

ch 4-1

國立臺北科技大學九十六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

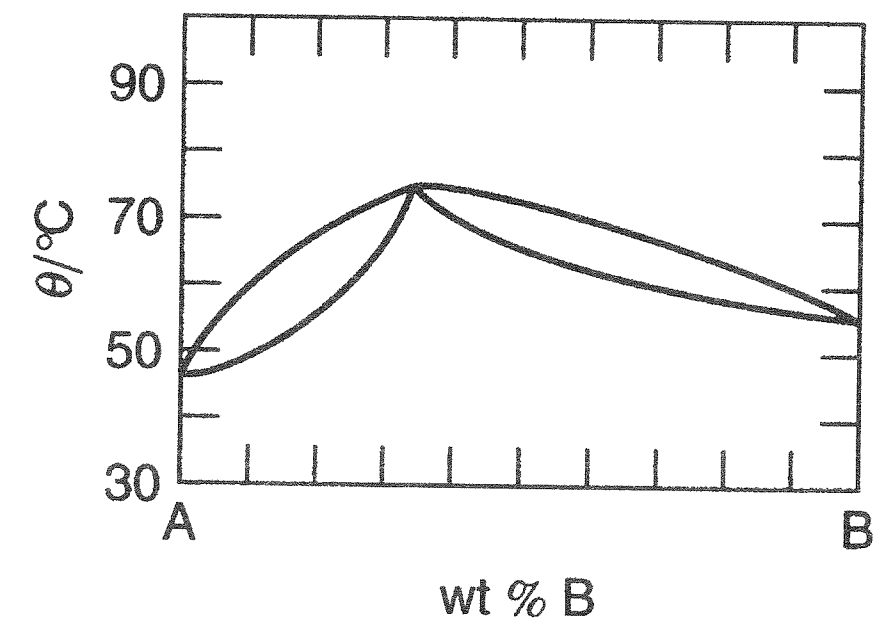
第一頁 共二頁

注意事項：

1. 本試題共 7 題，配分共 100 分。第 1 題 24 分，每小題 3 分；第 2-6 題各 12 分；第 7 題 16 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. For each of the following processes deduce whether each of the quantities q , w , ΔU , ΔH , ΔG , and ΔA is positive, zero, or negative.
 - (a) Reversible melting of solid benzene at 1 atm and the normal melting point.
 - (b) Reversible melting of ice at 1 atm and 0°C .
 - (c) Reversible adiabatic expansion of an ideal gas.
 - (d) Reversible isothermal expansion of an ideal gas.
 - (e) Adiabatic expansion of an ideal gas into a vacuum.
 - (f) Joule-Thomson adiabatic throttling of an ideal gas.
 - (g) Reversible heating of an ideal gas at constant pressure.
 - (h) Reversible cooling of an ideal gas at constant volume.
2. A typical biological cell has a volume of 10^{-9} cm^3 , a surface area of 10^{-6} cm^2 , and a membrane thickness of 10^{-6} cm ; the dielectric constant of the membrane may be taken as 3. Suppose that the concentration of K^+ ions inside the cell is 0.168 M and that the Nernst potential across the cell wall is 0.086 V. (a) Calculate the net charge on either side of the wall, and (b) Calculate the fraction of the K^+ ions in the cell that are required to produce this charge.

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3. The speed that a body of any mass must have to escape from the earth is $1.12 \times 10^4\text{ m s}^{-1}$. At what temperature would the average speed of (a) an He molecule, and (b) an O_2 molecule be equal to this escape speed?
 4. A conductivity cell when standardized with 0.005 M KCl was found to have a resistance of 94.5 Ω . With 0.005 M ammonia solution the resistance was 879 Ω . Calculate the base dissociation constant of ammonia, given the following molar conductivities at these concentrations: $\lambda(\text{K}^+) = 73.48\text{ }\Omega^{-1}\text{ cm}^2\text{ mol}^{-1}$; $\lambda(\text{Cl}^-) = 76.31\text{ }\Omega^{-1}\text{ cm}^2\text{ mol}^{-1}$; $\lambda(\text{NH}_4^+) = 73.4\text{ }\Omega^{-1}\text{ cm}^2\text{ mol}^{-1}$; $\lambda(\text{OH}^-) = 198\text{ }\Omega^{-1}\text{ cm}^2\text{ mol}^{-1}$.
 5. Answer the following questions, using the accompanying figure.

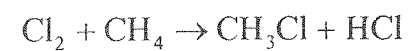


- (a) A liquid mixture consists of 40 g of component A and 60 g of component B. At what temperature would the mixture begin to boil? (b) Under the conditions in (a), what is the composition of the vapor when boiling first occurs? (c) If the distillation is continued until the boiling point is raised by 5.0°C , what would be the composition of the liquid left in the still? (d) Under the conditions in (c), what are the composition and mass of the two components collected over the initial 5.0°C interval?

注意：背面尚有試題

6. A 95-watt mercury-vapor lamp emits radiation of 253.7 nm wavelength and may be assumed to operate with 90% efficiency. If all the light emitted is absorbed by a substance that is decomposed with a quantum yield of 1.1, how long will it take for 0.02 mol to be decomposed ?

7. The gas-phase reaction



proceeds by a free-radical chain reaction in which the chain propagators are Cl and CH₃ (but not H), and the chain-ending step is $2\text{Cl} \rightarrow \text{Cl}_2$. Write the mechanism, identify the initiation reaction and the chain-propagating steps, and obtain an expression for the rate of the overall reaction.