


Final Assessment Test – April 2025

Course: TBIT206L - Fundamentals of Chemical Engineering

Class NBR(s): 1290 / 1291

Time: Three Hours

Slot: B1+TB1

Max. Marks: 100

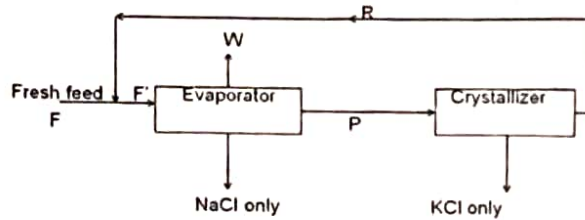
- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

 Answer ALL Questions

(10 X 10 = 100 Marks)

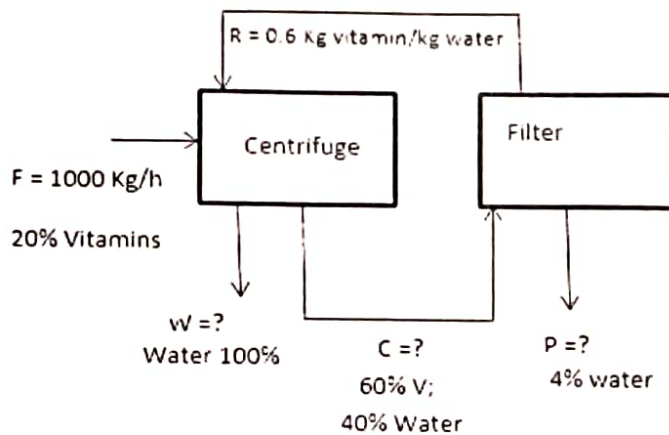
- A solution of NaCl in water contains 230 g NaCl per litre at 20°C. The density of the solution is 1.148 g/cc. Find molality, molarity and normality of the solution. (Na – 23; Cl -35.5)
 - Explain in detail about the positive displacement pumps with a neat labelled sketch?
 - It is required to make 500 Kg mixed acid containing 60% H₂SO₄, 30% HNO₃ and 10% water by blending a) the spend acid containing 10% HNO₃, 50% H₂SO₄ and 40% water b) aqueous 95% HNO₃ and c) aqueous 96% H₂SO₄. All % are by wt. Calculate the quantity of each of the three acids required for blending.
 - A saturated solution of salicylic acid (C₇H₆O₃) in methanol (CH₃OH) contains 64 Kg salicylic acid per 100 Kg methanol at 298 K (25°C). Find (a) the wt %, weight fraction of salicylic acid, methanol and (b) mole %, mole fraction of the salicylic acid, methanol.
 - Explain in detail about the practical applications of Bernoulli's equation
 - Toluene is heated from 290 k to 350 k at the rate of 0.25 kg/s. Calculate the heat required to be added to toluene using constants, given below. (C= a + bT+ cT² + dT³ and the values of constant are given based on kJ/kmol.k for C)
- | a | b×10 ³ | c×10 ⁶ | d×10 ⁹ |
|--------|-------------------|-------------------|-------------------|
| 1.8083 | 812.223 | -1512.67 | 1630.01 |
- Cracked gas from a petroleum refinery has the following composition by volume, methane (CH₄) 50%, ethane (C₂H₆) 10%, propane (C₃H₈) 20%, butane (C₄H₁₀) 20%. Find (a) average molecular weight of the gas mixture (b) composition by weight. (c) specific gravity of the mixture.
 - A simple U tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find vacuum pressure in pipe if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left from the center of the pipe is 15 cm below.

- 9.a) A solution containing 15% NaCl, 5% KCl and water is fed to the process shown in figure at the rate of 25,500 kg/h. The compositions of the stream are as follows: Evaporator product P: NaCl =20%, KCl=25% and water. Recycle product R: NaCl =25 % and water. Calculate the flow rates in kg/h and compute the composition of feed to the evaporator(F')



OR

- 9.b)



Find R, W, C and P?

- 10.a) Water enters a two fluid heat exchanger at 55°C and leaves at 85°C. Hot gases enter at 305°C and leaves at 160 °C. If the total heat transfer area is 500 m² and the overall H.T coefficient is 600 kcal/h m²°C. Determine heat transferred per hour for parallel flow and counter flow of the two fluids.

OR

- 10.b) Crude oil flows at the rate of 10,000 kg/h through the inside pipe of a double pipe H.E and is heated from 32°C to 90°C. The heat is supplied by a petroleum fraction initially at 230°C. If the temperature of the heating fluid falls down to 100°C inside the H.E. Compare the performances of parallel and counter current exchanges with respect to the heat transfer area and fluid flow rates. Overall H.T coefficient is 400 Kcal/h m² °C. Specific heats of crude oil and petroleum fraction are 0.56 and 0.6 Kcal/kg °C respectively.

⇔⇔⇔ W/D/TY ⇔⇔⇔