Chemical S5 2015

TED (15) **5071**
(Revision -2015)

Reg. No.....
Signature .....

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, APRIL – 2019

MASS TRANSFER OPERATIONS-I

[Maximum Marks: 100] [Time: 3 Hours]

PART-A

[Maximum Marks: 10]

(Answer ***all*** questions in one or two sentences. Each question carries 2 marks)

I. 1. Define molecular diffusion.

2. Define humidity.

3. Define critical moisture content.

4. Define relative volatility.

5. Differentiate between less volatile component and more volatile component. (5x 2 = 10)

PART-B

[Maximum Marks: 30]

(Answer any ***Five*** of the following questions. Each question carries 6 marks)

II. 1. Draw the neat sketch of packed column and mark its parts.

2. Differentiate between chemical and physical adsorption.

3. Explain the working of humidifiers.

4. Illustrate the construction and use of humidity Chart.

5. Draw the rate of drying curve and mention various zones on it.

6. Derive an equation for drying time for constant rate period.

7. Explain equilibrium distillation. (5x 6 = 30)

PART-C

[Maximum Marks: 60]

(Answer ***one*** full question from each Unit. Each question carries 15 marks)

UNIT -I

III. (a). Summarise the various types of packings used in absorption tower and its materials of construction. (7)

(b). List the characteristics of packing materials. (8)

OR

IV. (a). Explain the preparation methods of silica gel. (7)

(b). Ammonia from ammonia air mixture is to be absorbed in an absorption tower using water as solvent. Data for absorption system is as follows.

Air flow rate = 200Kg/hr

Liquid phase compositions:

At the top of packing = 0.000013Kg NH_3/KgH_2O

At the bottom of packing = 0.0006Kg NH_3/KgH_2O

Gas phase compositions:

At the bottom of packing = 0.0044Kg NH_3/Kg inert gas

Calculate the mass flow rate of water entering the absorption rower on solute free basis (8)

UNIT -II

V. (a). Explain the following terms with mathematical model (1). Molal humidity. (2). Absolute humidity. (3). Relative humidity (4). Saturation humidity (5). Humid heat and humid volume. (9)

(b). If the atmosphere in the afternoon during a humid period is 30°C and 80% relative humidity (Barometer reads 738 mm Hg) while at night just 21°C (745mmHg). What percentage of water in the afternoon air is deposited as dew at night?

Data

Vapour pressure of water at 30°C = 35.1mmHg

Vapour pressure of water at 21°C = 15.5mmHg (6)

OR

VI. (a). The dry bulb temperature and dew point of ambient air were found to be 30°C and 20°C respectively. The barometer reads 99.99KPa pressure calculate

(a). Molal humidity. (b). Absolute humidity (c). Relative humidity

(d). Saturation humidity.

Data

Vapour pressure at 18^0 C = 2.1KPa

Vapour pressure at 29^0 C = 9.005KPa

(b). Derive the wet bulb equation (8)

(7)

UNIT -III

VII. (a). Explain the constructional details and working of Flash dryer. (7)

(b). A wet soild is dried from 30% to 10% under constant drying condition is 6 hrs. The equilibrium moisture content is 2% and critical moisture content is 16%. How long will it take to dry the material from 15% to 6% moisture content under the same drying condition. All moisture contents on dry basis. (8)

OR

VIII. (a). A wet solid is dried from 30% to 4% under constant drying condition is 4 hrs. The equilibrium moisture content is 2% and critical moisture content is 10%. How long will it take to dry the soild to 7% moisture content under the same drying condition. All moisture contents on dry basis. (8)

(b). Explain the constructional details and working of drum dryer. (7)

UNIT -IV

IX. (a). The 100 Kmol mixture containing 50 mole% N-heptane and 50 mole % N-octane is subjected to Flash vaporized at atmospheric pressure to vaporized 60 mole % feed. Compute the composition on the vapour and the residue.

X	1	0.66	0.49	0.31	0.15	0
Y	1	0.81	0.67	0.49	0.28	0

(9)

(b). Distinguish between the minimum boiling azeotrope and maximum boiling azeoptrope. (6)

OR

X. (a). Compute the vapour-liquid equilibrium at constant pressure of 101.325KPa absolute for mixtures of benzene with toluene which obey Raoult's and Dalton's law. Construct T-X-Y diagram and X-Y diagram.

DATA

Temperature °C	Benzene Vapour pressure KPa	Tolune vapour Pressure KPa
80	101.325	-
85	117.6	45.9
90	138.3	55.2
96	161.8	65.8
99	174.7	71.7
105	202.6	84.6
110	234.1	99.5
110.1	-	101.325

(8)

(b). Derive an equation for Relative volatility from volatilities of A and B components (7)