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# 淡江大學九十一年度日間部轉學生招生考試試題

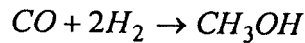
系別：化學工程學系三年級

科目：質能均衡

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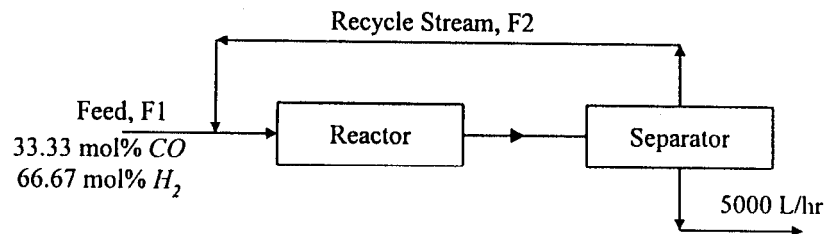
本試題共 **壹** 頁

1. Methanol is synthesized by the reaction of carbon monoxide with hydrogen,



15% of  $CO$  is converted to  $CH_3OH$  (the density is 74 g/L) in the reactor. From the reactor, the material flows to a separator where the pure  $CH_3OH$  product is separated as a liquid from the unreacted gases. These gases are then recycled back to the feed stream so that the process runs economically.

The process is shown below,



Calculate

- (a) the molar flow rate of feed gas (F1), [20 pts]
  - (b) the molar flow rate of recycle gas (F2). [20 pts]
2. A binary mixture (A + B) which obeys the Raoult's law is injected into a vacuum chamber. When the liquid mixture is in equilibrium with its vapor phase, the chamber is at 560 mmHg and 20 °C. Estimate the compositions (mole fractions) of liquid and gas phases at the equilibrium. [20 pts]
- (Note:  $P_A^*(20\text{ }^\circ\text{C}) = 600\text{ mmHg}$  and  $P_B^*(20\text{ }^\circ\text{C}) = 500\text{ mmHg}$ )
3. Write the simplified energy balances (i.e., the relation between all types of energy involved in the process) for the following changes:
- (a) A fluid is allowed to flow through slightly opened valve from a region where its pressure is 15 atm and 628 K to a region where its pressure is 3 atm, the whole operation being adiabatic. [20 pts]
  - (b) 1 lb<sub>m</sub> of gas at 100 psia and 370 °F, enclosed in a cylinder fitted with a movable frictionless piston, is kept at a constant volume until the temperature has fallen to 250 °F. [20 pts]