FS(R)-15

April-2007

Industrial Chemistry

(Vocational)

Paper – II

Time : 3 Hours] **[Max. Marks : 70**

Instruction : **All** questions carry equal marks.

[At. Wt:– H $\rightarrow$ 1, C $\rightarrow$ 12, N $\rightarrow$ 14, O $\rightarrow$ 16, Na $\rightarrow$ 23, P $\rightarrow$ 31, S $\rightarrow$ 32, cl $\rightarrow$ 35.5, K $\rightarrow$ 39]

1. (a) Define : Molality, Equivalent weight, Work.

 (b) A solution of caustic soda in water contains 20% NaOH by weight at 60 °C. The density of the solution is 1.196 kg/lit. Find the molarity, normality and molality of the solution.

 (c) Explain : (1) Average Molecular weight and (2) Density of Gas Mixture.

OR

 (a) Define : Weight fraction, Pressure, Force.

 (b) Ethanol and water forms an azeotrope containing 96% ethanol by weight. Find the composition of azeotrope by mole percent.

 (c) In a textile mill a double effect evaporator system concentrates weak liquor containing 4% NaOH by weight to produce a lye containing 24% solid by weight. Calculate the evaporation of water per 100 kg feed in the evaporator.

2. (a) Define : Unit operation, process flow sheet, Tie material.

 (b) Soyabean seeds are extracted with hexane. The seeds contain 18.6% oil, 69.0% solid and 12.4% moisture. At the end of the process, cake(meal) is separated from hexane oil mixture. The cake contains 0.8% oil, 87.7% solids and 11.5% moisture. Find the percentage recovery of oil. All % are by weight.

 (c) Explain (1) Evaporation and (2) Filtration operation with block diagram used to solve material balance problems.

OR

 (a) Define : Stoichiometric coefficient, Excess reactant, % yield.

(b) Monchloroacetic Acid (MCA) is manufactured in a reactor by the action of glacial acetic acid with chlorine gas at 100 °C in the presence of PCl_3 catalyst. MCA thus formed will further react with chlorine to form Dichloroacetic Acid (DCA). To prevent the formation of DCA, excess acetic acid is used.

A small scale unit which produce 5000 kg/day MCA requires 4536 kg/day chlorine gas which also result in 263 kg/day formation of DCA. Find % yield, % conversion and selectivity of MCA production.

3. (a) Define : Purge ratio, Heat of combustion, Heat capacity.

(b) A stream of nitrogen flowing at a rate of 100 kg mole/hr is heated from 30 °C to 100 °C, Calculate the heat that must be transferred, if C_p^o for

Nitrogen $= 6.457 + 1.389 \times 10^{-3}\,T - 0.069 \times 10^{-6}\,T^2$.

(c) What is saturated and supersaturated solution ? Explain one crystallizer with diagram.

OR

(a) What is distillation ? Explain steam distillation.

(b) Define Adsorption. Explain fixed bed adsorption process for solvent recovery.

(c) What is Hard water ? Explain any one water softening process.

4. (a) Define : Calorific value. Explain Bomb Calorimeter.

(b) What is Fuel Oils ? Discuss any one boiler with diagram.

(c) Explain characteristics of a good fuel.

OR

(a) Write a note on applications of Evaporation in industry.

(b) What is Filtration ? Explain Nutsche filter.

(c) Write a note on : Spray dryer.

5. Answer any **three** of the following :

(a) Give a brief account on various raw material used for the manufacture of glass.

(b) Define Polymers. Give a brief account of polymer processing by Injection moulding machine.

(c) Write a note on vacuum pumps.

(d) Define extraction. Write a note on spray tower extraction with diagram.

(e) Write a note on Refrigeration.

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