國立中正大學九十二學年度碩士班招生考試試題

系所別：化學工程學系　　科　目：化工熱力學與化工動力學

1. A irreversible gas phase reaction, A ⇒ 2R, is carried out in a tubular plug flow reactor at T (temperature)= 60 °C and P_t (total pressure) = 4.75 atm. The feed consists of 50 mol% A and 50 mol% inert at a rate of 4000 kg/h. The molecular weights of A and inert are 40 and 20, respectively, and the rate coefficient is k=2000 hr^{-1}. Determine the reactor size for 35% conversion of A. (20 分)

2. 解釋名詞：

a. Arrhenius Equation
b. Semibatch Reactor
c. Differential Flow Reactor
d. Heterogeneous Catalysis
e. Reaction Order

(15 分)

3. 選出最佳之答案並解釋勿選此答案之理由

a. 下列那一種反應器可能有較大的外在質傳阻力 (1) CSTR (2) Fixed Bed Reactor (3)Batch Reactor (4) Fluidized Bed Reactor .
b. 一自催化反應其反應速率與產物關係爲 (1)產物愈多則速率愈快 (2) 產物愈少速率愈快 (3) 無關 (4) 隨著產物增加至最高點後逐漸減少。
c. 化學吸附爲 (1) 形成共價鍵 (2) 單層吸附 (3) 具電子轉移行爲 (4) 以上皆是。
d. 抽煙囪於氧化反應的行爲，此反應爲 (1) 質傳控制 (2)化學反應控制 (3) 伴隨著質傳與化學反應控制 (4) 無法判斷。
e. 反應之階數（reaction order）愈高則反應速率 (1) 愈快 (2)愈慢 (3) 在相同濃度下則愈快 (4) 無法判斷。

(15 分)

4. An ideal gas, Cp =(5/2)R and Cv =(3/2) R, is changed from P_1=1 bar and V_1= 10m^3 to P_2 =10 bar and V_2 =1m^3 by the following mechanically reversible processes:

(a) Isothermal compression.

(b) Adiabatic compression followed by cooling at constant pressure.

(c) Adiabatic compression followed by cooling at constant volume.

(d) Heating at constant volume followed by cooling at constant pressure.

(e) Cooling at constant pressure followed by heating at constant volume.

Calculate Q, W, ΔU and ΔH for each of these processes (25%).

5. A Carnot heat engine receives 250 kJs^{-1} of heat from a heat source reservoir at 525°C and rejects heat to heat-sink reservoir at 50°C.

(a) What are the work developed during the process and the efficiency of the cycle (5%).

(b) Calculate the change of entropy in the high temperature and low temperature reservoirs (10%).

6. On the basis that ΔG° (298°K)for the reaction 1/2 N_2 + 3/2 H_2 → NH_3 is -16kJ/mol.

(a) Find the equilibrium constant for the above reaction (5%).

(b) Find the equilibrium constant for NH_3 → 1/2 N_2 + 3/2 H_2 (5%).