

元智大學 101 學年度研究所 碩士班 招生試題卷

系(所)別： 生物科技與工程
研究所碩士班

組別： 不分組

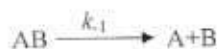
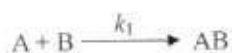
科目： 普通化學

用紙第 1 頁共 2 頁

●不可使用電子計算機

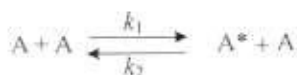
Chemistry (不可使用電子計算機)

- Write the formula for: (A) calcium sulfate (3 points) (B) sodium dichromate (3 points) (C) aluminum hydroxide (3 points) (D) iron(III) oxide (3 points) (E) ammonium nitrate (3 points)
- Describe the four laws of thermodynamics as simple as possible. (8 points)
- A typical reaction mechanism is shown in the following:



- (A) Based on rate law, write the reaction rate of disappearance for A and the reaction rate of formation for AB and P. (6 points).
 (B) Using steady-state approximation for [AB], determine the overall reaction rate in terms of [A], [B], and the rate constants. (5 points)

- Consider the high pressure reaction $A \rightarrow Q$. In reality, the reaction might proceed by the following steps:



where A^* is a free radical. Please derive an expression for the rate of product formation. (6 points)

- (A) A sample of nitrogen gas has a volume of 32.4 L at 20°C. The gas is heated to 220°C at constant pressure. What is the final volume of nitrogen? (4 points)

(B) A gas evolved during the fermentation of sugar was collected at 22.5°C and 702 mmHg. After purification, its volume was found to be 25.0 L. How many moles of gas were collected? (4 points)
- Given the following thermochemical equations:

$$Fe_2O_3(s) + 3 CO(g) \rightarrow 2 Fe(s) + 3 CO_2(g) \quad \Delta H^\circ = -28.0 \text{ kJ}$$

$$3 Fe(s) + 4 CO_2(g) \rightarrow 4 CO(g) + Fe_3O_4(s) \quad \Delta H^\circ = +12.5 \text{ kJ}$$

Calculate the value of ΔH° for the following reaction:

$$3 Fe_2O_3(s) + CO(g) \rightarrow CO_2(g) + 2 Fe_3O_4(s) \quad \Delta H^\circ = ? \text{ (7 points)}$$

元智大學 101 學年度研究所 碩士班 招生試題卷

系(所)別： 生物科技與工程
研究所碩士班

組別： 不分組

科目： 普通化學

用紙第 2 頁共 2 頁

●不可使用電子計算機

7. (A) Calculate the molality of C_2H_5OH in a water solution that is prepared by mixing 100 mL of C_2H_5OH with 250 mL of H_2O at $20^\circ C$. The density of the C_2H_5OH is 0.79 g/mL at $20^\circ C$? (5 points)
(B) How many grams of sodium hydroxide, $NaOH$, are needed to prepare 500 mL of 2 N solution? (5 points)
(C) What is the concentration of the solution prepared by diluting 200 mL of 2 M solution to a final volume of 800 mL? (5 points)
8. Urea $[(NH_2)_2CO]$ is prepared by reacting ammonia with carbon dioxide: $2 NH_{3(g)} + CO_{2(g)} \longrightarrow (NH_2)_2CO_{(aq)} + H_2O_{(l)}$
In one process, 629.0 g of NH_3 are allowed to react with 1320.0 g of CO_2 . (A) Which of the two reactants is the limiting reagent? (5 point) (B) Calculate the mass of $(NH_2)_2CO$ formed. (5 point) (C) How much of the excess reagent (in grams) is left at the end of the reaction? (5 point)
9. Initially 1 mole of oxygen is contained in a 1-liter vessel, and 5 mole of nitrogen are in a 2-liter vessel; the two vessels are connected by a tube with a stopcock. If the stopcock is opened and the gases mix, what is the entropy change? (15 points)