MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

Summer-13 EXAMINATION

Model Answer

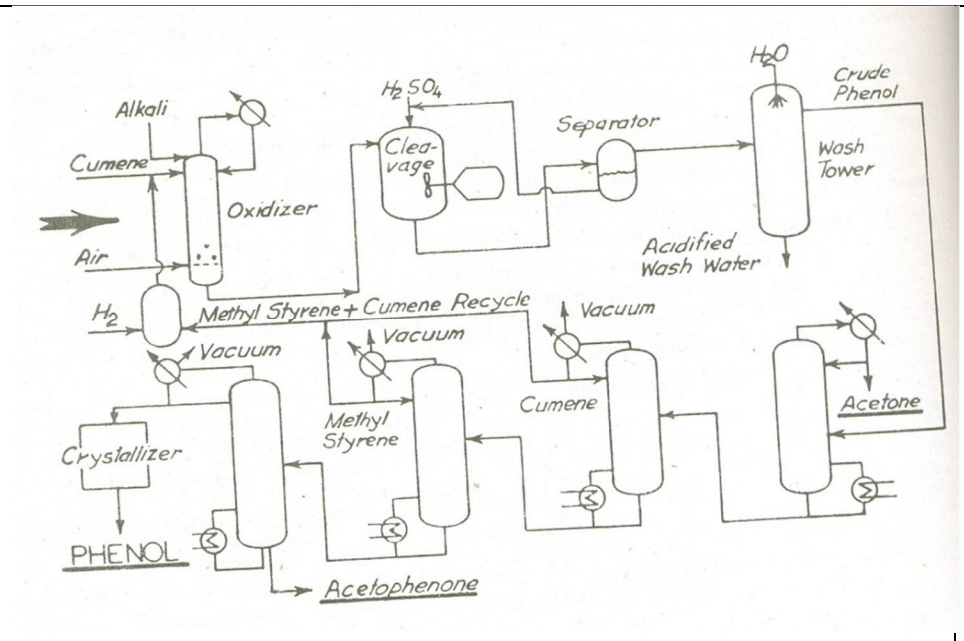
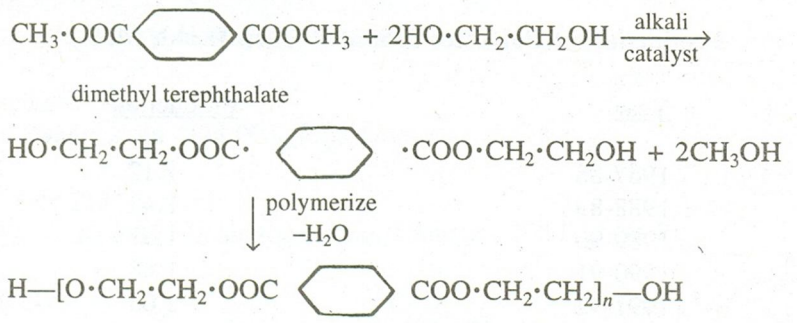
Subject & code:TOC (12127)

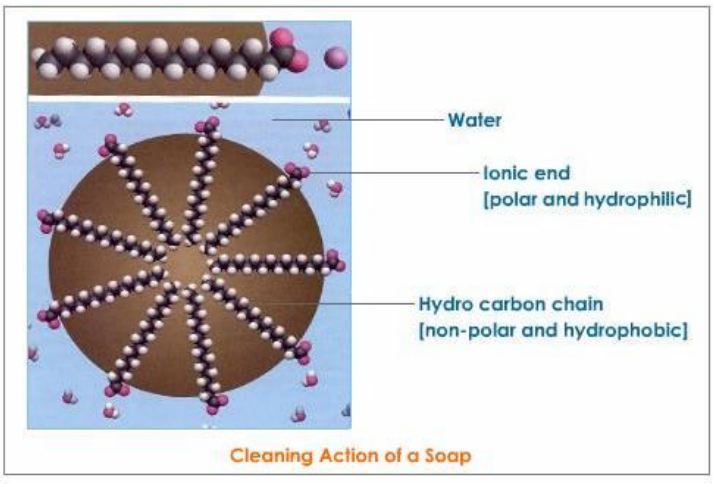
Important instructions to examiners :

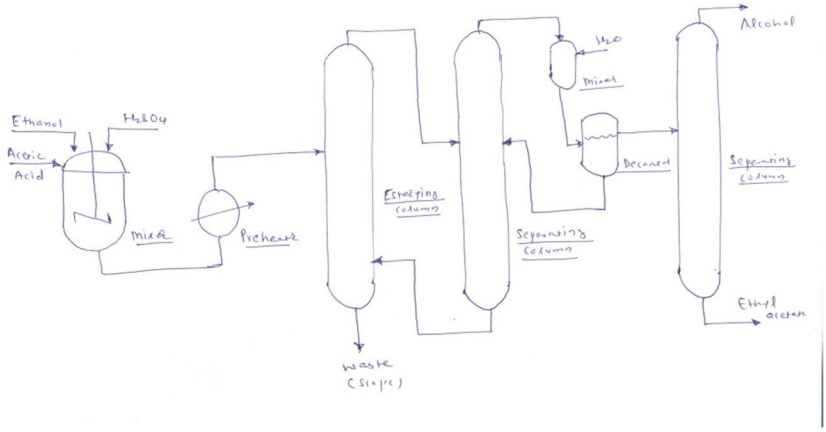
1. The answers should be examined by keywords and not as word to word as given in the model answer scheme.
2. The model answer and the answer written by candidate may vary, but the examiner may try to assess the understanding level of the candidate.
3. The language errors such as grammatical, spelling errors should not given more importance.
4. While assessing figures, examiner may give credit for principal components indicated in a figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5. Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answer and model answer.
6. In case of some questions credit may be given by judgment of relevant answer based on candidates understanding.

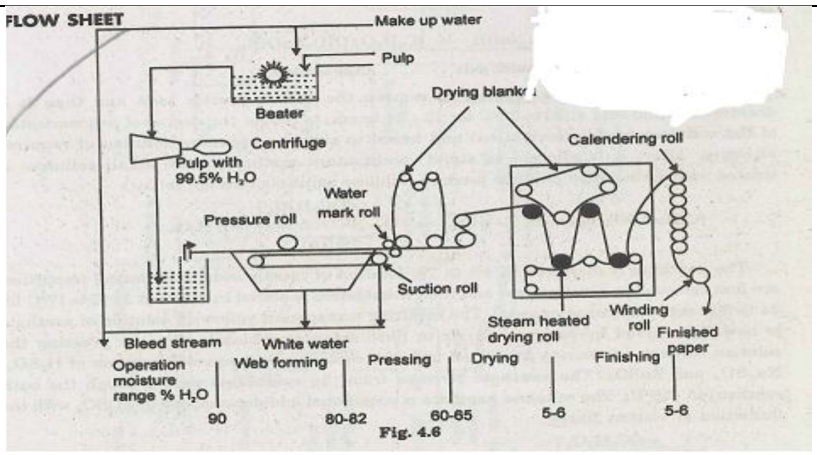
<table>
<tr><th>Q no:</th><th>Answer</th><th>mark</th><th>Total marks</th></tr>
<tr><td>1a. i</td><td>
<table>
<tr><th>S.No</th><th>Paint</th><th>Varnishes</th></tr>
<tr><td>1.</td><td>Paint is the mechanical dispersion mixture of one or more pigments in a vehicle.</td><td>Varnish is a homogenous colloidal dispersion solution of resin in oils or thinner or both.</td></tr>
<tr><td>2.</td><td>A paint contains pigment.</td><td>Varnish do not Contain Pigments.</td></tr>
<tr><td>3.</td><td>Paint Produce an opaque film.</td><td>Varnish produce transparent film.</td></tr>
<tr><td>4.</td><td>In paints pigments are dispersed in drying oils.</td><td>In varnishes resins are dispersed in oils or spirits.</td></tr>
</table>
</td><td>Any one difference</td><td>2</td></tr>
<tr><td>ii.</td><td>Pulp is a lignocellulosic fibrous material prepared by chemically or mechanically separating cellulose fibers from wood, fiber crops or</td><td>2</td><td>2</td></tr>
</table>

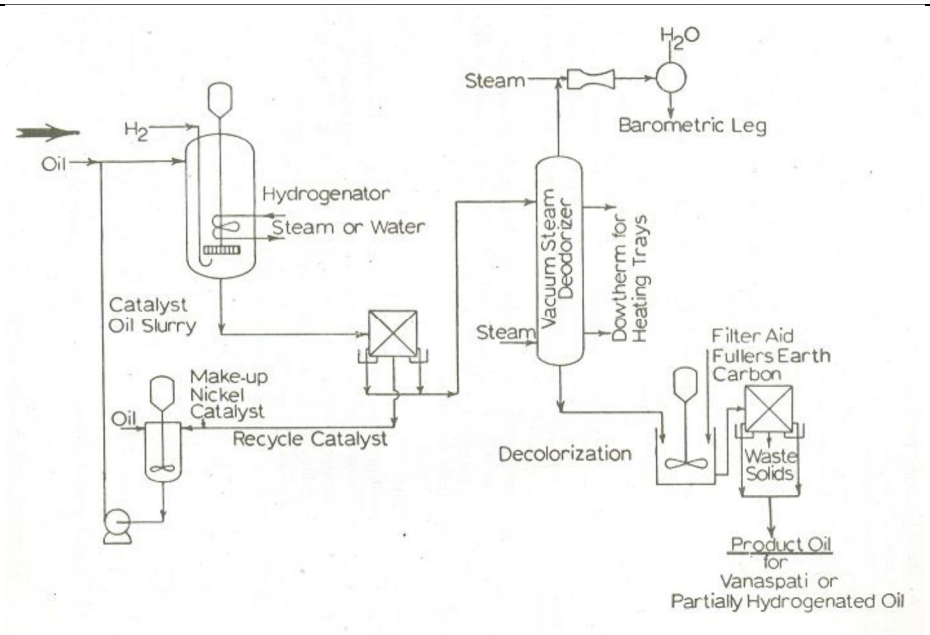
	waste paper.		
iii.	Addition polymerization and Chain polymerisation	1+1	2
iv	Pigment, Solvent, thinner, Film former, Plasticizer, Pigment extender, Antishrinking agent, Antifoaming agent	Any two	2
v	High Prssure process, Low pressure process and Ziegler process	Any two	2
vi	Soap is sodium or potassium salt of fatty acid. Raw material for soap is oil, caustic, perfume, fillers, brighteners	1+1	2
vii	Making clothes, fishing nets, filter cloth, conveyor belt, carpet , seatbelts	Any two	2
viii	Invertase and zymase	1+1	2
1 b i	**Lacquer** is a liquid covering consisting of a natural or synthetic derivative which is combined with a solvent that can be used to seal, cover or finish a surface. Once the solvent evaporates the lacquer forms a smooth clear (although coloring can be added) surface which is resistant to water and many liquids. **Constituents** Film forming agent- To form durable film Extender- to maintain viscosity Solvent- to dissolve film forming material and as carrier Plasticizer- To maintain plasticity of film Pgment- To give colour	2+2	4

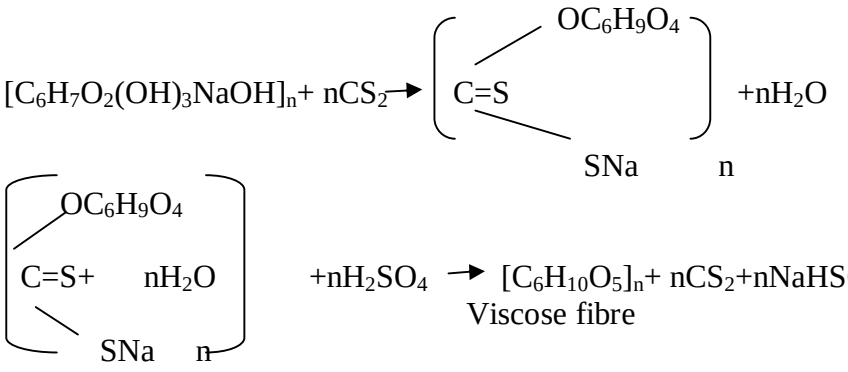
1.b.ii	 **Phenol by Cumene oxidation process**	4	4
1.b. iii	**Raw material for polyester** Dimethylterphthalate Ethylene glycol **Uses** Making clothes, fishing nets, filter cloth, conveyor belt, carpet , seatbelts **Reaction** 	1+1+2	4
2a	Quick vinegar method uses a generator, which is an upright tank filled with beechwood shavings and fitted with devices which allow the alcoholic solution to trickle down through the shavings in which the acetic acid bacteria are living. The tank is not allowed to fill as that	4	4

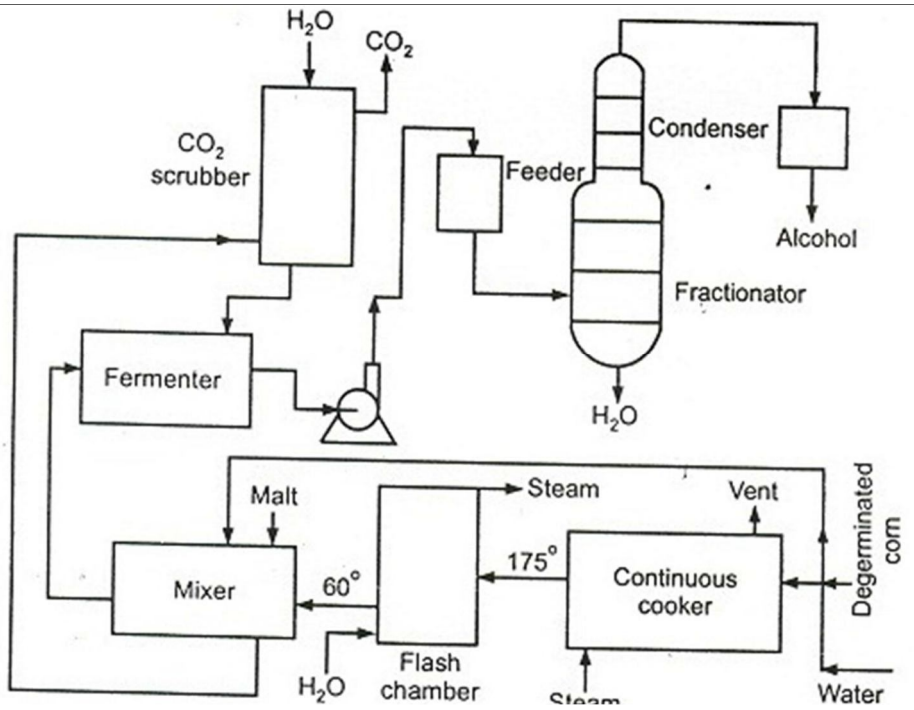
	would exclude oxygen which is necessary for the fermentation. Near the bottom of the generator are holes which allow air to be drawn in. the air rises through the generator and is used by the acetic acid bacteria to oxidise the alcohol. This oxidization also releases considerable amounts of heat which must be controlled to avoid causing damage to the bacteria.		
2.b	**Cleansing action of soap** Soap ions consist of two parts that is the head that consists of the anion region, ionic and also called the hydrophilic region which dissolves in water. Another part is the tail that consists of hydrocarbon region and its molecule has covalent characteristics. It's also called the hydrophobic region which dissolves in grease or oil(dirt) The soap molecules will dissolves in water and reduces the surface tension of water. Water wets the dirty surface. The hydrophilic region dissolves in water whereas the hydrophobic region dissolves in dirt such as grease. Grease is lifted off the surface of the material and suspended in water. The tail region emulsifies and breaks up the grease into small drops. When shaken, the water molecules will attract the soap ions and cause the grease to detach from the surface of the material. The soap bubbles help to float the grease emulsion in the water. When rinsed, the grease will be removed together with the water. 	4	4
2.c	Benzene direct oxidation	4	4

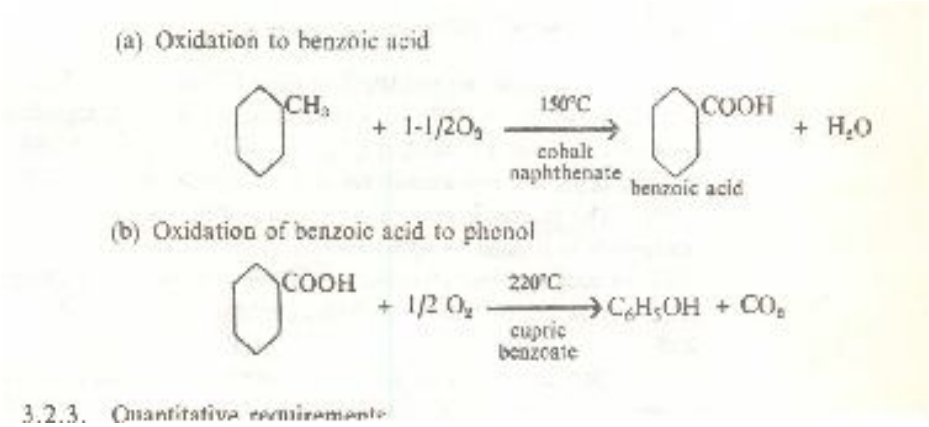
	Benzene sulfonate caustic fusion Chloro benzene caustic hydrolysis Rashig Toluene oxidation Cumene paraoxidation		
2.d	**Mechanical:** Debarked wood is defibered by mechanical grinders. Pulp is of poor quality **Semi chemical:** Mild chemical treatment is given. It is easy to separate cellulose from wood. **Chemical:** Cellulose from wood is derived by using digestion liquor. Hemicellulose and lignin is dissolved in liquor. Quality of pulp obtained is high. After digestion chemicals are recovered from digested liquor to avoid environment problem. Sulphate (Kraft) and sulphite are two chemical processes	1+1+2	4
2.e	**Ethyl acetate** 	4	4
2.f	**Solution polymerization is avoided due to:** • It reduces monomer concentration which results in decreasing the rate of the reaction and the degree of polymerization. • Solvent may cause chain reactions • Difficulty in separation of polymer and solvent Include cost of expensive separation	4	4
3.a	Manufacturing of paper by Foundriner process	4	4

	 Fig. 4.6		
3.b	Catalyst is used in Ziegler process is di-ethyl aluminium chloride and titanium tetrachloride. The product from reactor is taken in flash drum, here water is added to destroy residual catalyst. The bottom product from flash drum isaq. Slurry of polythene which is separated from aq. filterate.The overhead product of flash drum containing hydrocarbon solvent is trated in fractioner drier.	2 2	4
3.c	**Acid Value of oil**: - It is the number of milligrams of KOH required to neutralize the free acid present in one gram of oil. **Importance of acid value**:i)Acid value is the measure of free fatty acid presentin an oil and a fat. Low value indicates freshness of the oil or fat. ii) Acidity in animal or vegetable or vegetable oils increases by oxidation or by hydrolysis of the oil. It imparts bad odur to the oil. **Iodine Value**: - It is a number of milligrams of iodine absorbed by 100 grams of oil for complete saturation. **Importance of Iodine value**-: i) Iodine value is the measure of unsaturation of oil or fat. ii) It helps in classification of oils Thus, 1) An oil containing one double bond has iodine value < 90 ► Non – drying oil	1 1 1 1	4

	2) An oil containing two double bonds has iodine value <140► Semi-drying oil 3) An oil co containing three double bonds has iodine value >140 ➞ drying oil		
3.d	**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. oil	1 1 1 1	4
3.e		4	4

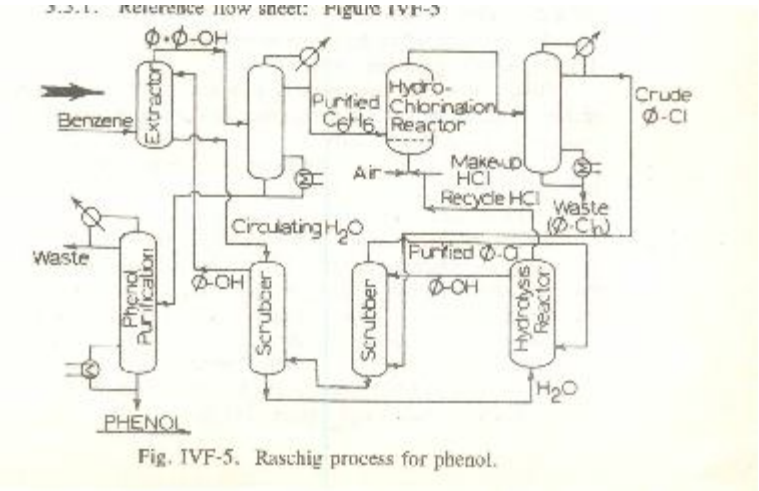
4.a	Chemical reaction-: $[C_6H_7O_2(OH)_3]_n + nNaOH \rightarrow [C_6H_7O_2(OH)_3NaOH]_n$ Cellulose alkali Alkali cellulose  	4	4
4.b	Manufacturing of oil -: **i) Solvent Extraction** Cakes obtained by pressing operations contain 5-10% oils can be recovered by heating the cake with volatile hydrocarbon like benzene , petroleum ether . The common solvent for edible oil is Hexane . The use of chlorinated solvents mainly to decrease the explosion and fire hazard did not prove much satisfactory. The solvent used should not make yhe oil toxic for the application. **ii) Refining**-:The colour and flavor to fats of edible non edible oils is mainly due to presence of non-glycerides compounds. Free fatty acids,waxes,coloured bodies,gossypol compounds are responsible for the undesired properties of fat or oils, used for edible purposes & industrial applications. Most of those compounds are removed by treatment with aq. Solution of caustic soda at 40-85 deg.C	2 2	4

4.c		4	4
4d	Paints are usually applied one coat on top of another and each coat has a specific function purpose. The primer is applied directly onto the cleaned steel surface. Its purpose is to wet the surface and to provide good adhesion for subsequently applied coats. In the case of primers for steel surfaces, these are also usually required to provide corrosion inhibition. The intermediate coats (or undercoats) are applied to 'build' the total film thickness of the system. Generally, the thicker the coating the longer the life. This may involve the application of several coats. The finishing coats provide the first line defence against the environment and also determine the final appearance in	4	4
4.e	Classification of plastics:- **i)Thermoplastics**-:The thermoplastics are those which when heated begin to soften at atemp. Of 60 deg.C then can be moulded without any	**2**	4

	change in chemical structure. e.g. Acrylics,cellulosics, fluorocarbons, polyethylene , nylon, polyvinyls **ii) Thermosetting plastics-:** The thermosetting . e.g. Alkydes , Epoxides Furah, Phenolics, Polysters	**2**	
4.f	**Detergent builders**-: Detergent builders are complex phosphates which increase detergent power. These are water softners which keep away Ca & Mg ions. They prevent redosition of soil from the wash water from the fabric. **Detergent brighteners**-: Brighteners are used to increase effectiveness of soaps & detergents. Fabric brighteners are fluroscent dyes which make the fabric look brighter because they have the ability to convert U. V. light. to visible light. **Detergent additives**-: Synthic detergents in granular form contains 2-9 % additives corrosion or tarnish inhibitors etc.corrosion inhibitors such sodium silicate protect metal &washer parts dishes from the action of detergent & water.	2 1 1	4
5.a	**Toluene Oxidation process for production of phenol** **Raw material** : (i) Toluene (ii) Air (iii) cobalt naphthenate and cupric benzoate catalyst **Reaction:**  **Process:-** Two stage oxidation process is used in the first fresh and	1 2 5	8

	recycle toluene are mixed with small amount of cobalt naphthenate catalyst and charged to reactor which liquid filled tower through air is spared. Cooling tubes are provided to remove the exothermic heat of reaction. The reactor is run at 150 0C and 3 atm. Excess air is used but toluene conversion is 40% this give by product. The yield of benzoic acid is about 90%. Off gases are vented and it is passes through condenser for collection of water and toluene. Liquid from reactor passes to a distillation column which strips the toluene and other by product at the bottom of column . Purified benzoic acid is separated by extracting the bottoms with hot water then crystallizing and filtering the crude benzoic acid. To make phenol the crude acid is melted mixed with cupric benzoate catalyst then charged to an air-sparged tower containing cooling tubes and mechanical agitation. Reactor condition are 220 0 C and 1.3-1.7 atms. Phenol product is obtained by continuously distilling the reactor liquor into a fractionating column where unreacted benzoic acid is returned to the reactor. Phenol is withdrawn as a bottoms product .		
5.b	**Production of Alcohol from Molasses:-** Raw material Molasses (Black strap) It is a mother liquor left after the removal of sugar crystals. By product of sugar industry. Contain about 55% sugar. Yeast commonly used for fermentation which produce large amount of alcohol. Following steps are carried out during process (i) Preparation of inoculum From selected strains o yeast the inoculum is prepared, in which starter containing yeast in its long phase. The yeast developed in the seed tank should be pure	2 6	8

	and free from contamination and mutation. (ii)Preparation of medium: The molasses is diluted with water to 10 to 18%.Can be used directly as fermentation medium. Nutrients such as ammonium sulphate or ammonium phosphate add to improve quality of fermentation. PH value adjusted to 4 to 5 by adding H_2SO_4. (iii) Fermentation: - Alcoholic fermentation is the anaerobic fermentation.so it is carried out in the absence of oxygen.CO_2 pushes air out and anaerobic fermentation starts The reaction is exothermic no temp. contral is required. Reaction is carried out for 50 hr at 30 to 40 0C in fermenter after mixing yeast starter and medium. (iv) $C_{12}H_{22}O_{16}$ $C_6H_{22}O_6$ +$C_6H_{12}O_6$ sucrose Glucose Fructose $C_6H_{12}O_6$ $2C_2H_5OH+2CO_2$ Glucose Ethanol (v) Recovery:- The fermented mesh is distilled to obtained pure ethyl alcohol. It contain 60% alcohol after distillation get 95% alcohol. To prepared absolute ethanol the 5% water is removed. (vi) By products:- n-amyl alcohol and isoamyl alcohol is obtained during distillation.CO_2 is obtained and is converted as a dry ice.		
5.c	**Uses** (i)For inner packaging like television,computer, washing machine (ii)For decorations (iii) In school and colleges for mounting drawing and photographs in exhibitions (iv)For decorating stalls in fairs,showcases of shops etc. **Environment issue:-**	4 4	8

	Thermocol is a bio-nondegradable product and is one more enemy of environment.But after its use its thrown away in dust bin and then travel to dumping ground to remain buried in the heap of trash. As it is bio-nondegradable product it remain intact.		
6.a	**Rusching process** This process has two vapour phase catalytic stage. Purified benzene is fed to a heater reactor containing ferric chloride catalyst. chloranation with HCL-O2 at 2200C occurs with residence time to produce 10-20% conversion of benzene. Fractionation separates unreacted benzene from chlorobenzene and polychlorobenzene The crude chlorobenzene is scrubbed with phenol, water washed,and sent to second catalytic stage.Here it is hydrolysed.Phenol from the hydrolyzer it is washed with water then extracted by benzene,and finally purified by two stage distillation. **Neat diagram**  Fig. IVF-5. Raschig process for phenol. **Uses :-** (i) Plastic industries (ii)Chemical intermediates for herbicides, insecticides, pharmaceuticals and dyestuffs.(ii) Petroleum refining.	3 3 2	8

6.b	The solvent is separated from the product stream by heating, evaporation or fractionation, and residual traces amounts are subsequently removed from the raffinate by stream stripping Description	2 6	8
6.c	(i) PVC:- Used for manufacturing raincoats,hand bags,plastic dolls,curtain cloths and vinyl flooring.Good electric insulator. (ii) Polystyrene:-It is used for manful. of polystyrene in films and fomas. (iii) Polyethylene:-High pressure polyethylene is used for producing household utensils,bowls and bckets and also packing film.Low pressure polyethylene is used for beer crates. (iv) Polesters:- In textile manfu Can be bland with cotton and wool called as teryool for fishing nets,filter cloths,conveyor belts etc. (v) Thermocol:-(i)For inner packaging like television,computer, washing machine(ii)For decorations	1.5 mark each	8