

國立臺北科技大學 100 學年度碩士班招生考試

系所組別：3520 化學工程研究所乙組

第一節 物理化學 試題

第一頁 共一頁

注意事項：

1. 本試題共 6 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (a) Show that the Joule-Thomson coefficient μ can be written as (10%)

$$\mu = -\frac{1}{C_p} \left(\frac{\partial H}{\partial P} \right)_T$$

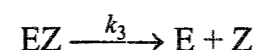
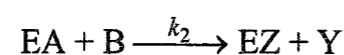
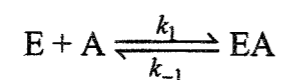
- (b) Obtain an expression for the Joule-Thomson coefficient for a gas obeying the equation of state

$$P(V_m - b) = RT$$

in terms of R , T , P , V_m , and $C_{p,m}$. (10%)

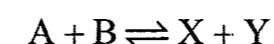
2. Calculate the mole fraction, activity, and activity coefficients for water when 11.5 g NaCl are dissolved in 100 g water at 298 K. The vapor pressure is 95.325 kPa. ($\lambda_{\text{Na}} = 22.98977$, $\lambda_{\text{Cl}} = 35.4527$) (10%)

3. The following is a simplified version of the mechanism that has been proposed by H. Theorell and Britton Chance for certain enzyme reactions involving two substrates A and B.



Assume that the substrates A and B are in excess of E so that the steady-state treatment can be applied to EA and EZ, and obtain an expression for the rate. (20%)

4. A solution reaction



is endothermic, and K_c at 25 °C is 20.

- a. Is the formation of X + Y exergonic at 25 °C ? (5%)
- b. Will raising the temperature increase the equilibrium yield of X + Y ? (5%)
- c. Is ΔS° positive or negative ? (5%)

5. A solution of LiCl at a concentration of 0.005 M is contained in a tube having a cross-sectional area of 5 cm². Calculate the speeds of the Li⁺ and Cl⁻ ions if a current of 2 A is passed. ($\lambda^\circ(\text{Li}^+) = 38.66 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$; $\lambda^\circ(\text{Cl}^-) = 76.31 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$). (15%)

6. The following information is obtained from cooling curve data on the partial system Fe₂O₃-Y₂O₃:

Composition of Melt / mol % of Y ₂ O ₃	Temperature of Break / °C	Temperature of Halt / °C
0		1550
5	1540	1440
10	1515	1440
15	1450	1440
20	1520	1440
25	1560	1440
30	1620	1575 / 1440
40	1705	1575
50		1720

Sketch the simplest melting point diagram consistent with these data. Label the phase regions and give the composition of any compounds formed. (20%)