

元智大學 102 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 / 頁共 / 頁

● 不可使用電子計算機

Chemistry (不可使用電子計算機)

1. What volume of isopropanol (rubbing alcohol) would you use if you need 25.0 g? (The density of isopropanol is 0.7855 g/mL at 20°C.) (9 points)
2. Please define the Acid and Base. (9 points)
3. Which molecules are likely to exist? Please explain it in details.
(A) CBr₃ (3 points) (B) ICl (3 points) (C) FH₄ (3 points) (D) H₂S (3 points)
4. What are the general properties of aldehydes and ketones? (9 points)
5. Draw structures for both the cis and trans isomers of 2-hexene. (9 points)
6. Write down the full names of following chemical using the appropriate name ending -diene, triene, tetraene and so forth.
(A) CH₃CH₂CH₂CH=CH₂ (3 points) (B) CH₃CH₂CH₃ (3 points) (C) CH₃CH=CH₂ (3 points) (D) CH₂=CH₂ (3 points)
7. Describe the four laws of thermodynamics as simple as possible. (8 points)
8. Assuming that the combustion of hydrogen gas provides three times as much energy per gram as gasoline, calculate the volume of liquid H₂ (density = 0.0710 g/mL) required to furnish the energy contained in 80.0 L (about 20 gal) of gasoline (density = 0.740 g/mL). Calculate also the volume that this hydrogen would occupy as a gas at 1.00 atm and 25°C. (10 points)
9. Which of the following process require energy as they occur? (6 points)
(A) Salt dissolves in H₂O. (B) A clear solution becomes a uniform color after a few drops of dye are added. (C) A cell produces proteins from amino acids. (D) Iron rusts. (E) A house is built. (F) A satellite is launched into orbit. (G) A satellite falls back to earth.
10. A certain first-order reaction has a half-life of 20.0 minutes. Calculate the rate constant for this reaction. (5 points)
11. The following mechanism is proposed for the reduction of NO₃⁻ by MoCl₆²⁻:

$$\text{MoCl}_6^{2-} \xrightleftharpoons[k_2]{k_1} \text{MoCl}_5^- + \text{Cl}^-$$

$$\text{NO}_3^- + \text{MoCl}_5^- \xrightarrow{k_3} \text{OMoCl}_5^- + \text{NO}_2^-$$
 (A) What is the intermediate? (4 points) (B) Derive an expression for the rate law (rate = d[NO₂⁻]/dt) for the overall reaction using the steady-state approximation. (7 points)

102025