

中原大學 102 學年度 碩士班 入學考試

102/3/2 13:30 ~ 15:00 化學系

誠實是我們珍視的美德，
我們喜愛「拒絕作弊，堅守正直」的你！

科目：物化、分析

(共 2 頁第 1 頁)

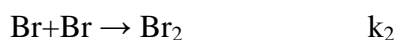
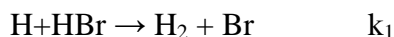
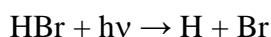
■可使用計算機，惟僅限不具可程式及多重記憶者

□不可使用計算機

(part A: 物化)

1. What is the time constant for the second order reaction $2A \rightleftharpoons A_2$? $[A]_0$ is the initial concentration of A and k is the rate constant. (10%)
2. Write down the permitted j values for an f electron. (10%)
3. Are the following transitions in helium allowed or forbidden? (A) $3d^3D \rightarrow 5p^3P$ (B) $2p^3P \rightarrow 2p^1P$ (C) $3s^1S \rightarrow 2s^1S$ (D) $4s^1S \rightarrow 3d^3D$ (E) $5p^1P \rightarrow 3d^3D$ (10%)

4. Consider the following photochemical reaction mechanism,



What is the steady-state concentration for H? (10%) What is the steady-state concentration of Br? (10%) What is the overall quantum yield ϕ based on reactant HBr? (10%)

5. If enzyme [E] and substrate [S] are treated as adsorbate and surface, respectively, and K_M is the Michaelis constant ($K_M = \frac{[E][S]}{[ES]}$), then using the concept of Langmuir isotherm, express the surface coverage θ in terms of [E], [S], and [ES]. (5%)
6. What is the efficiency for a Carnot cycle with high temperature = 500°C and low temperature = 380°C ? (5%)
7. As the pressure is increased at -45°C , ice I is converted to ice II. Which of these phases has the lower density? (5%)

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(part B: 分析)

8. Explain the origin of the rule of thumb that indicator color changes occur at $\text{pK}_{\text{HIn}} \pm 1$. (10%).
9. Compare the differences in (a) type of species can be determined, (b) detection limit, and (c) interference type for the three spectrometric methods (graphite-furnace AAS, ICP-AES and ICP-MS). Please make a brief explanation for your answer. (15 %)
10. List the types of substances to which each of the following chromatographic methods are most applicable: (15%)
 - (a) Gas chromatography
 - (b) Liquid chromatography
 - (c) Capillary electrophoresis
11. Calculate the fraction of association (α) for (a) $1.0 \times 10^{-2} \text{M}$ and (b) $1.0 \times 10^{-12} \text{M}$ potassium acetate. (c) Does α increase or decrease with dilution? ($K_a = 1.75 \times 10^{-4}$ for acetic acid)
(15%)
12. Explain why the following atom optical spectrometry do not identify and determine all elements in periodic table: (10%)
 - (a) flame AAS
 - (b) hydride generation AAS
13. Why must the slit width of a prism monochromator be varied to provide constant effective bandwidths but a nearly constant slit width provides constant bandwidth with a grating monochromator? (10%)