 3.4 Differentiate the given types of structural polymers.
- 3.5 Describe the polymerization process of the given polymer.
- 3.6 Explain the properties and uses of the given polymer.
- 3.7 Describe the application of relevant adhesives required for the given material.
- 3.8 suggest the lubricant for various types of machines in industry.
- 3.9 select the relevant catalyst for given application.

* Paints

Introduction -

Paints are protective and decorative coatings applied to the surface of engineering materials such as metals, wood, concrete and plastics. They consist of pigments, binders, solvents and additives that work together to provide protection against corrosion, moisture, chemicals and environmental degradation. In engineering applications, paint not only enhance the appearance of components and structure but also increase their durability and service life. Different types of paints are selected based on the materials, operating conditions and required performance characteristics, making them an essential part of modern engineering & construction practice.

* Purpose of applying Paint -

- 1] Paint protects the iron from corrosion and rusting.
- 2] Paint protects the wooden surfaces from insect and fungi.
- 3] Paint protects the wooden surfaces from moisture.
- 4] Paint reflects the heat and light.
- 5] It provides the beautiful appearance to the surface on which it is applied.
- 6] Paint provides smoothness to the surfaces.
- 7] It increased durability of engineering components & structures.
- 8] Paint protect surface from chemicals, oils, acids and alkalies.

* characteristics of good paint -

- 1] It should possess good adhesion capacity on the surface.
- 2] It should effectively cover the surface.
- 3] It should be withstand weather and environmental condition.
- 4] It should be cheap.
- 5] Film should be washable, glossy and attractive.
- 6] The film should not crack or shrink on drying.
- 7] It should resist corrosion.
- 8] It should retain its original color.
- 9] It should be durable.

* Ingredients of Paints

- 1) Pigment
- 2) vehicle
- 3) Thinners
- 4) Driers
- 5) Pigment extenders or fillers
- 6) Plasticizers
- 7) Antiskinning agents.

① Pigment -

Paint is solid coloring materials which gives color & opacity

Examples -

white - white lead, zinc oxide, titanium oxide.

Colored pigments - Red lead, ferric oxide, chrome red, chromium oxide, prussian blue, carbon black, umber brown.

Functions of pigment -

- i] It gives desired colored to the paint
- ii] It provides opacity to the paint film.
- iii] It gives protection to the paint from UV rays.
- iv] It provides durability to paint film.
- v] Reduce cost.

2) vehicle - (Film forming materials)

vehicle is the liquid component of paint that carries the pigment and forms a continuous film after the paint dries.

Examples -

- * vehicles for oil paints are - linseed oil, soyabean oil, dehydrated castor oil, fish oil
- * water is the vehicle for water based paint.

Functions of vehicle -

- i] film forming constituent
- ii] Binder for pigment
- iii] Provide toughness and durability to paint film.
- iv] It provide good adhesion to the paint film.
- v] It give waterproofness to paint film.

3) Thinners -

Thinner is a volatile liquid added to paint to reduce viscosity so that paint is easy to apply on surface.

Examples -

Turpentine, mineral spirit, benzene, dipentene, naphtha, toluene, xylol, kerosene, methylated naphthalene etc.

* Function of Thinners -

- 1] Thinner makes the paint more smooth.
- 2] It reduces the fluidity of paint.
- 3] It suspend the pigment.
- 4] It helps to dry the paint film by evaporation.
- 5] It reduces the viscosity of paint.

4] Driers -

Driers are the oxygen carrier catalyst.

* Examples -

Resinates, linolates, tungstate, naphthalates of Co, Mn, Pb & Zn.

* Functions of Driers -

- 1] The rate of drying of paint film by oxidation, polymerization and condensation is increases.
- 2] It improve the drying quality of the oil film.

5] Pigment Extenders or fillers -

- * Fillers are the inert solid material added to paint.
- * They do alter the some properties of paint.

* Examples -

Talc, sand (SiO_2), Barite (BaSO_4), Kaoline, clay, Limestone (CaCO_3)

* Functions of Fillers -

- i] It reduces the cracking of paint film after drying.
- ii] Fillers acts as a carrier substance for Pigment.
- iii] Reduce cost
- iv] Increases durability.
- v] Used to filled the voids or pores of paint.
- vi] It gives the good adhesion, toughness, hardness to paint film.

6] Plasticizers -

plasticizers gives elasticity to paint film after addition and prevents cracking of film after drying

Examples -

Tricresyl phosphate, triphenyl phosphate, tributyl phosphate, diamyl phthalate, dibutyl tartarate.

7] Antiskinning agents -

Examples - polyhydroxy phenol.

Function -

It's function to prevent gelling and skimming of paint film.

* Varnishes -

* Introduction -

varnish a transparent protective coating apply to wood, metal and other materials to improve their appearance & durability. Varnish is a solution of natural or synthetic resin in drying oil or in volatile solvent. The film is dries up by evaporation, polymerization and oxidation. And give glossy film.

* Defination -

varnish is a solution of natural or synthetic resin in drying oil or volatile solvent.

* Types of varnish -

There are two types of varnish.

1] oil varnish -

- * It is a mixture of natural or synthetic resin and thinner. oil varnish dries up by evaporation of volatile solvent by oxidation and polymerization of the drying oil.

e.g. Example - Copal varnish.

copal varnish is prepared by mixing copal in linseed oil and turpentine.

2] Spirit varnish -

- * It is the mixture of resin in a volatile solvent.
- * It is dries up by evaporation of the volatile solvent.
- * The film is brittle and has a tendency to crack, To avoid brittleness of film small amount of plasticizer is added in varnish.
- * It is used in polishing wooden surfaces.

Example - A solution of a resin shellac in alcohol.

* Difference between Paints and varnishes.

<u>Paint</u>	<u>varnishes.</u>
* In a paint mixture of pigment in vehicle. * paint produce opaque film * Paint contains pigment * Paint have different colours. * Paint apply on cement based, metal surface or wooden surface. * It reflect heat and light.	* varnish consist of mixture of resin in drying oil or thinner. * It produce transparent film. * Varnish contains varnish. * Varnish has no colour. * varnish apply on only wooden surface. * Varnish surface do not reflect heat and light.

* Insulators -

An insulator is a material that prevents the flow of heat & electricity. There are two types of insulators thermal or electrical

* Thermal Insulator -

Definition - "The materials that retard the flow of heat".

* characteristics of Thermal Insulators -

- 1) It should have low thermal conductivity.
- 2) It should be chemically inert.
- 3) It should be fireproof.
- 4) It should be waterproof.
- 5) It have low density.
- 6) It should be able to different temperature.

* Classification of Thermal Insulator -

- a) Organic Thermal insulator
- b) Inorganic thermal insulator.

a) Organic Thermal Insulator -

- * These organic thermal insulators based on hydrocarbon polymers.
- * These are suitable upto 150°C temperature.

* Example - Thermocol, wool, cotton, paper, charcoal powder, sawdust-coke, powder, rubber.

b) Inorganic Thermal insulators -

- * These are based on siliceous / Aluminous / calcium materials in fibrous, granular or powder form.

* Inorganic thermal insulators suitable above 150°C.

Examples - Glass wool, mineral wool, calcium silicate, asbestos paper, asbestos fibre etc.

* Glass Wool -

Glasswool is an inorganic thermal insulator. The glass fibres are prepared from the molten glass, flows into a container, having small holes. Then it rotates rapidly and the glass fibres are form. These fibres fall on the conveyor belt and by binding into a texture like wool.

* Properties of glass wool -

- 1) Glasswool is chemically inert.
- 2) Non corrosive
- 3) Have low thermal conductivity
- 4) Highly resistance to moisture.

- 5) It has good tensile strength.
- 6) Fire proof
- 7) It has low density.

* Application of glass wool -

- 1) It is used for electrical insulation
- 2) used in oven, refrigerators.
- 3) It is used in cavity wall insulation, ceiling tiles, curtain walls, and for ducting.
- 4) sound proofing and also used to insulate piping.
- 5) Glasswool used as a dust filtering material in air filters.
- 6) Glasswool is thermal as well as electrical insulator.

* Thermocole - (Expandable Polystyrene) EPS -

* Thermocole is made from Polystyrene. When gas is blowing into polystyrene then it expands into a solid foam like material called thermocole or expandable polystyrene EPS.

* It is spongy porous foam. It contains many tiny air-filled cells, giving it an excellent thermal and sound insulator.

* Properties of Thermocol -

- 1) very lightweight.
- 2) Low thermal conductivity.
- 3) Good electrical insulation.
- 4) It has low cost.
- 5) Easy to cut and shape.
- 6) It has good tensile strength (3-6 kg/cm)
- 7) Resistance to moisture.
- 8) It is shock proof

* Uses of thermocole -

- a) Thermal insulation in buildings, refrigerators, and cold storage
- b) It is used for packaging of delicate instruments, glassware.
- c) sound insulation in cinema halls, factories, offices.
- d) It is used for decoration.
- e) It is used in model making and craft work.
- f) It is used in ceiling roofs, walls, floors, door, partition, and cemented water tank.
- g) Thermocole is used as thermal as well as electrical insulator.

* Polymer and monomer -

* **Definition** - Polymers are very large molecular weight molecule that are formed by joining of number of monomers in the repeating unit.

* **monomer** - A monomer is a small molecule that can chemically combine with other similar molecules to form a polymer.
e.g. Ethylene, vinyl chloride, styrene.

* **Polymerization** - The process in which large number of small monomers linking together to form a large molecule in presence of temperature, pressure and catalyst is known as the polymerization.

* Degree of Polymerization -

"The number of repeating units present in polymer is called as degree of polymerization."

* Classification of Polymers or Plastics -

I) classification of Polymer on the basis of molecular structure -

a] Linear polymer.

b] Cross-linked polymer.

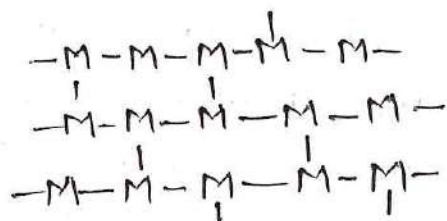
a] **Linear Polymer** - Linear polymers formed by monomers are joined with each other and formed long straight chain.

e.g. Polyethylene, PVC, Polystyrene

* $-M-M-M-M-M-$

b] **Cross-linked Polymers.**

Cross-linked polymers formed by monomers are joined with each other and formed a network or cross-linked structure.



e.g. Bakelite, Nylon-66 etc.

* Linear Polymer formed by same type monomer.

* Cross-linked polymer formed by different type of the polymer.

* classification of polymer on the basis of monomers -

a] Homopolymer

b] Copolymer.

a] Homopolymer - Polymers are formed by the same types of monomers are called homopolymers.

e.g. Polyethylene, PVC, Polystyrene etc.

b] Copolymer - The polymers formed by different types of two or more different types of repeating monomers are called copolymers.

e.g. styrene, acrylonitrile, styrene butadiene, Nylon-66, Bakelite

* Homopolymers are formed by addition polymerization

* Copolymers are formed by condensation polymerization.

* classification on the basis of thermal behaviour.

a] Thermoplastics

b] Thermosetting

a] Thermoplastics - These type of polymer becomes soft on heating and hard on cooling. These are formed addition polymerization reaction.

example - Polyethylene, Polystyrene, PVC, cellulose acetate.

b] Thermosetting - These type of polymer becomes permanently hard, when heated they does not become soft.

* These are formed by condensation polymerization reaction

example - Urea-formaldehyde, Nylon-66, Bakelite etc.

Thermoplastic	Thermosetting
1) These are soften on heating and harden on cooling.	1) They becomes permanently hard.
2) These are formed by addition polymerization.	2) These are formed by condensation polymerization.
3) They have low molecular wt.	3) Have high molecular weight
4) Thermoplastics formed by the addition polymerization.	4) These are formed by the condensation polymerization.
5) They have linear structure.	5) They have cross-linked structure.
6) They are soluble in the organic solvents.	6) They are soluble in inorganic solvents.
7) Ex. PVC, polyethylene, polystyrene etc.	7) Ex. Bakelite, Urea-formaldehyde, Nylon-66 etc.

* Types of Polymerization Reactions -

a] Addition Polymerization b] Condensation Polymerization.

a] Addition Polymerization - [chain growth polymerization]

These polymers are formed by same types of monomers without elimination of by products like water, ammonia & methanol are called addition polymerization.

* Example - Phenol Polyethylene, PVC, Teflon, Polystyrene etc.

b] Condensation Polymerization [step growth polymerization].

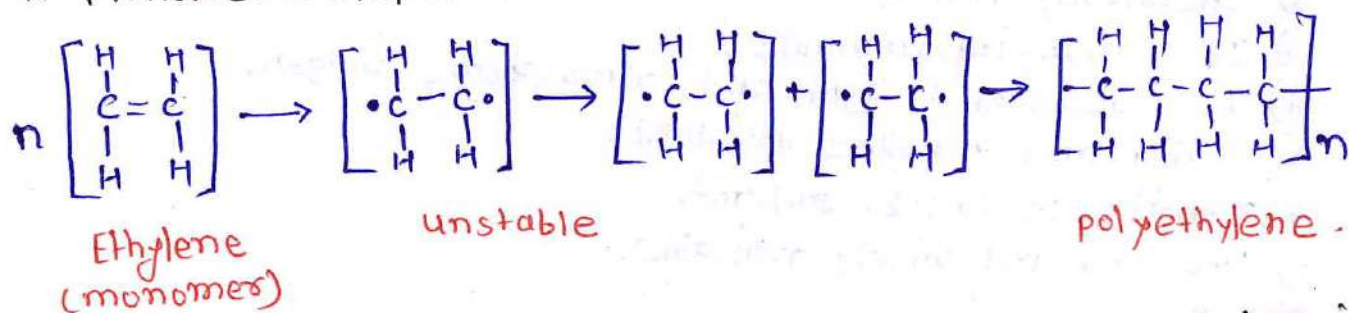
* condensation polymerization in which polymer is formed by different types of monomers with elimination of small molecule like water, ammonia, methanol are called condensation polymerization.

* Examples - Nylon-66, Epoxy resin, Phenol formaldehyde etc.

* Synthesis of Polymers -

* Synthesis of Polyethylene -

* Monomer - Ethylene.



Polyethylene is formed by ethylene monomer. Polyethylene is formed by one of the double bond between carbon atom is break and formed unstable radical. when these unstable molecule joined then polyethylene is formed.

* Properties -

- 1] HDPE - High Density Polyethylene. have high density
- 2] Has high tensile strength.
- 3] It has low moisture absorption.
- 4] LDPE - Low Density Polyethylene has low density.
- 5] Low tensile strength

* Applications -

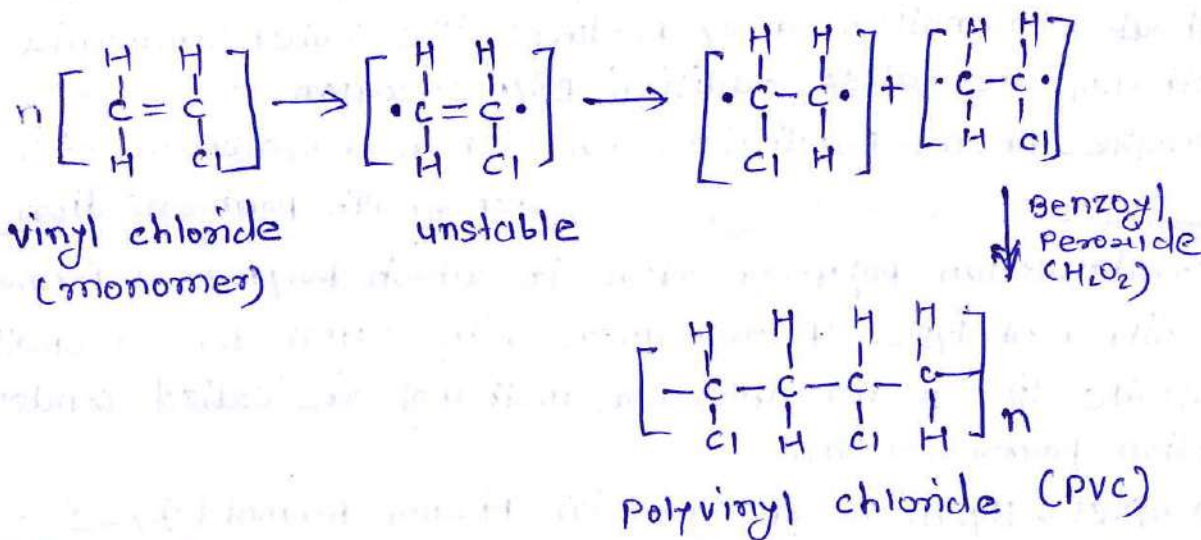
- 1] HDPE used in waterpipes, toys, detergent bottles etc.
- 2] LDPE used for plastic bag, film wrap,

* product in consumer packaging bag, bottles, liners, toys etc.

* synthesis of Polyvinyl chloride PVC -

* Monomer - Vinyl chloride.

Polyvinyl chloride is formed by number of vinyl chloride in presence of benzoyl peroxide or H_2O_2 Catalyst.



* Properties -

- 1) It is colourless, odourless.
- 2) chemically inert.
- 3) It is non-flammable.
- 4) It is resistant to light and atmospheric oxygen.
- 5) water and moisture resistant.
- 6) Density - 1.3 to 1.45 gm/cm³.
- 7) Low cost and widely available.

* Applications of PVC -

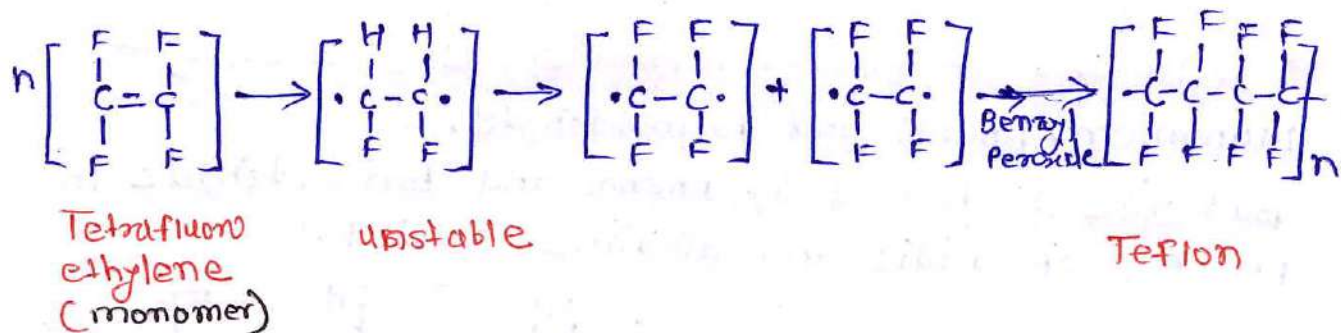
* Plasticized PVC is used to making rain coats, curtains, table cloth, electrical insulation, bottles, door, and window component, radio components, chemical container.

* Unplasticized PVC has high rigidity and superior chemical resistance. Tank linings, light fittings, safety helmet, cycle and motor cycle mudguards, refrigerator components.

* synthesis of Teflon (Polytetrafluoroethylene) PTFE -

It is formed by polymerization of tetrafluoro ethylene in presence of catalyst benzoyl Peroxide.

Monomer - Tetra fluoro ethylene.



* Properties -

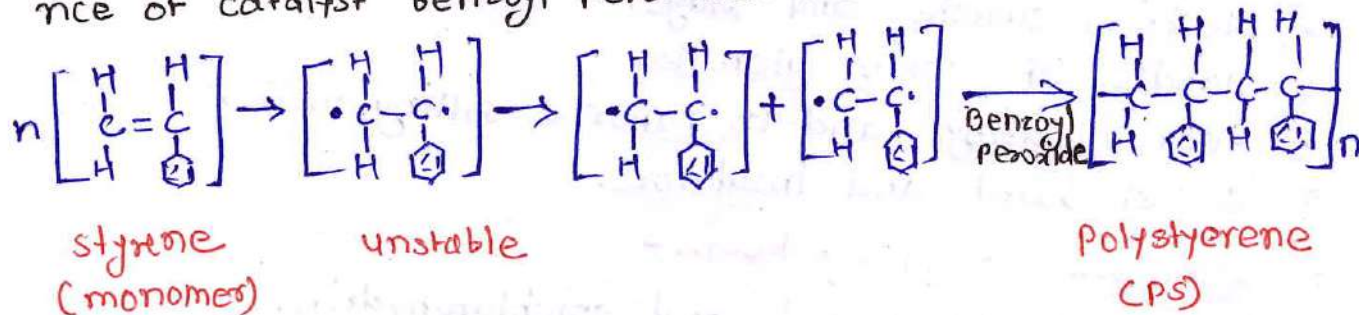
- 1) It is harder and stronger than other polymer.
- 2) Excellent resistant to water, alcohol, acids etc.
- 3) It has high molecular wt.
- 4) Low chemical reactivity.

* Applications.

- 1) Non-stick cookware coatings.
- 2) Used in pipework for reactive and corrosive chemicals.
- 3) It is used as an insulating material for motor, transformer, cables, wires etc.
- 4) Used for making gaskets, tank linings, packings.
- 5) Graft material in surgical interventions.

* Synthesis of Polystyrene (PS) -

polystyrene formed by polymerization of styrene in presence of catalyst benzoyl peroxide. monomer - styrene.



* Properties -

- 1) It is a very good electrical insulator.
- 2) It can easily moulded.
- 3) It is transparent, hard and brittle.
- 4) Good chemical resistance to diluted acid and bases.
- 5) Low Melting point.
- 6) It has excellent optical clarity.

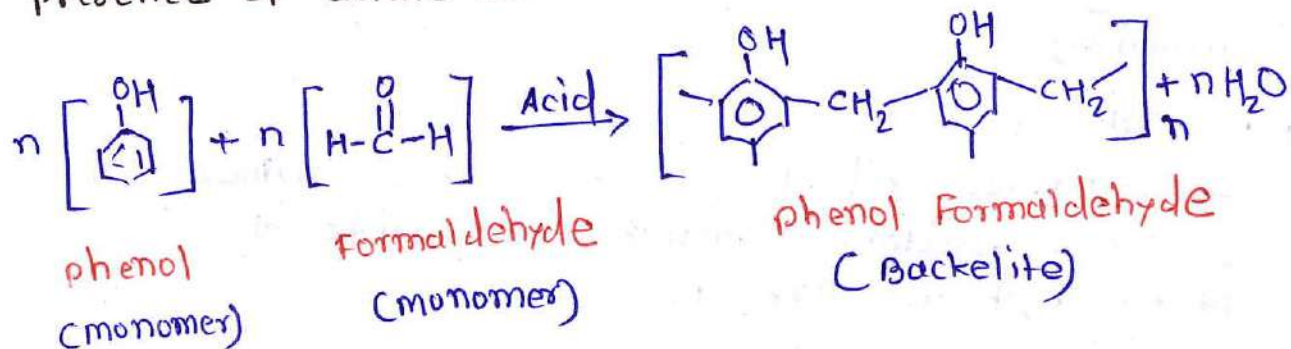
* Applications -

- 1) Used for making battery cases, refrigerator parts etc.
- 2) Used in products like dining utensil, plastic cups, toys, cosmetic containers, cover etc.
- 3) food packing, optical electronic, medical & automotive parts.

* Synthesis of phenol formaldehyde (Bakelite) -

Monomer - phenol and formaldehyde.

Bakelite is formed by phenol and formaldehyde in presence of acidic and alkaline catalyst.



* Properties -

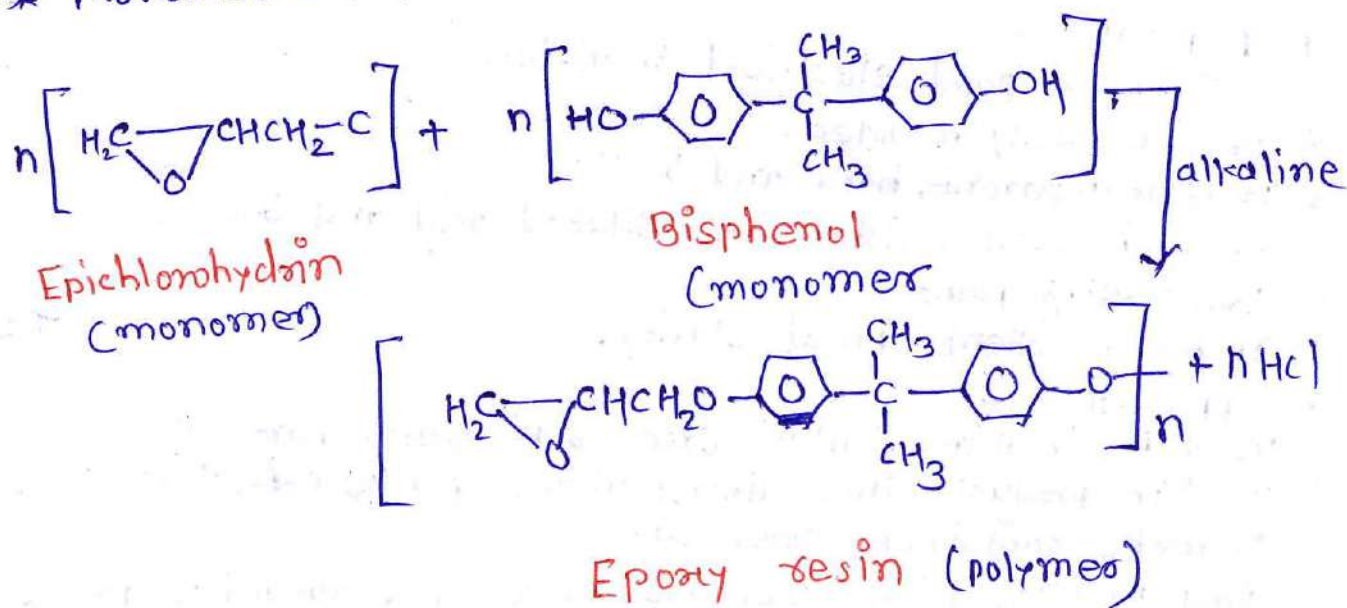
- 1) Bakelite is hard,
- 2) Resistant to heat, scratches and destructive solvents.
- 3) It can stable at different temperature.
- 4) It resist to electricity.

* Applications -

- 1) Used for making sheets, rods and tubes.
- 2) It is used as an adhesives.
- 3) Radio and telephone casings.
- 4) Electrical switches and plugs.
- 5) Handles of cooking utensils.
- 6) Gears, bearings and in paper & rolling mills.
- 7) socket board, and insulators.

* Synthesis of Epoxy Resin -

* Monomer - Bisphenol and epichlorohydrin.



* Properties -

- 1) It has good corrosion resistance
- 2) Excellent resistance to chemicals, acids, alkalis and solvent
- 3) Good adhesion property.
- 4) Resistance to moisture.

* Applications -

- 1) Epoxy resin is used making moulds of aircraft and the automobiles.
- 2) Electrical insulation materials.
- 3) Adhesives and bonding agents.
- 4) Protective coatings and paints.
- 5] It is used for surface coatings and gas storage vessels.

* Difference between addition polymerization and Condensation polymerization.

Addition polymerization	Condensation Polymerization
1) It is the process in which the same type of monomers linked to each other without elimination of small product like H_2O , HCl , NH_3 etc	1) In the process different types of monomers linked to each other with elimination of H_2O , NH_3 or HCl .
2] In this process monomer should contain at least one $C=C$ double bond.	2] In this process monomer should contain more than one functional group.
3) They are soluble in organic solvents.	3] They are insoluble in organic solvents.
4) Polymers are joined by weak covalent bond.	4) Polymers are joined by strong covalent bond.
5) It has linear chain structure	5] It has Cross-linked structure
6) Example - Polyethylene, PVC, Polystyrene, Teflon.	6] Example - Bakelite, Epoxy resin, Urea formaldehyde.
7] It contain same type of monomers.	7] It contain different types of monomers.
8) It is the chain growth polymerization.	8] It is the step growth polymerization.

* Adhesives -

* **Definition** - Any substance applied to one or both surface of two separate items that binds them together and resist their separation is called an adhesives.

* A substance capable of holding materials together by surface attachment is called adhesives.

* Adhesives are useful for joining the substance.

* Characteristics of Adhesives -

- 1) It has ability to bind the different materials.
- 2) Highly resist to chemicals.
- 3) Resist to temperature.
- 4) Resist to moisture.
- 5) It has good adhesion property
- 6) Highly resist to insect, fungi
- 7] It has ability to withstand at different load, stress.

* classification of adhesives -

a] Based on structure .

b] Based on by origine.

a] classification of adhesives based on structure -

i] **Thermosetting synthetic adhesive** -

- * These are formed by condensation polymerization Reaction
- * They have cross-linked structure.
- * Good adhesion property.

Examples -

- 1] phenol formaldehyde resin - Used for making waterproof plywoods, laminates, in air craft and ship building industry
- 2] urea formaldehyde resin - used for wooden surfaces, plywoods, lamination, in air-craft and ship industry.
- 3] Epoxy resin - Bonding in glass, metallic, ceramic articles, in air craft industry.
- 4] Polyesters - making laminated glass and cloth.
- 5] silicon resin - for bonding metals, glass, plastic, rubber, ceramics etc.

* Thermoplastic synthetic adhesives -

- * These are formed by addition polymerization process.
- * They are soft.
- * Examples -
 - * cellulose derivatives - Used in cloth and footwear industry.
 - * Acrylics - used in bonding cloths, papers, glass, leather etc.
 - * Polyvinyls - Used in sealing operation in food industry.

* classification of adhesives by origins -

- a] Natural adhesives
- b] Synthetic adhesives.

a] Natural adhesives - Are obtained from natural sources.

* Examples -

- 1) shellac resin - used in making belt, conveyers etc.
- 2) starch adhesive - making in manufacturing envelopes, stamps, notebook, binding books etc.
- 3) Asphalt - Used for bonding paper, cloth, metal bonding.
- 4) Animal glues - Used for furniture, radio cabinets etc.
- 5) vegetable glues - adhesive for paper craft, wall poster etc.

b] synthetic adhesives -

- * These adhesives are manufacture by man.
- * Properties of synthetic adhesives better than natural adhesive

* Examples -

- ① Polyvinyl acetate - used for woodwork glue.
- ② Contact adhesives - used for joining polystyrene & fabrics and laminates for plastic and wooden base.
- ③ Epoxy resin - used for joining metals & plastics.
- ④ Acrylic polymer adhesives - used in fabric leather coating

* Lubricants -

* Definition - A substance reduces the frictional resistance between moving parts called as lubricant.

* The process of reducing frictional resistance between moving parts surface is called lubrication.

e.g. oils, grease, graphite, water etc.

* Classification of Lubricants -

- a] solid Lubricant
- b] semisolid Lubricant
- c] Liquid Lubricant.

a] solid Lubricant -

- * solid lubricants either in the form of dry powder or mixed with water or oil
- * They are used at high temperature and heavy load.
- * Examples -
graphite, molybdenum disulphide, Boron nitride, tungsten disulphide, soapstone, talc, mica etc.

* Graphite - It is commonly used.

- * Either powder or mixed with water or oil.

* Molybdenum disulphide -

- * It is used at 400°C temperature
- * It is used at velocities.
- * It is used along with solvents and in greases.

* b] semisolid Lubricants -

e.g. Grease, Vaseline, Waxes, are semisolid lubricants.

* Composition of Grease -

80% mineral or synthetic oil + 10% heavy metallic soap + 10% additives. (rust inhibitor, antioxidant, deactivator)

- * Lithium based grease - Petroleum oil + lithium soap.
- * sodium based grease - Petroleum oil + sodium soap.
- * cup based grease - Petroleum oil + calcium soap
- * Axle grease - Petroleum oil mixed with lime + heavy metal hydroxide, resin or oil.

c] Liquid Lubricants -

e.g. oil, water

- * water - used for milling and lathe turning.
- * Mineral oil - obtained from crude petroleum oil.

e.g. Paraffins, naphthalene.

* Vegetable oil - olive oil, palm oil, Castor oil, Hazel nut oil

* Blended oil - mineral oil mixed with animal or vegetable oil.

- * Animal oil - Obtained from animal sources.
- * Lard oil - obtained from kidney, intestine and fat of pigs.
- * Tallow oil - made from fats of cattles.
- * Neat foot oil - Obtained by boiling fat of neat with water.
- * Synthetic oil - These are chemically prepared.
- * used in sockets motor, submarines etc.

* Characteristics of Lubricants -

- 1) Lubricant should maintain oil film between moving parts.
- 2) It should withstand high pressure.
- 3) It should not volatalize.
- 4) Retain fluidity at different temperature.

* selection of lubricants -

- ① For Gears - For high pressure gears grease are used.
- * It must have anti foaming property
 - * Good oilness
 - * Have low adsorption capacity
- * For cutting tools - such as Boring, drillings, sawing, cutting.
 - * oils are used for cutting tools.
 - * Liquid (oil) lubricants are used for cutting tools.
 - * For steam turbine - solid lubricants are used for steam turbine.
 - * At high temperature solid lubricants are used.

* Properties of Lubricants -

- 1) viscosity
- 2] viscosity index
- 3] oilness
- 4] Flash point and fire point
- 5] volatility.
- 6] cloud point pour point
- 7] Acidity
- 8] Saponification value
- 9] Emulsification.

1) viscosity - It is the measure of fluid's resistance to flow at given temperature.

- * Greater resistance to flow higher is the viscosity
- * Low viscosity liquid - used in delicate instruments, used in high speed with low load. e.g. watches, clocks, sewing machine etc.
- * High viscosity liquid - used in heavy load and slow speed machines.

e.g. Tractor, concrete machine, rail track joint etc.

2] Viscosity index -

- * It is a measure for the change of viscosity with the variation in temperature.
- * As temperature increases then decrease temperature viscosity.
- * A good lubricant is that whose viscosity does not change with temperature.

3] Oiliness - It is the power of an oil to maintain continuous film.

- * Low viscosity liquids have high oiliness.
- * Animal and vegetable oil are superior oiliness than mineral oil.
- * A good lubricant should have sufficient oiliness.

4] Flash point and Fire Point -

- * Flash point - "The lowest temperature at which oil begins to give enough vapours which gives momentary flash of a light, when flame is applied to it is called as flash point".
- * Fire Point - The lowest temperature at which oil gives the enough vapours which catch fire and burn continuously for 5 second when flame is applied to it is called as fire point.
- * A good lubricant should have high flash and fire point.

5] Volatility - It is the property to evaporate and loss its characteristics.

- * A good lubricant should have high volatility.

6] Cloud point and Pour point -

- * Cloud point - cloud point of lubricant is the temperature below which wax in the lubricant forms cloudy appearance.
- * Pour point - Is the temperature at which lubricant can flow and below which lubricants becomes freeze to flow.
- * A good lubricant should have high cloud point and pour point.

7] Acidity or Neutralisation number -

The no. of milligrams of KOH is required to neutralized free acids in one gram of oil is called acidity or neutralization number.

* A good lubricant is that which does not contain the free acid. It causes the corrosion of metal.

* Saponification value -

The number of milligrams of potassium hydroxide (KOH) required to saponify 1 gram of oil / fat is called saponification value.

* A good lubricant should have moderate saponification value

* Emulsification -

* when oil mixed with water, the mixture is called emulsion

* A good lubricant does not form emulsion.

* Application of lubricants -

1) Used to reduce friction between moving surface.

2) These are used as coolant

3) Used to reduce heat generation.

4) Liquid lubricants used in cutting tools, medicines,

5] used as antiwear, antioxidant, antifoaming agents.

6] Used to reduce noise & vibration.

7] Used for improve smooth movement

8] Used in soap and paint industries.

9] Used in engine, gearbox, breaks, moving parts.

* Catalyst -

* "catalyst is the substance which alter the rate of chemical reaction".

* The process of changing the rate of chemical reaction by using catalyst is known as catalysis.

* The concept catalysis was introduced by J.J. Berzelius in 1835.

* Types of catalyst -

a] positive catalyst

b] Negative catalyst

c] Autocatalyst.

a] Positive catalyst - Those catalyst increase the rate of chemical reaction, when added is called positive catalyst.

* Unit Related Questions. *

- Q] Write the name of ingredients of Paint.
- Q] Give the function of ingredients of Paints.
- Q] Define paint with their characteristics.
- Q] What is Varnish, give different types of Varnishes.
- Q] Differentiate between Paint and Varnishes.
- Q] Define thermocole give its properties and applications.
- Q] Write properties of glasswool.
- Q] Write application of glasswool and thermocole.
- Q] Define polymer, polymerization & degree of polymerization
- Q] Define polymerization, Give its type of polymerization.
- Q] Give the difference between thermoplastic and thermosetting
- Q] Explain the synthesis of polyethylene with their application
- Q] Write properties of polyvinyl chloride
- Q] Write properties and application of polystyrene
- Q] Write properties and application of Teflon.
- Q] Explain synthesis of phenol formaldehyde.
- Q] Give synthesis with their application of epoxy resin.
- Q] Define adhesives with their characteristics.
- Q] Explain classification of an adhesives.
- Q] Define lubricants.
- Q] Write the types of lubricants.
- Q] Explain the characteristics of lubricants.
- Q] Explain properties of lubricants.
- Q] State the functions of lubricants.
- Q] State the types of lubricants with their examples.
- Q] Explain catalysis with their types.
- Q] State the types of catalyst.
- Q] Write the industrial application of catalyst.
- Q] State characteristics of catalyst
- Q] Differentiate between homogeneous & heterogeneous catalysis

* Unit related MCQ.

- Q] which is not a constituent of paint ?
 a] Pigment b] Thinner c] Vehicle ☒ d] Alcohol.
- Q] select the lubricant which is used for watches is ?
 a] Tungsten disulphide b] Graphite ☒ c] Hazelnut oil d] MoS_2
- Q] A red pigment is
 a] zinc sulphide ☒ b] Lead c] zinc oxide d] none of them
- Q] The polymers cannot be recycled ----
 a] Thermoplastic ☒ b] Thermosetting c] Elastomer d] All of above
- Q] The monomer of vinyl chloride contain
 a] single bond ☒ b] Double bond c] triple bond d] None of them.
- Q] The type of lubricants used for cutting tools ----
 a] solid lubricants b] semisolid ☒ c] Liquid d] Both a & b
- Q] solid lubricants is used for ----
 a] cutting tools ☒ b] steam turbine c] sewing machine d] gun.
- Q] In rocket and submarine which type of lubricant is used
 a] animal oil b] vegetable oil c] mineral oil ☒ d] Synthetic oil
- Q] which are the monomers of epoxy resin
 a] phenol b] Bisphenol c] Epichlorohydrin ☒ d] Both b & c
- Q] which is example of positive catalyst in formation of NH_3
 a] Fe b] CO ☒ c] Mo d] None of them.

8/1/2026

