

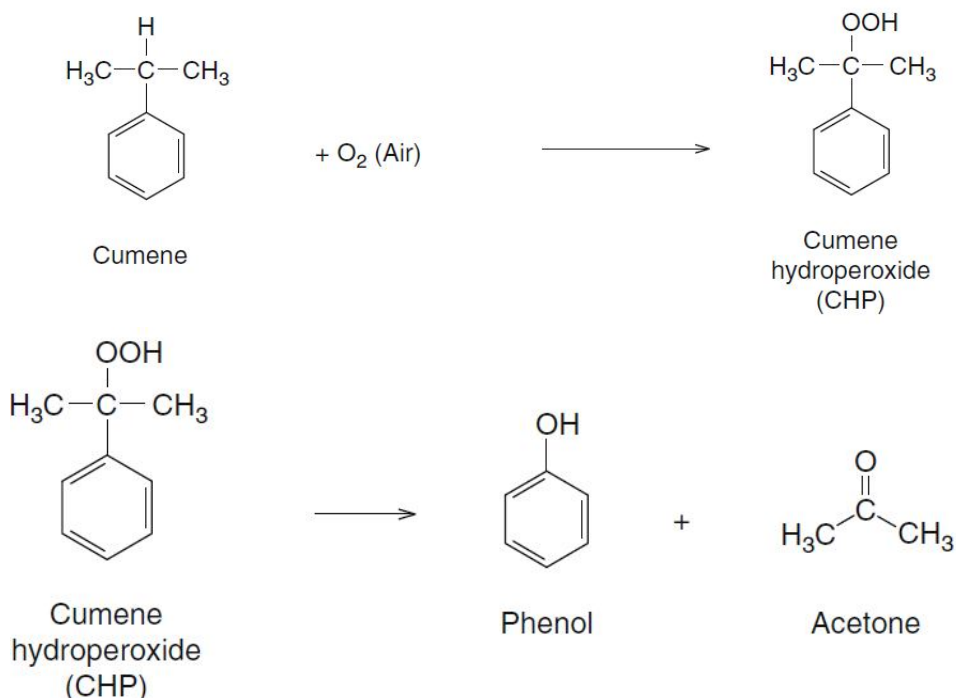
MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

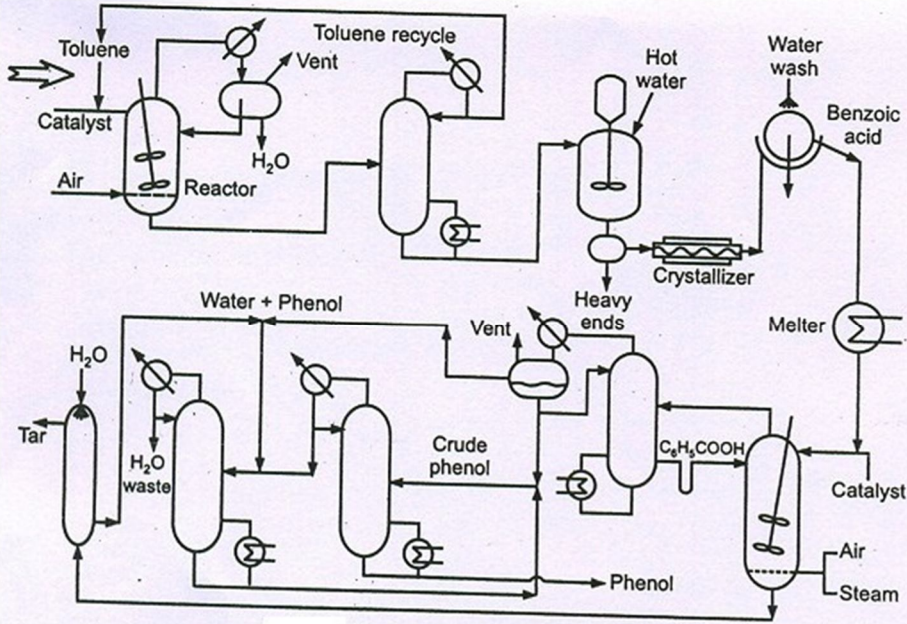
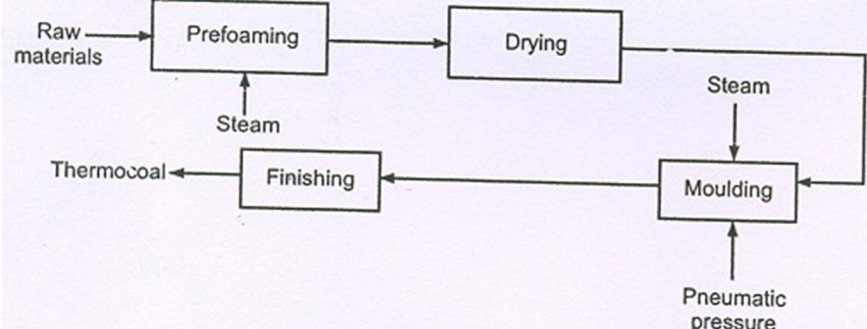
WINTER-12 EXAMINATION

Model Answer

Subject code: **TOC (12127)**

Q. No	Answer	Remarks								
1(A)(a)	Thinner or solvent in paint is used to dissolve polymers in paint and to disperse pigments (emulsion formation).It adjust viscosity, form thin film.	2marks								
(b)	Mechanical:- Chemical:- Kraft, Sulphite Semi chemical:-	2marks								
(c)	<div><div>$\text{C}_2\text{H}_4 + \text{Cl}_2 = \text{C}_2\text{H}_4\text{Cl}_2 = \text{C}_2\text{H}_3\text{Cl} + \text{HCl}$<div><div>(Ethylene)</div><div>(Chlorine)</div><div>(1,2 dichloroethane)</div><div>(Vinyl monomer)</div></div></div><div><div><div><div><div>H</div><div>H</div></div><div><div>C=C</div></div><div><div>H</div><div>Cl</div></div></div><div><div><div>vinyl chloride</div></div></div></div><div><div>free radical vinyl polymerization</div><div>→</div><div><div><div>H</div><div>H</div></div><div><div>—C—C—</div></div><div><div>H</div><div>Cl</div></div><div><div>poly(vinyl chloride)</div></div></div></div></div></div>	2marks								
(d)	Weighing Mixing Grinding Filtering Filling	2marks								
(e)	<table><tr><th>Paint</th><th>Varnish</th></tr><tr><td>It is mechanical mixture of pigment in solvent</td><td>It is homogenous colloidal dispersion solution of resin in oils or thinner or both.</td></tr><tr><td>It produces opaque film.</td><td>It produces transparent film</td></tr><tr><td>It contains pigment</td><td>It does not contain pigment</td></tr></table>	Paint	Varnish	It is mechanical mixture of pigment in solvent	It is homogenous colloidal dispersion solution of resin in oils or thinner or both.	It produces opaque film.	It produces transparent film	It contains pigment	It does not contain pigment	2marks
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(f)	Saponification value of oil: - It is the number of milligrams of KOH required to saponify one gram of oil.	2marks								
(g)	Polyesters are also used to make bottles, films, liquid crystal displays, holograms, filters, dielectric film for capacitors, film insulation for wire and insulating tapes.	2marks								
(h)	Acetic acid is used in the production of cellulose acetate mainly for photographic film and polyvinyl acetate for wood glue, as well as synthetic fibres and fabrics.	2marks								
1(B) a)	Ethanol is used as fuel. In alcoholic beverages , for the production of esters, as a solvent	2marks								

	Butanol is used as Solvent, in perfumes, as a fuel, for the production acetates and ethers.	2marks
b)	Acid Value of oil: - It is the number of milligrams of KOH required to neutralize the free acid present in one gram of oil. Iodine Value: - It a number of milligrams of iodine absorbed by 100 grams of oil for complete saturation.	2marks 2marks
c)	 <p>The diagram illustrates the industrial production of phenol from cumene. It starts with the chemical structure of cumene (isopropylbenzene), which reacts with oxygen from the air (O_2) to form cumene hydroperoxide (CHP). The structure of CHP is shown with a benzene ring attached to a carbon atom that is also bonded to two methyl groups and a hydroperoxy group ($-OOH$). An arrow points to the decomposition of CHP into phenol (a benzene ring with an $-OH$ group) and acetone (a three-carbon chain with a double-bonded oxygen on the central carbon).</p>	2marks 2marks
2(a)	Pigments: - It finely divided solids generally made up metal oxides .It is used to give colour to paint. Drying oil: - These are unsaturated oils. It is used to form protective film and give gloss. Thinners or solvent: - It is alcohols or turpentine. is used to dissolve polymers in paint and to disperse pigments (emulsion formation).It adjust viscosity, form thin film. Plasticizer: - These are polymers. Used to impart elasticity to paint.	1mark each

(b)	 <p style="text-align: center;">1 Phenol from toluene oxidation</p>	4marks
(c)		4marks
(d)	<p>Types of Papers:-</p> <p>Printing Paper:- To use in office printing ,Xeroxing</p> <p>Wrapping Paper:- To make bags, cartoon wrapping</p> <p>Book paper:- To make text books, handbooks</p> <p>Tissue Paper:- to make cigarette, toilet paper, napkin papers</p> <p>Groundwood printing paper:- To make catalogue, newsprint, poster</p> <p>Paperboard:- boxes, cartoons</p>	1mark each

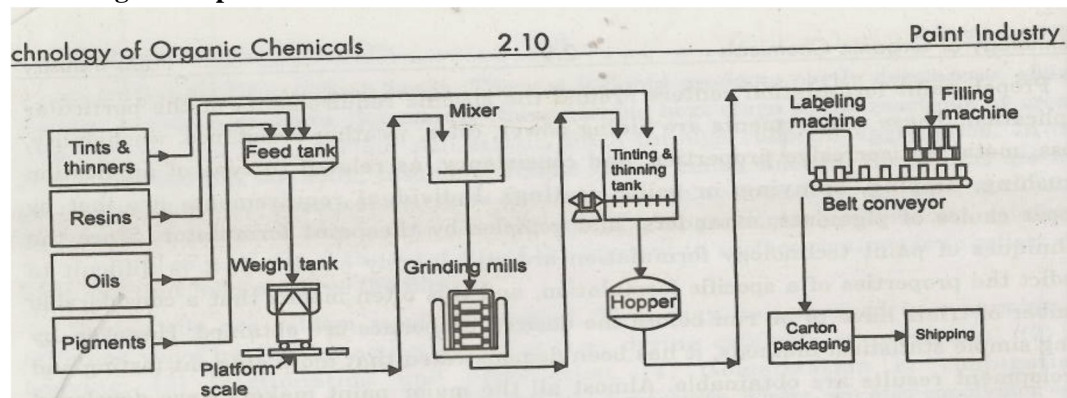
(e)		4marks
(f)	<p> $\text{H}_3\text{C}-\text{O}-\text{C}(=\text{O})-\text{C}_6\text{H}_4-\text{C}(=\text{O})-\text{O}-\text{CH}_3 + \text{HO}-\text{CH}_2-\text{CH}_2-\text{OH}$ </p> <p style="text-align: center;"> dimethyl terephthalate ethylene glycol </p> <p> $\longrightarrow \text{HO}-\text{CH}_2-\text{CH}_2-\text{O}-\text{C}(=\text{O})-\text{C}_6\text{H}_4-\text{C}(=\text{O})-\text{O}-\text{CH}_2-\text{CH}_2-\text{OH} + 2 \text{CH}_3\text{OH}$ </p> <p style="text-align: center;"> <i>bis</i>-(2-hydroxyethyl)terephthalate methanol </p> <p> \downarrow </p> <p> </p> <p style="text-align: center;">polyethylene terephthalate (polyester)</p>	2marks

		2marks															
3.a)	<table border="0"> <thead> <tr> <th></th><th>Sulphate process</th><th>Sulphite process</th></tr> </thead> <tbody> <tr> <td>i)Chemical rxn</td><td>Hydrolysis of lignin to alcohol</td><td>$RC=CR + Ca(HSO_3)_2 \rightarrow RCH-CR'SO_3 1/2Ca$</td></tr> <tr> <td>ii)Chemical nature</td><td>Alkaline</td><td>Acidic</td></tr> <tr> <td>iii) Operating con.</td><td>Time:- 2-5 hrs Temp.-: 340-350 °f Pressure:- 100-135 psi</td><td>Time :- 6-12 hrs Temp.-: 255-320°f Pressure:- 90-110psi</td></tr> <tr> <td>iv)Chemical recovery</td><td>Cooking chemicals are recovered</td><td>SO₂ is recovered</td></tr> </tbody> </table>		Sulphate process	Sulphite process	i)Chemical rxn	Hydrolysis of lignin to alcohol	$RC=CR + Ca(HSO_3)_2 \rightarrow RCH-CR'SO_3 1/2Ca$	ii)Chemical nature	Alkaline	Acidic	iii) Operating con.	Time:- 2-5 hrs Temp.-: 340-350 °f Pressure:- 100-135 psi	Time :- 6-12 hrs Temp.-: 255-320°f Pressure:- 90-110psi	iv)Chemical recovery	Cooking chemicals are recovered	SO ₂ is recovered	01mark 01mark 01mark 01mark
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3b)	<p>Classification of resins:-</p> <p>i) Natural resin e.g. Shellac, Asphalt</p> <p>ii) Synthetic resin e.g. acrylic phenolic resin, Epoxy resin, unsaturated polyester resin, urea formaldehyde resin</p> <p>Classification of plastics:-</p> <p>i)Thermoplastics e.g. Acrylics,cellulosics, fluorocarbons, polyethylene , nylon, polyvinyls</p> <p>ii) Thermosetting plastics . e.g. Alkydes , Epoxides Furah, Phenolics, Polysters</p>	01mark 01mark 01mark 01mark															
3c)	<p>Cleansing action of detergents:-</p> <p>Detergents are a class of surface active agents which are used for cleaning & for industrial surface active applications. Their action is based on colloidal chemistry principles.</p> <p>The grease is pulled away from the surface to be cleaned by the key mechanism. The success of any cleansing agent is to supply compounds with hydrophobic (water repelling group) & hydrophilic groups(water attracting group) which decrease surface tension &</p>	04mark															

increase wettability.

3d)

Flow diagram of paint:-

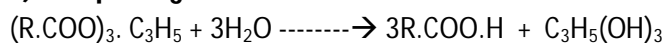


04marks

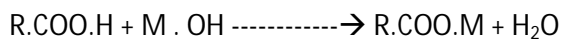
3e)

Chemical Reaction :-

a) Fat splitting:-



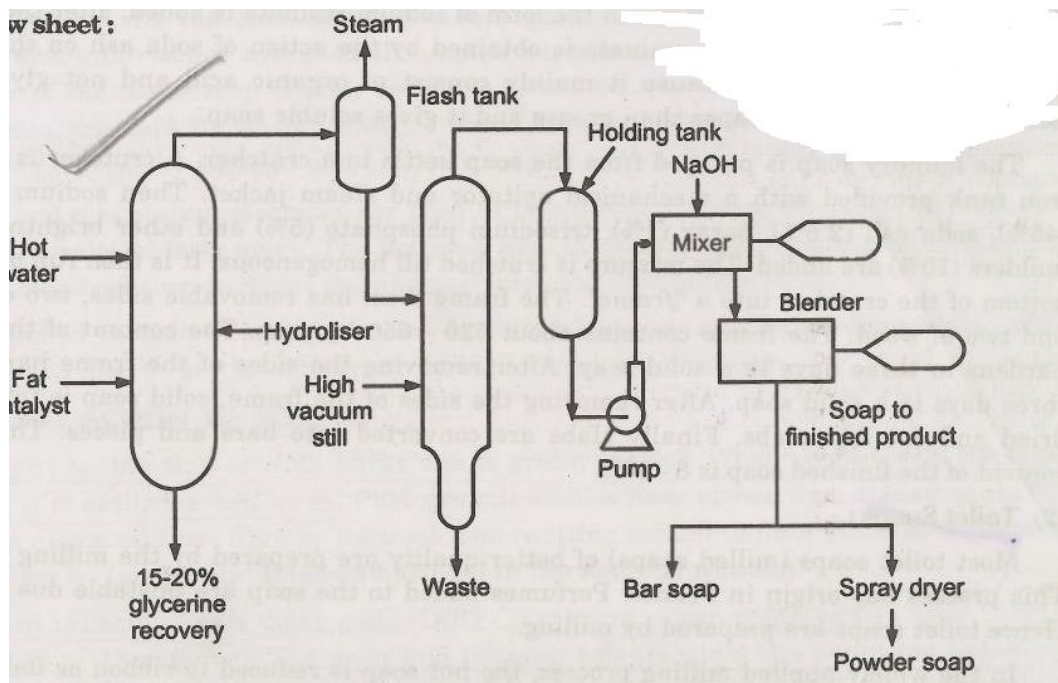
b) Saponification:-



Where M is usually an alkali metal such as **Na** or **K**

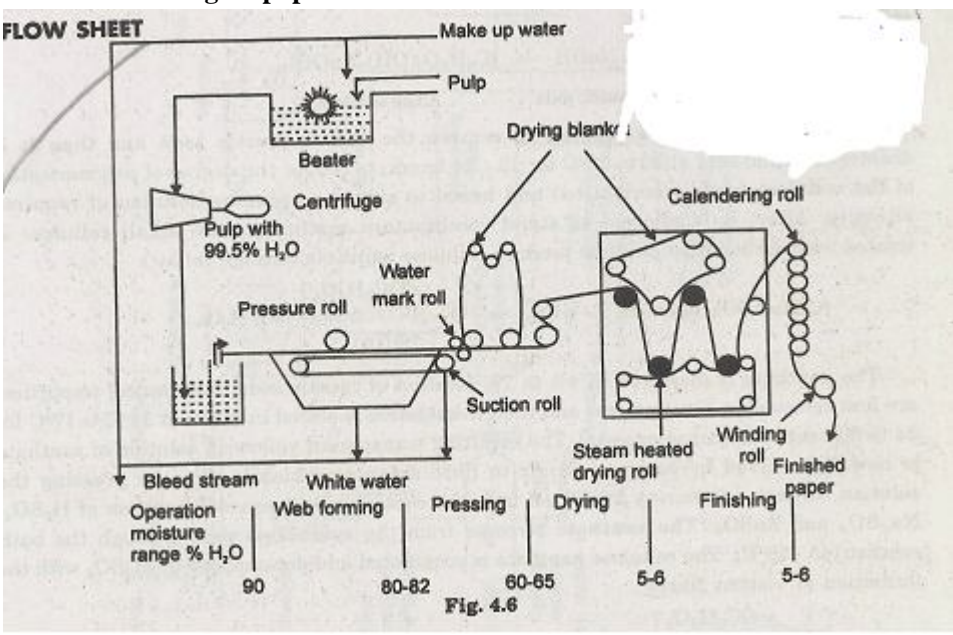
01mark

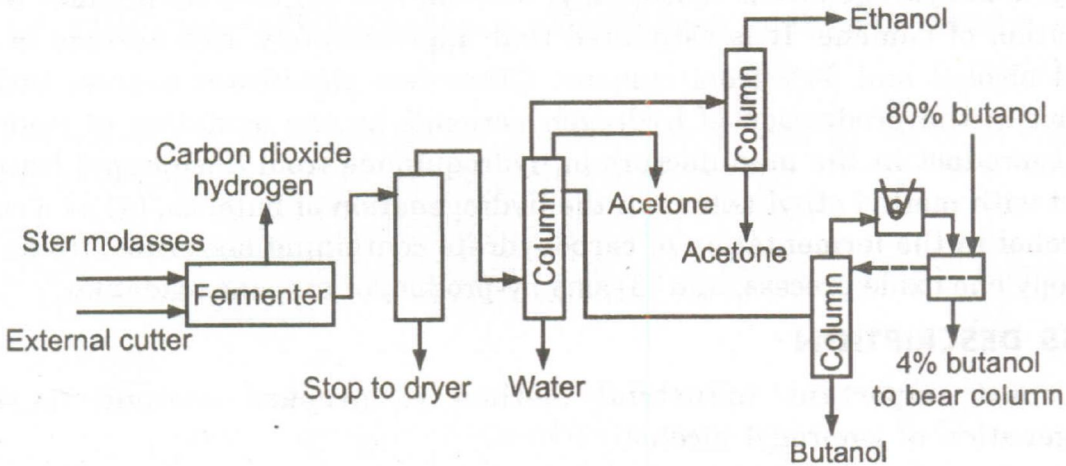
Flow sheet :



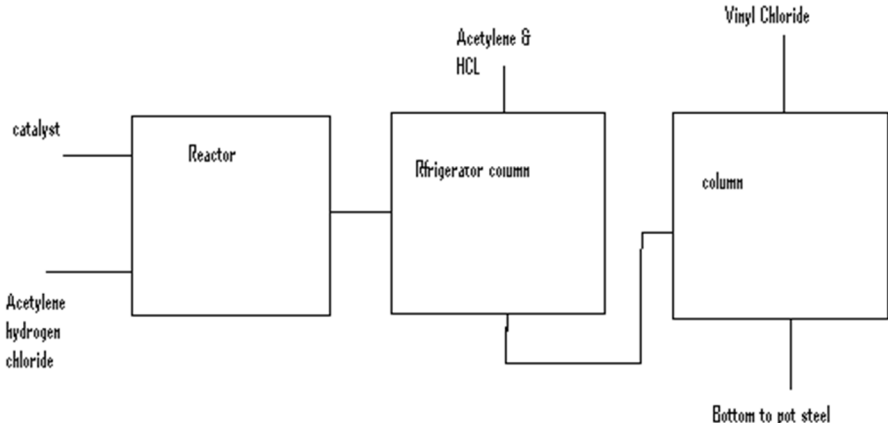
03marks

4.a)	<p>A) PRESSING OPERATIONS</p> <p>i) Processing :- oilseeds are passed over magnetic separator whereby iron particles are removed.</p> <p>ii) Removal of shells, hulls, dirt a) large size particles are removed by screening b) small size & dirt particles are removed by air blowing</p> <p>iii) Grinding:- The cleaned oil seeds are introduced into the crushing chamber.</p> <p>iv) Hydraulic pressing</p> <p>B) SOLVENT EXTRACTION</p> <p>Cakes obtained by pressing operations contain 5-10% oils can be recovered by heating the cake with volatile hydrocarbon like benzene, petroleum ether. The common solvent for edible oil is Hexane.</p> <p>C) Refining</p>	04marks
4.b)	<p>Manufacturing of ethyl acetate:- Ethyl acetate is produced by action of ethanol on acetic acid in the presence of concentrated H_2SO_4 catalyst.</p> $CH_3CH_2OH + CH_3COOH \xrightarrow{H_2SO_4} CH_3COOCH_2CH_3 + H_2O$ <p style="text-align: center;">Esterification reaction</p> <p>The process is carried out in batches or continuous. The main variable acetic acid conc. (8 to 80%) & 95% ethanol & 63 to 96 % H_2SO_4 are used. For batch process, reactions are mixed with 10 parts by weight 8 % acetic acid, 10 parts by weight 95% ethanol & 0.33 parts, 63 to 96% H_2SO_4.</p> <p>Product contains mixture of 83% ethyl acetate, 9% ethanol & 8% water which is removed from top of column at $70^\circ C$. Then ethyl acetate is separated & purified and ethanol recycled. The yield of ethyl acetate 99% is based on acetic acid</p>	04marks
4c)	<p>Definition:- Varnishes is defined as a homogeneous colloidal dispersion solution of natural or synthetic resins in oil or both.</p> <p>Types:- i) Oil varnishes</p> <p>ii) Spirit Varnishes</p> <p>Uses:- Used in finishing furniture, exterior wood work, marine application also in electrical impregnation.</p>	01mark 01mark 02marks
4.d)	<p>Importance of saponification value:- i) Whether an oil or fat contains lower or higher proportion of the same fatty acid.</p> <p>ii) The proportion of lower fatty acid or higher fatty acid in oil or fat.</p> <p>iii) From the saponification value, we know whether oil is animal, vegetable or mineral</p> <p>iv) The saponification value gives the estimation of non fatty impurities.</p>	02marks

	<p>Determination:- a weighed quantity of an oil or a fat is saponified by adding known excess amt. of alcoholic KOH. As a result, part of KOH is used in saponification i.e. obtaining glycerol & soap. The unused amount of alcoholic KOH is estimated by titration with standard solution of an acid.</p>	02marks
4.e)	<p>Plastics:-</p> <p>Plastics defined as a non-metallic material that can be moulded to any shape by application of heat and pressure .</p> <p>Classification:- i) Thermoplastics :- The thermoplastics are those which when heated begin to soften at a temp. of 60°C . then can be moulded without any change in chemical structure. e.g. Acrylics, cellulose, fluorocarbons, polyethylene , nylon, polyvinyls.</p> <p>ii) Thermosetting plastics:- The thermosetting materials undergo chemical change when moulded and cannot be resoftened by heating to reshape them e.g. Alkydes , Epoxides, Phenolics, Polystyrene</p>	01mark 01mark ½mark 01mark ½mark
4.f)	<p>flow sheet for mfg. of paper</p>  <p>Fig. 4.6</p>	04marks

5.(a)	<p>Molassess is diluted with water to a concentration of 5% sugar, sterlized cooled to 30⁰c and pump fermenter. After fermentation for 36 to 48 hours the mixture containing 1.5 to 2.5 % mixed solvent is pump to column. 50% mixture is taken off as overhead and slop is removed as bottom. This slop is used as animal feed. The mixed solvent vapours from the beer column are send to batch fractionating column from which 3 fractions Acetone, Ethanol & Butanol are removed as overhead leaving water as bottom. The acetone & ethanol fraction are purified by conventional fractionation, the butanol fraction containing 50% water is led to column from which vapour containing 70 % butanol & 30 % water are removed as overhead.</p> <p>Reaction: $(C_6H_{10}O_5)_x \rightarrow C_6H_{12}O_6$ STARCH GLUCOSE $C_6H_{12}O_6 \rightarrow CH_3COCH_3 + C_2H_5OH + CH_3CH_2CH_2CH_2OH + CO_2 + H_2$ GLUCOSE ACETONE ETHANOL BUTANOL</p> 	4marks
(b)	<p>Cumene process made by alkylation of benzene with propylene is mixed with recycle cumene and send to hydragenator unsaturates and α- methyl styrene are converted to saturated material to avoid undesirable decomposition of the peroxide during the oxidation step. Hydrogen over nickel catalyst at 100⁰c in batch reactor is the usual process.</p> <p>Oxidation is carried out on presence of air aqueous emulsion stabilized by alkali such as sodium carbonate.</p> <p>The cumene peroxide is cleaved in a acidifier with sulfuric acid. This agitation vessel is at 55-56⁰c. The reaction produced 76 wt. % cumene, 14 % phenol, 8% acetone and 1-2 α- methyl styrene and acetophenone. This mixture is separated in series of four distillation column, phenol is removed as overhead of the last vacuum fractionators and purified by crystallization.</p>	4marks

		4marks
(c)	<p>Process:</p> <p>vinyl chloride monomer is manufactured by chlorination of ethylene. Ethylene is cracked at high temperature then immediately inject to chill the vinyl chloride. HCL is removed by product.</p> <p>The vapor phase reaction between acetylene and hydrogen chloride in presence of mercuric chloride catalyst gives vinyl chloride. Anhydrous HCL gas and pure dry acetylene are mixed and fed to reactor. The reaction is exothermic so coolant is circulated to keep temperature 160-250⁰c the gases are condensed the acid free monomer is further fractionated in second refrigerated column where vinyl chloride is obtained which is stabilized with phenol .</p>	4marks

	 <p style="text-align: center;">Q. No. 5 c)</p>	4marks
6.(a)	<p>This process is carried out in two stages – 1) Hydro chlorination 2) Hydrolysis.</p> <p>In the process purified benzene is added in a pack reactor containing ferric chloride and cupric chloride. Temperature is 220⁰c with 10-20% conversion of benzene.</p> <p>The crude chlorobenzene is scrubbed with phenol, water wash and send to second catalytic stage where it is hydrolyzed. Phenol from hydrolyser wash with water extracted by benzene and finally purified by two stage distillation.</p>	4 marks

	<p>3.5.1. Reference flow sheet. Figure 14.15</p>	4marks
(b)	<p>Hydrogenation for edible purpose and industrial application: it is desirable to have solid fats or oil containing unsaturated fatty acid can be hydrogenated to produce a fat containing saturated glycerides. The liquid fats can be converted to solid fats.</p> <p>Hydrogen can be added to a double bond the reaction is required high pressure and a catalyst such as platinum, nickel. A complete hydrogenation convert molecule in to the corresponding saturated molecules.</p>	4marks

		4marks
(c)	<p>Ziegler process:</p> <p>Catalyst is prepared by adding diethyl aluminium chloride and titanium tetra chloride as co-catalyst. Pure ethylene is taken to the reactor along with catalyst at pressure 15 – 100 psi and the temperature 20-700c for 10 minutes. The product is taken in flash drum, water is added. The bottom product is aqueous slurry of polyethylene which is separated from filtrate.</p>	4marks

