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SARDAR PATEL UNIVERSITY
EXTERNAL EXAMINATION, NOVEMBER 2012
M.Sc. INDUSTRIAL CHEMISTRY-SEM 1
UNIT OPERATIONS 1- PS01CICH01

30th Nov,2012 **Max.Marks:70**
Time:10.30 a.m -1.30 p.m

Answer all the questions. **Figures to the right side indicate marks**

Q1. Write the number of the correct answer. (each question carries one mark) **(08)**

a According to Ficks law of diffusion
i. Mass Transfer Flux = Diffusivity/concentration gradient iii. None of these
ii. Diffusivity = Flux/ concentration gradient iv. Flux= concentration gradient / Diffusivity

b. Sides of the equilateral triangle in solubility curve represent
i. A pure component iii. A ternary mixture
ii. A binary mixture iv.A partially miscible ternary mixture

c. For separating a high boiling mixture where decomposition of material is to be avoided,we use
i. Simple distillation iii.Steam distillation
ii. Azeotropic distillation iv. Flash distillation

d. Weeping in a valve plate column is ------that in sieve plate column
i. Less than iii. More than
ii. Equal to iv. Double than

e. Overall efficiency in a distillation column is
i. ratio of no. of ideal plates to actual plates iii. ratio of no. of actual plates to ideal plates
ii. not dependent on the tray spacing iv. not dependent on reflux ratio

f. The transition from constant drying rate to falling drying rate is represented by
i. free moisture content iii.critical moisture content
ii. bound moisture content iv.unbound moisture content

g. In gas absorption,mass transfer takes place from----------
i. liquid phase to gas phase iii.gas phase to liquid phase
ii. gas phase to gas phase iv.none of the above

h. The power required to drive (P) a centrifugal pump depends on the rpm of the impeller(N) according to the relation

i. $P \propto N$ iii. $P \propto N^2$
ii. $P \propto N^3$ iv. $P \propto N^5$

Q2. Answer any seven (each question carries two marks) **(14)**

a. Define Selectivity & distribution co-efficient of solvent .
b. Why are density & boiling point of the solvent important considerations for the selection of solvent?
c. Define Relative volatility. What is its importance in distillation ?
d. Define entrainment in plate columns.
e. Distinguish between drying and evaporation.
f. Define dew point & bubble point
g. Distinguish between gas absorption & desorption .
h. Define friction factor.How do you calculate friction factor in laminar & turbulent ranges.
i. Define discharge & % slip of reciprocating pump.

Q3.

a. 100 kg/h of acetic acid -water solution with 30 % acetone is to be cross currently extracted with 40 kg of isopropyl ether solvent in each stage. Determine the number of stages required to reduce the acetic acid concentration to19 % in the final raffinate. **(06)**

Raffinate				Extract		
C%	A%	B%		C%	A%	B%
1.41	97.1	1.5		0.37	0.7	98.93
6.42	91.7	1.9		1.93	1.0	97.07
13.3	84.4	2.3		4.82	1.9	93.28
25.5	71.1	3.4		11.4	3.9	84.7
36.7	58.9	4.4		21.6	6.9	71.5
46.4	37.1	16.5		36.2	15.1	48.7

b. With the help of block diagrams, differentiate between multistage cross current & counter current extraction . **(06)**

OR

b.Enlist the steps involved in calculation of theoretical stages in counter current extraction**(06)**

Q4.

a. Explain simple(differential) distillation with an example. State Rayleighs equation for simple distillation. **(06)**

b. Explain the various parts of a fractionator and their functions. **(06)**

OR

b. Explain the various steps involved in calculating the theoretical number of stages using Ponchon-Savarit method. **(06)**

Q5.

a. Define equilibrium moisture ,free moisture, critical moisture content, Absolute humidity ,relative humidity and rate of drying . (06)

b. Define hold up in driers. What are the variables affecting hold up in a rotary drier?(06)

OR

b.

i. Distinguish between pressure filters and vacuum filters (03)

ii. Discuss the criteria for selecting solvent in gas absorption. (03)

Q6.

a. A centrifugal pump was built to supply water against a head of 22.5 m.If it is required to supply water against a head of 20 m,find the necessary reduction in the original impeller diameter of 0.3 m without reducing the speed of the impeller. (06)

b. A reciprocating pump has a piston of 0.3 m dia and stroke 0.2 m. If the r.p.m of the pump is 30 and if it delivers 0.0065 m^3/sec of water,find the co-efficient of discharge and % slip of pump.(06)

OR

b. Discuss Prandtls boundary layer concept. (06)

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