

國立中山大學 109 學年度 碩士暨碩士專班招生考試試題

科目名稱：普通化學【海資系碩士班丙組】

—作答注意事項—

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，不得另攜帶紙張，請衡酌作答。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，其後果由考生自行負擔。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
- 試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

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題號：452003

※本科目依簡章規定「不可以」使用計算機(問答申論題)

共 1 頁第 1 頁

注意事項：答案若涉及計算，請將演算過程列出，否則不予計分。

原子量：H=1, C=12, O=16, Na=23, $\log 2=0.30$, $\log 3=0.48$

- (20%) 1. Write the chemical formula of the following compounds. (2% each)
 (a) hydrogen chloride (b) magnesium hydroxide (c) calcium carbonate
 (d) sulfuric acid (e) sodium nitrate (f) hydrogen peroxide
 (g) potassium permanganate (h) potassium cyanide (i) methane
 (j) ethyl alcohol
- (10%) 2. Write the electron configuration for sodium (atomic number 11) and zinc (atomic number 30). (5% each)
- (10%) 3. The volume of a gas-filled balloon is 50 L at 20°C and 742 torr. What volume will it occupy at standard temperature and pressure (273 K and 760 torr)?
- (8%) 4. Which of the following substance exhibits H bonding? (4%)
 For any that do, show the H bonds between two of its molecules. (4%)
 (a) C₂H₆ (b) CH₃OH (c) $\text{CH}_3\overset{\text{O}}{\parallel}\text{C}-\text{NH}_2$ (d) $\text{CH}_3\overset{\text{O}}{\parallel}\text{CCH}_3$
- (10%) 5. Balance these equations : (5% each)
 (a) $\text{I}^- + \text{NO}_2^- \rightarrow \text{I}_2 + \text{NO}$ (acidic solution)
 (b) $\text{CrO}_4^{2-} + \text{Fe}(\text{OH})_2 \rightarrow \text{Cr}(\text{OH})_3 + \text{Fe}(\text{OH})_3$ (basic solution)
- (10%) 6. The reaction between nitrogen monoxide (NO) and oxygen (O₂) forms nitrogen dioxide (NO₂). This oxidation reaction of NO is believed to occur by a two-step mechanism :
 $\text{NO}_{(g)} + \text{O}_{2(g)} \rightleftharpoons \text{NO}_{3(g)}$ (fast)
 $\text{NO}_{3(g)} + \text{NO}_{(g)} \rightarrow 2\text{NO}_{2(g)}$ (slow)
 (a) Write the equation for the overall reaction. (5%)
 (b) Write the rate law for the overall reaction. (5%)
- (12%) 7. Carbonic acid (H₂CO₃) is a diprotic acid. Calculate the pH and the concentrations of all species (H₂CO₃, HCO₃⁻ and CO₃²⁻) in a 0.020 M carbonic acid. (3% each)
 (K_{a1} = 5.0 X 10⁻⁷, K_{a2} = 5.0 X 10⁻¹¹)
- (10%) 8. An environmental chemist needs a carbonate buffer of pH 10.00 to study the effects of acid rain on limestone-rich soil. How many grams of Na₂CO₃ must he add to 1.5 L of 0.20 M NaHCO₃ to make the buffer? (K_a of HCO₃⁻ is 5.0 X 10⁻¹¹)
- (10%) 9. Solutions of Ca(OH)₂ are used in industry as a strong, inexpensive base.
 (a) Calculate the molar solubility of Ca(OH)₂ in water. (5%)
 (b) What is the molar solubility of Ca(OH)₂ in 0.10 M Ca(NO₃)₂? (5%)
 (K_{sp} of Ca(OH)₂ is 6.8 X 10⁻⁶)