



School of Bio Sciences and Technology

Fall Semester 2023-2024

Continuous Assessment Test – I

Programme Name & Branch: B. Tech. Biotechnology

Course Name & code: Principles of Chemical Engineering, BBIT201L

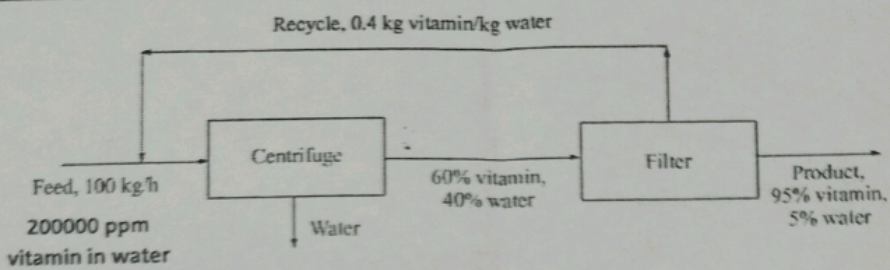
Class Numbers: VL2023240101977, VL2023240101975

Faculty Names: Dr. Dhanya V., Dr. Sreeja S.

Exam Duration: 90 min

Maximum Marks: 50

Q.No	Question	Max Marks
1.	In a process for producing caustic (NaOH), 4000 Kg/h of a solution containing 10% NaOH by weight is evaporated in the first evaporator, giving a 20% NaOH solution. This is then fed into a second evaporator, which gives a product of 50% NaOH. Calculate the following: a) The amount of water removed from each evaporator b) The amount of feed to the second evaporator c) The amount of product produced	10
2.	C₂H₄O is manufactured by oxidation of ethylene. CO₂ is produced as a by-product. 3360 Kg of C₂H₄ is fed to the reactor. The product is found to contain 3960 Kg of ethylene oxide and 352 Kg of CO₂. C₂H₄ + 0.5 O₂ → C₂H₄O C₂H₄ + 3 O₂ → 2 CO₂ + 2 H₂O Calculate: a) Percentage conversion of C₂H₄ b) Percentage yield of ethylene oxide c) Selectivity of the process d) Percentage yield of ethylene oxide for the below reaction scheme C₂H₄ + 0.5 O₂ → C₂H₄O C₂H₄O + 2.5 O₂ → 2 CO₂ + 2 H₂O	10

3.	 Final purification stage in the preparation of vitamins from natural sources requires centrifugation and continuous filtration as depicted in the figure. Determine the flow rate of the recycle stream in kg/h.	10
4.	a) The heat capacity of HCl for the temperature range of 300 K to 1500 K is given by $C_p = 28.194 + 1.805 \times 10^{-3} T + 1.513 \times 10^{-6} T^2$ where C_p is in KJ/Kgmol K and T is in K. Calculate the enthalpy change when 3 Kg of HCl is heated from 300 K to 1000 K. Molecular weight of HCl is 36.46. b) Calculate the energy required for the dissociation of 1 Kg of sodium bicarbonate at 298 K. $2 \text{ NaHCO}_3 (\text{s}) \rightarrow \text{Na}_2\text{CO}_3 (\text{s}) + \text{CO}_2 (\text{g}) + \text{H}_2\text{O} (\text{g})$ Heat of formation of the reactants and products at 298 K in (KJ/gmol) is as given below: $\text{NaHCO}_3 (\text{s}) = -950.81$ $\text{Na}_2\text{CO}_3 (\text{s}) = -1130.68$ $\text{CO}_2 (\text{g}) = -393.51$ $\text{H}_2\text{O} (\text{g}) = -241.82$	5 5
5.	A cup of water is frozen by placing it in a freezer. It takes 30 minutes to freeze the water completely from an initial temperature of 30°C. Determine the mass of the water in the cup if the rate of heat removal was 1000 W. The latent heat of freezing of water is 3100 KJ/kg, and the specific heat capacity of water is 4200 J/Kg. K.	10

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