淡江大學九十三學年度碩士班招生考試試題

系別：化學工程與材料工程學系　　　科目：化學反應工程 50%

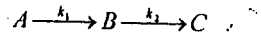| 准帶項目請打「○」否則打「×」 |
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1. At 500 K, the rate of a reaction is ten times the rate at 400 K. Find the activation energy of this reaction:

   (a) From Arrhenius law. (5 %) $k = Ae^{-\frac{E}{RT}}$

   (b) From collision theory. (5 %) $k = A\sqrt{T}e^{-\frac{E}{RT}}$

   (c) What is the percentage difference in rate of reaction at 600 K predicted by these two methods? (10 %)

2. Consider the classic first-order sequence

   $$A \xrightarrow{k_1} B \xrightarrow{k_2} C$$

   in an isothermal batch reactor.

   (a) Derive a relationship that will express B as a function of A. (15 %)
   (b) Derive the reaction time for which B is a maximum. (15 %)

1. A center power plant, rated at 600000 kW, generates steam at 580K and discards heat to a river at 290K. If the thermal efficiency of the plant is 60 % of the maximum possible value, how much heat is rejected to the river at rated power? (10 points)

2. The following vapor pressure data is available for solid and liquid hydrogen cyanide.

T (K)	245	250	255	T (K)	270	280	290	300
P°, solid (mmHg)	53.4	75.8	106.2	P°, liquid (mmHg)	230.6	359.0	542.1	796.6

With the help of Clausius-Clapeyron equation and assume transition heat is independent of temperature, please calculate (1) the heat of vaporization (cal/mol), (2) the heat of fusion (cal/mol), (3) the triple point (T=? K, P=? mmHg), (4) the normal boiling point, and (5) the entropy of vaporization at the normal boiling point (cal/mol-K). (20 points)

3. The standard Gibbs energy of reaction on the production of methanol from 1 mole of $CO_{(g)}$ and 2 moles of $H_{2(g)}$ are as follows: $CO(g) + 2H_{2(g)} \rightarrow CH_3OH_{(g)}$

T (K)	500	600	700
ΔG^o (cal)	5082	10835	16685

(a) What is the equilibrium conversion of CO at 600K and 1 bar? (b) If the heat of reaction ΔH^o is independent of temperature, calculate the heat of reaction ΔH^o (cal) and entropy of reaction ΔS^o at 600K and 1 bar (cal/K). (20 points)