

系所組別 資源工程學系乙組

考試科目 熱力學

考試日期 0307 節次 1

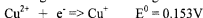
※ 考生請注意 本試題 可 不可 使用計算機

(1) Calculate the emf at 25°C of a concentration cell  $\text{Pt, H}_2/\text{HCl}(m_1) // \text{Pt, H}_2/\text{HCl}(m_2)$  in which the molalities are 0.2 m ( $m_1$ ) and 3 m ( $m_2$ ). (12%)

$$\begin{aligned} R &= 8.314 \text{ J K}^{-1} \text{ mol}^{-1} \\ &= 8.205 \times 10^{-2} \text{ Latm K}^{-1} \text{ mol}^{-1} \\ &= 8.314 \times 10^{-2} \text{ L bar K}^{-1} \text{ mol}^{-1} \\ &= 8.314 \text{ Pa m}^3 \text{ K}^{-1} \text{ mole}^{-1} \end{aligned}$$

(2) Calculate  $E^0$  for the process  $\text{Cu}^+ + e \Rightarrow \text{Cu}$

Making use of the following  $E^0$



(3) Toluene ( $m_w=92$  g/mole) and water are immiscible. If boiled together under an atmospheric pressure of 755 Torr at 83°C, what is the ratio of toluene to water in the distillate? The vapor pressure of pure toluene and water at 83°C are 322 Torr and 400 Torr respectively (12%)

(4) Detail the steps in going from the Clapeyron equation to the Clausius-Clapeyron equation. What specific assumptions are made? (12%)

(5) The solubility of oxygen in water at 1 atm pressure and 298 K is 0.00115 (mole/Kg of water). Under these conditions, calculate the standard chemical potential for a saturated solution of oxygen in water. (12%)

(6) Calculate the activities and activity coefficients for an acetone-chloroform solution in which  $x_2 = 0.6$ . The vapor pressure of pure chloroform at 323K is  $P_2^* = 98.6$  kPa and the vapor pressure above the solution is  $P_2 = 53.3$  kPa. For acetone, the corresponding values are  $s P_1^* = 84.0$  kPa and  $P_1 = 26.6$  kPa. (15%)

(7) The equilibrium const for an association reaction  $A + B \Rightarrow AB$  is  $1.8 \times 10^3 \text{ dm}^3 \text{ mol}^{-1}$  at 25°C and  $3.45 \times 10^3 \text{ dm}^3 \text{ mol}^{-1}$  at 40°C. Assuming  $\Delta H^0$  to be independent of temperature, calculate  $\Delta H^0$  and  $\Delta S^0$  (12%)

(8) Liquid water at 100°C is in equilibrium with water vapor at 1 atm pressure. If the enthalpy change associated with the vaporization of liquid water at 100°C is  $40.6 \text{ kJ mol}^{-1}$ , what are  $\Delta G$  and  $\Delta S$ ? (10%)