

淡江大學 104 學年度日間部轉學生招生考試試題

系別：化學工程與材料工程學系三年級 科目：質能均衡

考試日期：7月26日(星期日) 第5節

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1. The density of a fluid is given by the empirical equation

(25%)

$$\rho = 70.5 \exp(8.7 \times 10^{-7} P)$$

Where ρ is density (lbm/ft³) and P is pressure (lbf/in²).

(1 N=0.2250 lbf; 1 g=0.002205 lbf; 1 ft=12in=30.48 cm)

(a) What are the units of 70.5 and 8.7×10^{-7} ?

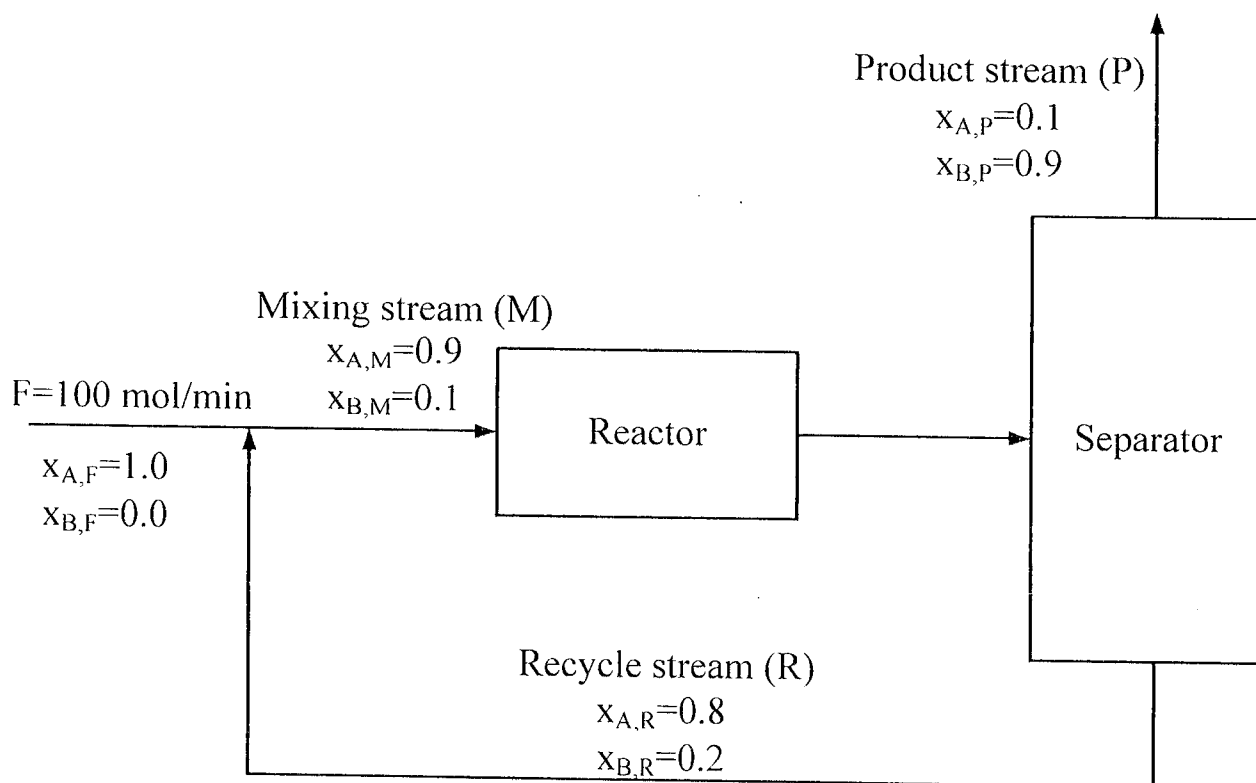
(b) Calculate the density in g/cm³ for a pressure of 9.0×10^6 N/m².

(c) Derive a formula for ρ (g/cm³) as a function of P (N/m²).

2. One hundred mol/h of butane (C₄H₁₀) and 6000 mol/h of air are fed into a combustion reactor. The mole fraction of O₂ in the air is 1/5.76. Calculate the percent excess air. (20%)

The combustion reaction is : C₄H₁₀ + 13/2 O₂ → 4 CO₂ + 5 H₂O

3. A chemical reaction A → B is to be carried out in the reactor. The unconsumed reactant is separated by a separator and recycled back to the reactor inlet. The process stream information (flowrate and mole fraction) is shown in the figure. Assume the reactant is 50% converted. Calculate R and P (mol/min). (25%)



4. A 10.0 wt.% H₂SO₄ solution at 60 °F is to be concentrated to 50.0 wt.% by evaporation of water. The concentrated solution and water vapor emerge from the evaporator at 180 °F and 1 atm. The feed solution flowrate is 1000 lbm/h. The enthalpy of water vapor (H_v) at 180 °F and 1 atm is 1138 Btu/lbm. (30%)

背面尚有試題

本試題雙面印刷

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- (a) Draw the basic flow diagram and mark the operating conditions of each stream.
- (b) Calculate the effluent flowrates of the top-stream and the bottom-stream of the evaporator by using material balance on H_2SO_4 and total mass balance.
- (c) Calculate "the heat must be transferred to the evaporator" by using energy balance.

