淡江大學九十二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：物　理　化　學

准帶項目請打「○」否則打「×」
○　簡單型計算機（工程）
×　字典

所有單位一律使用 SI unit; R= 8.314 J $mol^{-1}K^{-1}$

(每一題 20 分)

1. Calculate the ΔG_{mix} (J/mol) of the system CCl_4-acetonitrile at 45 °C with the following data; X is mole fraction. X_{CCl4}, in liquid = 0.4790; X_{CCl4}, in vapor = 0.5684. Total vapor pressure is 0.4927 bar; The vapor pressure of pure CCl_4 and CH_3CN are 0.3450 and 0.2778 bar, respectively. Assume vapor is in ideal gas state. (20 points)

2. The breakup of NO_2 according to the reaction $NO_2(g) \leftrightarrow NO(g) + \frac{1}{2}O_2(g)$ has been found to processed at a total pressure of 1atm. The percentage of NO_2 that is decomposed is shown in the following table. What value do these data suggest for the enthalpy of the reaction (KJ/mol)? (20 points)

T, K	457	552	767	903
NO_2 Decomposed, %	5.0	13.0	56.5	99.0

3. (a)請分別畫出水及二氧化碳的壓力-溫度(P-T)相圖(必須標示出相態,相線,三相點及臨界點) (b)請利用 Clapeyron Equation 解釋水的固相-液相線(S-L-E)斜率為何和大多數物質不同. (c)利用水的相圖解釋為何加入非揮發性溶質後,水的沸點會上升. (20 points)

4. Some of the data of the reaction $(CH_3)_3CBr + H_2O \rightarrow (CH_3)_3COH + HBr$ in a water-acetone solvent at 25 and 50 °C are as follows:

At 25 °C		At 50 °C	
Time (h)	$(CH_3)_3CBr$ mol/L	Time (h)	$(CH_3)_3CBr$ mol/L
0	0.1039	0	0.1056
6.2	0.0776	0.30	0.0856
10.0	0.0639	0.45	0.0767
18.3	0.0353	0.90	0.0536
30.8	0.0207	1.75	0.0270
43.8	0.0101	3.00	0.0089

(a) Verify that the reaction is first-order, and deduce the values of the rate coefficient (1/h) at the two temperatures. (b) In addition, estimate the activation energy (KJ/mol). (20 points)

5. The following data are reported for the osmotic pressure of polystyrene (ρ = 1.20 g/cm^3) in the toluene (ρ = 1.004 g/cm^3) at 25 °C. Determine the molar mass of polystyrene and its second osmotic virial coefficient. (20 points)　　1dL = 100 mL

C (g/dL)	0.31	0.72	1.34	1.88	2.38
h (cm)	0.351	0.860	1.671	2.479	3.261