



Winter-15 EXAMINATION
Model Answer

Important Instructions to examiners:

- 1) The answers should be examined by key words 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 be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the 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 answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based one equivalent concept.

**Winter-15 EXAMINATION**
Model Answer

Subject code :(17427)

Page 2 of 24

Q No.	Answer	Marks	Total marks										
1	Attempt any six		12										
A i)	Absolute alcohol: It is ethanol containing water less than one percent by weight. Denaturated alcohol: is ethanol that has additives (like methanol) to make it poisonous, extremely bad tasting, foul smelling or nauseating, to discourage recreational consumption.	1 1	2										
ii)	Difference between paint and varnish <table border="1"><thead><tr><th>Paint</th><th>Varnish</th></tr></thead><tbody><tr><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>A paint contains pigment.</td><td>Varnishes do not Contain Pigments.</td></tr><tr><td>Paint Produce an opaque film.</td><td>Varnish produces transparent film.</td></tr><tr><td>In paints pigments are dispersed in drying oils.</td><td>In varnishes resins are dispersed in oils or spirits.</td></tr></tbody></table>	Paint	Varnish	Paint is the mechanical dispersion mixture of one or more pigments in a vehicle.	Varnish is a homogenous colloidal dispersion solution of resin in oils or thinner or both.	A paint contains pigment.	Varnishes do not Contain Pigments.	Paint Produce an opaque film.	Varnish produces transparent film.	In paints pigments are dispersed in drying oils.	In varnishes resins are dispersed in oils or spirits.	1 mark each for any two	2
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iii)	Uses of Rayon Tire chord Artificial hair Bottle plugs Fibers Cellophane	1 mark each for any 2	2										

**Winter-15 EXAMINATION**
Model Answer

Subject code :(17427)

Page 3 of 24

iv)	Limitations of soap action <ul style="list-style-type: none">• Soap cannot be used in hard water.• Ordinary soaps are not suited for fabrics such as silks, wool etc. The alkalis in them injure the fiber.• If the water is slightly acidic in nature soaps cannot be used for cleaning purpose. The acid media change soaps into carboxylic acid and the action of soap becomes ineffective.	1 mark each for any 2	2
v)	Phenol from toluene (a) Oxidation to benzoic acid : (b) Oxidation of benzoic acid to phenol : 	1+1	2
vi)	Name of pigments White : Titanium oxide , zinc oxide Red : Cadmium red(Cadmium selenide), Burnt Sienna	½ mark each	2
vii)	Uses of Polystyrene disposable plastic cutlery and dinnerware, CD "jewel" cases, smoke detector housings, license plate frames, plastic model assembly kits	1 mark each for any 2	2
viii)	Uses of ethyle acetate	1 mark	



Winter-15 EXAMINATION

Model Answer

Subject code :(17427)

Page 4 of 24

	<ul style="list-style-type: none">• As a solvent.• In paint as a hardener• In perfumes• An effective asphyxiant for use in insect collecting and study.	each for any 2	
1b	Attempt any two		8
1 B i)	Phenol from chlorobenzene-Caustic process Dry benzene and catalyst of iron turning are charged continuously into a chlorinator. The partially chlorinated mixture boils up into a fractionating column. Benzene is fractionated from the top and returns as cycle recycle while mono chloro benzene is withdrawn near the bottom plate of the column. Chlorobenzene and dilute caustic soda (10% solution) are mixed in a pump in a mole ratio of 1:1.25 . Diphenyl oxide is added to repress the formation of more diphenyl oxide and mixture is pumped through a preheater, then to multi tube reactor where causticisation occurs at 425oC and 350 atm. Residence time is around 15 minutes. Heat is removed from reactor reflux by exchange in the feed pre heater. The cooled hydrozylate is acidified in neutralizer to liberate phenol and sodium chloride which must be separated by distillation.	4	4
ii)	Hydrogenation of Oil The dry pure oil and nickel catalyst is taken in an iron cylinder. The cylinder has two inlets & outlets. One inlet is used for the introduction of oil & the other to introduce dry hydrogen. Unused hydrogen is removed through the upper outlet, while lower outlet is used to take the hydrogenated oil. The cylinder is provided with stirrer inside it. The temp. is regulated between 140 ⁰ C-180 ⁰ C. From the second inlet ,pure hydrogen gas are well mixed with the oil. In the cylinder oil, &dry hydrogen gas are well mixed with mechanical stirrer.	4	4



Winter-15 EXAMINATION
Model Answer

	<p>After certain time a sample of hydrogenated oil is taken through outlet is situated at the bottom of the cylinder. The iodine value of the hydrogenated oil is determined. If it is 60 ,the process of hydrogenation is stopped. And all the hydrogenated oil is taken out It is passed through cooler then filter pressed to remove nickel particles.</p>														
iii)	<p>Difference between sulphate</p> <table border="1"> <thead> <tr> <th>Sulphate Process</th> <th>Sulphite Process</th> </tr> </thead> <tbody> <tr> <td>This process is alkaline in nature due to use of caustic and sodium carbonate</td> <td>This process is acidic in nature due presence of sulfur dioxide.</td> </tr> <tr> <td>Cooking chemicals are recovered from black liquor</td> <td>Sulfur dioxide is recovered.</td> </tr> <tr> <td>Pulp produced by the kraft process is stronger than that made by other pulping processes</td> <td>Acidic sulfite processes degrade cellulose more than the kraft process, which leads to weaker fibers.</td> </tr> <tr> <td>Fiber yield is less.</td> <td>Fiber yield is more.</td> </tr> <tr> <td>Comparatively difficult to bleach the pulp.</td> <td>Can be bleached easily.</td> </tr> </tbody> </table>	Sulphate Process	Sulphite Process	This process is alkaline in nature due to use of caustic and sodium carbonate	This process is acidic in nature due presence of sulfur dioxide.	Cooking chemicals are recovered from black liquor	Sulfur dioxide is recovered.	Pulp produced by the kraft process is stronger than that made by other pulping processes	Acidic sulfite processes degrade cellulose more than the kraft process, which leads to weaker fibers.	Fiber yield is less.	Fiber yield is more.	Comparatively difficult to bleach the pulp.	Can be bleached easily.	1 mark for each point in both processes. (any four)	4
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2	Attempt any four		16												
2 a)	<p>Manufacturing process of acetic acid from acetaldehyde</p> <p>The continuous oxidation of CH_3CHO in liq. phase is carried out by using air or O_2 in presence of manganous acetate. The reaction mix cantaining CH_3CHO diluted with crude acid & manganous acetate solution is circulated upward through oxidation tower. Reaction condition when air is used 55°C-65°C & 5 atm. Press and when O_2 used then temp 700c-800c and press</p>	4	4												

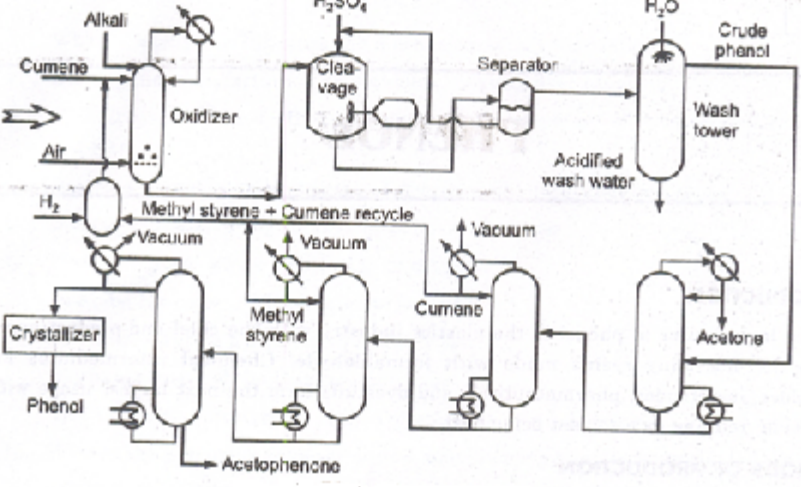
**Winter-15 EXAMINATION**
Model Answer

	sufficient to keep the acetaldehyde in liq.state. The reaction mix is drawn off from top of oxidation tower and distilled continuously in three distillation columns. The crude acetic acid is fed to the top of distillation column and other volatile components are withdrawn as overhead and residue containing manganous acetate is removed at the bottom.		
b)	Saponification value It is the no. of milligrams of KOH required to saponify one gram of an oil or fat. <i>Use</i> i) Whether an oil or fat contains lower or higher proportion of the same fatty acid. ii) The proportion of lower fatty acid or higher fatty acid in oil or fat. iii) From the saponification value, we know whether oil is animal, vegetable or mineral iv) The saponification value gives the estimation of non fatty impurities. Acid Value Acid value is the mass of potassium hydroxide (KOH) in milligrams that is required to neutralize one gram of chemical substance. <i>Use</i> It indicates the quality of oil. It is important to know while storing oil in metal tanks. It is important to know while using in engines to avoid corrosion problem.	1 1 1 1	4
c)	Phenol from Cumene	4	4

**Winter-15 EXAMINATION**
Model Answer

Subject code :(17427)

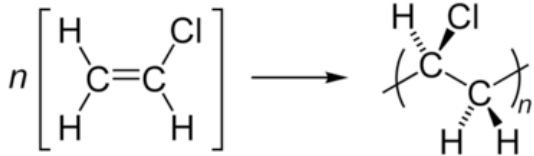
Page 7 of 24

			
d)	<p>Properties of ethyl acetate</p> <p>Molecular wt : 88</p> <p>Colorless liquid</p> <p>Fruity odor</p> <p>MP : -83.6 °C</p> <p>BP : 77.1 °C</p> <p>Miscible in ethanol and acetone</p> <p>Properties of butanol</p> <p>Molecular wt : 74</p> <p>Colorless refractive liquid</p> <p>Banana like odor</p> <p>MP : -89.8 °C</p> <p>BP : 117.7 °C</p> <p>Very soluble in acetone</p>	½ mark each for four	4
e)	Polyvinyl chloride	1	4

**Winter-15 EXAMINATION**
Model Answer

Subject code :(17427)

Page 8 of 24

	<p>Reaction</p> $\text{C}_2\text{H}_2 + \text{HCl} \rightarrow \text{CH}_2=\text{CHCl}$ <p>OR</p> $\text{CH}_2=\text{CH}_2 + \text{Cl}_2 \rightarrow \text{CH}_2\text{ClCH}_2\text{Cl}$ $\text{CH}_2\text{ClCH}_2\text{Cl} \rightarrow \text{CH}_2=\text{CHCl} + \text{HCl}$ <p>Vinyl chloride monomer can be polymerized to produce PVC</p>  <p>Raw Material</p> <p>Vinyl chloride monomer (ethylene + chlorine)</p> <p>In emulsion polymerisation, a typical formulation is 100 parts of water, 100 parts of vinyl monomer, 1 part of catalyst persulfate and 1.5 parts of detergent emulsifier. This is fed to a pressure reactor, either cont. or batch operating at 50 deg. C for periods as long as 72 hrs. The micellular polymer particles can be further stabilised by addition of more emulsifying agent and solid as vinyl latex. For solid polymer, mixture acid coagulated and dried or spray dried directly.</p>	1 1 1	
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**Winter-15 EXAMINATION**
Model Answer

Subject code :(17427)

Page 9 of 24

	<p>(block diagram drawn by student should be given marks)</p>		
f)	Manufacturing of detergents. Molten sodium is added slowly to coconut oil in an aliphatic solvent plus esterifying alcohol such as amyl alcohol. After certain time reaction is completed. The batch is pumped into a water tank where mixture settles into three layers, the top is the high molecular weight alcohols, the intermediate layer contains regenerated reducing alcohol, and the bottoms have caustic soda and glycerin for recovery. Lauryl alcohol is reacted with sulfuric acid to get sulfated fatty alcohol. It is one type of synthetic detergent.	4	4
3	Attempt any four		16
3 a)	Viscous Rayon	4	4



Winter-15 EXAMINATION
Model Answer

<p>b)</p>	<p>Uses of ethyl alcohol</p> <p>Following are the uses of ethyl alcohol</p> <ol style="list-style-type: none"> i) In manufacturing of alcoholic beverages, ii) As a solvent for paints and varnishes, iii) in drug preparation, iv) In manufacture of chloroform, acetaldehyde, chloral, ether, etc. and synthetic rubber v) As anti freeze in automobile radiators 	<p>1 mark each for any four</p> <p>4</p>
<p>c)</p>	<p>Cleansing action of soap</p> <p>The dirt on skin or cloth sticks due to greasy matter. When rubbed with soap solution, it is easily washed away.</p> <p>Soap molecule has a polar end ($-\text{COO}-\text{Na}^+$) and a non polar end (a long carbon chain of 12 to 18 carbons). The polar end is water soluble while the non polar end is oil soluble.</p> <p>Normally oil droplets in contact with water tend to coalesce to form oil layer</p>	<p>4</p> <p>4</p>

**Winter-15 EXAMINATION**
Model Answer

Subject code :(17427)

Page 11 of 24

	<p>and aqueous layer.</p> <p>The non polar ends of soap molecules dissolve in the oil droplet leaving the carboxyl ate ends projecting into the surrounding water.</p> <p>Due to the presence of negatively charged carboxylic groups, each of the oil droplets surrounded by an ionic atmosphere. Oil droplets do not coalesce due to the repulsion between similar charges thus stable emulsion of oil in water is formed. In this way soap cleans by emulsifying the fat or grease containing dirt.</p>		
d)	<p>manufacturing process of polyester from DMT</p> <p>Raw Materials: DMT, Ethylene glycol.</p> <p>Chemical Reactions:</p> $\text{CH}_3\text{COO} \begin{array}{c} \diagup \\ \text{C}_6\text{H}_{10} \\ \diagdown \end{array} \text{COOCH}_3 + 2\text{HO}\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{OH} \xrightarrow{\text{Catalyst}}$ <p style="text-align: center;">DMT</p> $\text{HO}\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{OOC} \begin{array}{c} \diagup \\ \text{C}_6\text{H}_{10} \\ \diagdown \end{array} \text{COOCH}_2\text{CH}_2\text{OH} \xrightarrow{\text{Polymer}} \text{H}[\text{O}\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{OOC} \begin{array}{c} \diagup \\ \text{C}_6\text{H}_{10} \\ \diagdown \end{array} \text{COOCH}_2\text{CH}_2]_n\text{-OH} + 2\text{CH}_3\text{OH}$ <p style="text-align: center;">Polyester</p>	2	4

**Winter-15 EXAMINATION****Model Answer**

Subject code :(17427)

Page 12 of 24

	<p>Process Description:</p> <p>In production of polyester one mole of DMT and two moles of ethylene glycol in presence of catalyst like litharge or zinc, calcium, magnesium salt or alkali salt are taken and fed to trans-esterification reactor. The catalyst concentration may vary from 0.005 to 0.1 %. The reaction starts at 150 deg C to 160 deg C and methyl alcohol is distilled out until the reaction is complete. At the end of reaction the temperature will raise up to 230 deg C. the reaction product is mixture of glycol terephthalate and low polymer.</p> <p>In second stage the temperature is raised further and reaction takes place between hydroxyl end group to produce polymer and glycol vacuum applied slowly and temperature raised to remove glycol. Then the polymer is converted to fiber by spinnerate and is converted to finished roll by bobbin and winder.</p>	2	
e)	<p>Butanol from propylene.</p> <p>Raw materials Propylene , Hydrogen, Synthesis gas</p> <p>Reaction</p> $\text{C}_3\text{H}_6 + \text{CO} + \text{H}_2 \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{CHO} \xrightarrow{\text{H}_2} \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ <p>Process description:</p> <p>Propylene is compressed at 150 atm and cobalt naphthanate added to give 0.5 to 1 % Co in sol.</p> <p>This stream is passed concurrently with Co+H₂ stream through a packed bed</p>	1 3	4

**Winter-15 EXAMINATION**
Model Answer

	<p>tower</p> <p>The tower contains a porous carrier with 2 % metallic cobalt deposited</p> <p>The reaction is highly exothermic and temperature of 170 degC is controlled by recycle of a portion of prod stream after cooling</p> <p>The product liquid fraction is mixed with steam at 180 degC and a relatively low pressure of 20 atm. To decompose cobalt carbonyl and naphthanate depositing cobalt on porous carrier as oxides</p> <p>This cobalt is dissolved periodically in an acid wash and converted in naphthanate for reuse Crude butaraldehyde from demerisation reactor is continuously hydrogenated using a fixed bed nickel catalyst at 100 atm and 150 degC</p> <p>The resulting butanol are fed to a distillation column comprising of several fractionating column in series</p> <p>Light and heavy ends are obtained in addition to the product alcohol.</p>		
f)	<p>Uses of phenol.</p> <p>1. The major uses of phenol involve its conversion to precursors to plastics. Condensation with acetone gives bisphenol-A, Condensation of phenol, alkylphenols, or diphenols with formaldehyde gives phenolic resins, a famous example of which is Bakelite. Partial hydrogenation of phenol gives cyclohexanone, a precursor to nylon. Nonionic detergents are produced by alkylation of phenol to give the alkyl phenols , e.g., nonylphenol, which are then subjected to ethoxylation.</p> <p>2. Phenol is also a versatile precursor to a large collection of drugs, most notably aspirin</p>	1 mark each for any four	4



Winter-15 EXAMINATION

Model Answer

Subject code :(17427)

Page 15 of 24

	<p>cooker may be batch or continuous and are operated under pressure. In continuous process grain is precooked for 1 to 5 min with water. The mass is continuously fed to steam heater that instantaneously raises temperature to 175deg C. The mass is passed through series of pipes and discharged through a relief valve into flash chamber. Time in cooker is about 1.5 min and pressure is maintained at 60 to 100 gauge. The temperature of mass drops to about 60 deg C in flash chamber. The coked grain mass is missed with malted barley and water and this is send to fermentator. The gases during fermentation are scrubbed by using water and send to series of rectification column and the condensation product is nothing but alcohol.</p>														
b)	<p>Constituents of lacquers. Also give their functions .</p> <table border="1"><thead><tr><th>Constituent</th><th>Function</th></tr></thead><tbody><tr><td>1. Film forming material</td><td>Durability, Hardness, adhering capacity, water resistance</td></tr><tr><td>2. Extenders</td><td>To reduce cost and viscosity</td></tr><tr><td>3. Solvents</td><td>To suspend pigment and to dissolve film forming material.</td></tr><tr><td>4. Plasticizer</td><td>To reduce brittleness and to improve adherence</td></tr><tr><td>5. Pigments</td><td>To give aesthetic- appearance to reflect light etc</td></tr></tbody></table>	Constituent	Function	1. Film forming material	Durability, Hardness, adhering capacity, water resistance	2. Extenders	To reduce cost and viscosity	3. Solvents	To suspend pigment and to dissolve film forming material.	4. Plasticizer	To reduce brittleness and to improve adherence	5. Pigments	To give aesthetic- appearance to reflect light etc	1 mark each for any four	4
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c)	<p>Comparison between soap and detergents. (any four)</p> <table border="1"><thead><tr><th>Soaps</th><th>Detergents</th></tr></thead><tbody><tr><td>1. Are sodium salts of long chain carboxylic</td><td>Are sodium salts of long chain benzene sulphonic acids or alkyl</td></tr></tbody></table>	Soaps	Detergents	1. Are sodium salts of long chain carboxylic	Are sodium salts of long chain benzene sulphonic acids or alkyl	1 mark each for any four	4								
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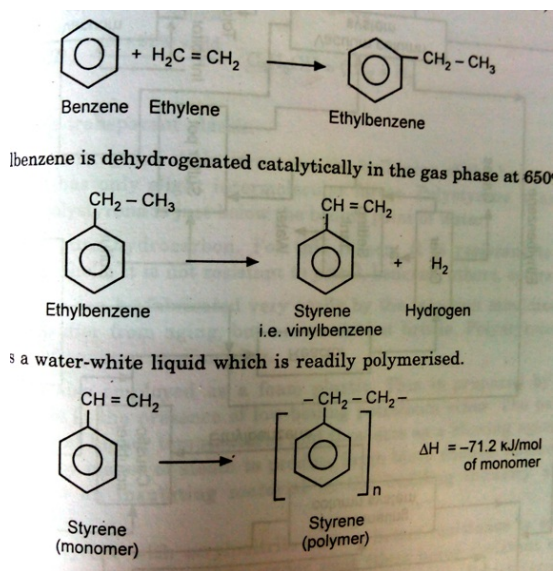
Winter-15 EXAMINATION
Model Answer

	<p>Low pressure Process</p> <p>1. Process is carried out at 400 to 500 psi</p> <p>2. Highly pure ethylene is required</p> <p>3. Produces high density (HDPE) and linear low density (LLDPE) polyethylenes.</p> <p>4. Polymer is having short chain branching</p> <p>5. Polymer produces is found to be much stiffer</p> <p>6. Process is more safer</p>	<p>High pressure process</p> <p>Process is carried out at 15000 to 30000psi</p> <p>Highly pure ethylene is not required</p> <p>produces conventional low density polyethylene (LDPE)</p> <p>Polymer is having long chain branching</p> <p>Polymer produces is found to be less stiffer</p> <p>Process is less safe</p>	for any four	
f)	<p>Define following terms</p> <p>i) Chalking Chalking is the progressive powdering of the paint from the surface inward that is caused by continuous and destructive oxidation of the oil after the original drying of the paint.</p> <p>ii) Flaking: It is the peeling of paint film due to poor attachment of the paint to the surface being covered caused due to dirt or grease on the surface or due to water entering from behind the paint.</p> <p>iii) Alligotoring: A pattern of cracking of paint on a surface leaving roughly hexagonal areas of uncracked paint.</p>		1 mark each	4

Winter-15 EXAMINATION
Model Answer

Subject code :(17427)

Page 18 of 24

	OR Alligatoring is a form of peeling in which the centre portion of the section remains attached to the surface. iv)Checking: It is the very fine type of cracking of painted surface		
5	Attempt any two		16
5 a)	<p>Benzene is alkylated with ethylene in the presence of aluminum chloride. Dry benzene and ethylene are continuously fed to an alkylating tower operating at atm pressure. Small amount of ethylene chloride is added as a catalyst promoter .Granulated AlCl_3 is used as a catalyst. The crude ethyl benzene from settling tank is washed with 50% caustic solution to neutralize it.</p> <p>Purified ethyl benzene is heated with steam Sulfur is continuously mixed in the reactor. Crude styrene stream contains 37% styrene and 61% ethyl benzene. Styrene is obtained by titillating this stream.</p>  <p>The diagram illustrates three chemical processes:</p> <ul style="list-style-type: none">Alkylation: Benzene (a benzene ring) reacts with ethylene ($\text{H}_2\text{C}=\text{CH}_2$) to form ethylbenzene (a benzene ring with a CH_2CH_3 group attached).Dehydrogenation: Ethylbenzene is dehydrogenated catalytically in the gas phase at 650°C to produce styrene (vinylbenzene, a benzene ring with a $\text{CH}=\text{CH}_2$ group) and hydrogen (H_2).Polymerization: Styrene (monomer) is polymerized to form polystyrene (polymer), represented as a chain of repeating units $[\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2]_n$. The enthalpy change for this reaction is $\Delta H = -71.2 \text{ kJ/mol}$ of monomer.	2	8

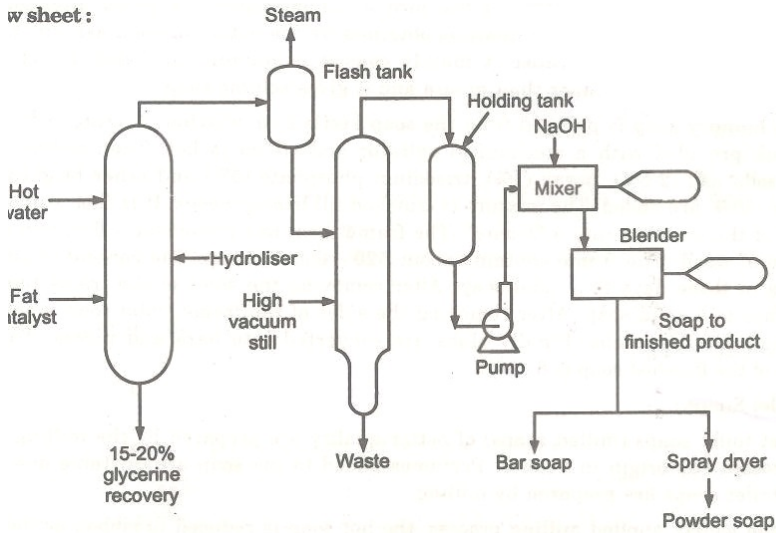
Winter-15 EXAMINATION
Model Answer

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<p>b)</p>	<p>Soap Manufacturing</p> <p>Chemical Reaction :-</p> <p>a) Fat splitting:-</p> $(R.COO)_3.C_3H_5 + 3H_2O \rightarrow 3R.CO.OH + C_3H_5(OH)_3$ <p>b) Saponification:-</p> $R.CO.OH + M.OH \rightarrow R.CO.O.M + H_2O$ <p>Where M is usually an alkali metal such as Na or K</p> <p>Process</p> <p>Glycerides plus catalyst are added at the bottom of the hydrolysis tower where high pressure water at 230-250°C is passed countercurrently to the glycerides. And triglycerides are broken into fatty acid and glycerine with a 15-20% glycerine solution being removed from bottom of the tower. The fatty acid are passed overhead to a flash tank to remove excess steam. The crude fatty acid are vacuum distilled and the condensate in the distillate receiver is either available as a marketable product or for soap mfg.</p>	2	8

**Winter-15 EXAMINATION**
Model Answer

Subject code :(17427)

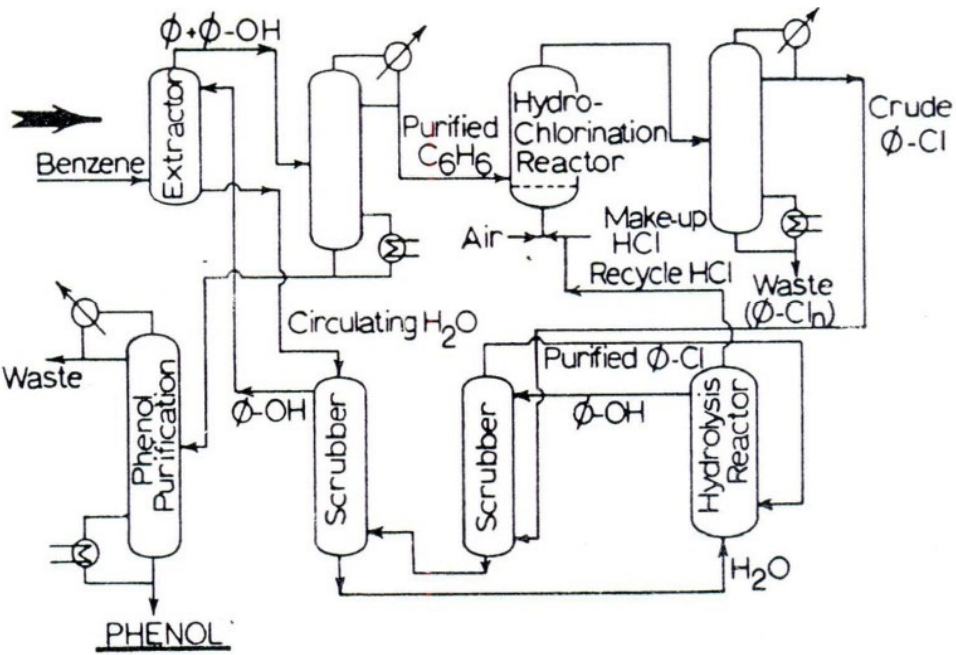
Page 20 of 24

	<p>Caustic soda is added to fatty acid in a continuous high speed mixture and the saponification is completed in a slow speed blender where other ingredients are added if desired. Soap from the blender may be pumped through heated lines to bar soap or flake or spray drying equipments followed by packing operations.</p> <p>Worksheet :</p> 	3	
c)	<p>Manufacturing of Phenol by Raschig process</p> <p>Chemical reactions</p> <p>(a) Hydrochlorination</p> $\text{C}_6\text{H}_6 + \text{HCl} + \frac{1}{2}\text{O}_2 \xrightarrow[240^\circ\text{C}]{\text{FeCl}_3 + \text{CuCl}_2} \text{C}_6\text{H}_5\text{Cl} + \text{H}_2\text{O}$ <p>(b) Hydrolysis</p> $\text{C}_6\text{H}_5\text{Cl} + \text{H}_2\text{O} \xrightarrow[350^\circ\text{C}]{\text{SiO}_2 \text{ catalyst}} \text{C}_6\text{H}_5\text{OH} + \text{HCl (recycle)}$ <p>Process description: the Raschig process has two vapour-phase catalyst stages.</p>	2	8



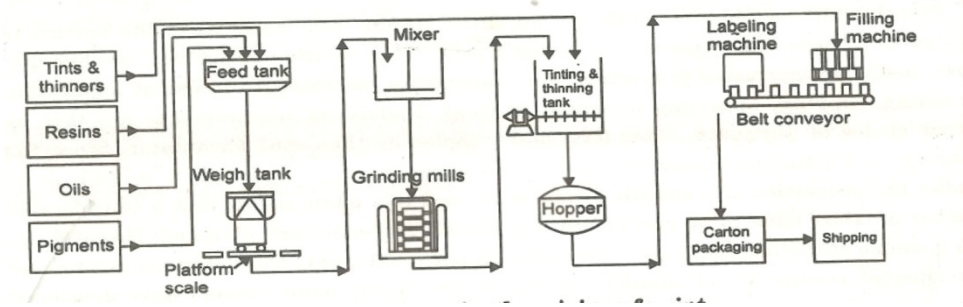
Winter-15 EXAMINATION

Model Answer

	<p>Purified benzene is fed to a heater, packed reactor containing ferric chloride & cupric chloride catalyst. Chlorination with HCl-O_2 at 220°C occurs with a short residence time to produce 10-20% conversion of benzene. Fractionation separates unreacted benzene from chlorobenzene & polychlorobenzene.</p> <p>The crude chlorobenzene is scrubbed with phenol, water washed & sent to the second catalytic stage. Here it is hydrolyzed in a tubular high temp furnace with either SiO_2 or $\text{Ca}_3(\text{PO}_4)_2$ as the catalyst. Phenol from the hydrolyzer is washed with water, then extracted by benzene & finally purified by two stage distillation. HCl vapours from the high temp catalytic hydrolyzer is recycled to the hydrochlorination stage</p> 	<p>2</p> <p>4</p>	
<p>6</p>	<p>Attempt any two</p>		<p>16</p>
<p>6 a)</p>	<p>Raw material of paint Pigments: - It is finely divided solids generally made up metal oxides .It is</p>	<p>2</p>	<p>8</p>



Winter-15 EXAMINATION
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	<p>used to give colour to paint.</p> <p>Drying oil: - These are unsaturated oils. It is used to form protective film and give gloss.</p> <p>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.</p> <p>Plasticizer: - These are polymers. Used to impart elasticity to paint.</p> <p>The weighing assembling, and mixing of the pigments and vehicles takes place on the top floor. The mixer may be similar to large dough kneader with sigma blades. The batch masses are conveyed to the floor below, where grinding & further mixing takes place. A variety of grinding mills are used.</p> <p>After mixing, the paint is transferred to the next to the next lower floor, where it is thinned & tinted in agitated tanks, which may hold batches of several thousand litres. The liquid paint is strained into a transfer tank or directly into the hopper of the filling machine on the floor below, centrifuges ,screens or press. Filters are used remove non dispersed pigments. The paint is poured into cans or drums, labelled,packed & moved to storage each step being completely automatic.</p> 	4	
b)	<p>Manufacturing of pulp from sulphite process</p> <p>In this process wood chips are charged into digester . The cooking liquor is</p>	2	8

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	<p>prepared by absorbing SO₂ into into tower packed by limestone to which water is fed from the top. The following reaction takes place.</p> $\text{SO}_2 + \text{H}_2\text{O} = \text{H}_2\text{SO}_3 + \text{Q}$ $2\text{H}_2\text{SO}_3 + \text{CaCO}_3 = \text{Ca}(\text{HSO}_3)_2 + \text{CO}_2 + \text{H}_2\text{O} + \text{Q}$ <p>The aqueous solution of calcium bisulphate is the saturated with sulfur trioxide. The acid liqueur contain bisulphate and H₂SO₃. The wood cooking removes maximum amount of hemicelluloses and lignin and keep cellulose intact.</p> <p>After cooking pressure in the digester is reduced. SO₂ escaped is recovered and reused. The contents in digester are washed and unreacted material is separated from pulp.</p>	4 2	
c)	<p>Polyethylene by 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</p>	4	8



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Model Answer

	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.	4	
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