

中原大學 107 學年度碩士班考試入學

107/3/7 8:00 AM~9:30 AM

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：普通化學(分「普通化學(A)」及「普通化學(B)」兩部份計分，各佔100分)(共4頁，第1頁)

可使用計算機(僅限於四則運算、三角函數及對數等基本功能，可程式之功能不可使用)

不可使用計算機

----- (不可直接作答於試題，請作答於答案卷) -----

一、普通化學(A)，選擇題 (10 題，每題 10 分，共 100 分)

- The element rhenium (Re) exists as two stable isotopes and 18 unstable isotopes. Rhenium-185 has in its nucleus
 - 75 protons, 110 neutrons.
 - 75 protons, 75 neutrons.
 - 75 protons, 130 neutrons.
 - 130 protons, 75 neutrons.
 - not enough information is given.
- The volume of a balloon is 3.02 L at 22.7°C. The balloon is heated to 43.6°C. Calculate the new volume of the balloon.
 - 1.57 L
 - 3.02 L
 - 2.82 L
 - 3.23 L
 - 5.80 L
- A sample of oxygen gas has a volume of 4.50 L at 27°C and 800.0 torr. How many oxygen molecules does it contain?
 - 1.16×10^{22}
 - 1.16×10^{23}
 - 2.32×10^{24}
 - 5.8×10^{22}
 - none of these
- Which one of the following statements is *false*?
 - If q_p for a process is negative, the process is exothermic.
 - A bomb calorimeter measures ΔH directly.
 - The change in enthalpy, ΔH , for a process is equal to the amount of heat absorbed at constant pressure, q_p .
 - The freezing of water is an example of an exothermic reaction.
 - The change in internal energy, ΔE , for a process is equal to the amount of heat absorbed at constant volume, q_v .

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科目：普通化學(分「普通化學(A)」及「普通化學(B)」兩部份計分，各佔100分)(共4頁，第2頁)

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5. Which of the following statements is true for a monatomic ideal gas?

- a. $C_v < C_p$
- b. $C_v > C_p$
- c. $C_v = C_p + R$
- d. $C_p = \frac{3}{2}R$
- e. C_v is temperature dependent
- f. B and C
- g. A, D, and E

6. Consider the process $A(l) \rightleftharpoons A(s)$. An increase in temperature favors which direction?

- a. to the right
- b. to the left
- c. More information is needed.
- d. neither

7. Use the following initial rate data for the reaction in aqueous solution to determine the rate law.

| $[\text{CH}_3\text{COCH}_3]_0 (M)$ | $[\text{Br}_2]_0 (M)$ | $[\text{H}^+]_0 (M)$ | $\frac{\Delta[\text{Br}_2]}{\Delta t} (M/s)$ |
|------------------------------------|-----------------------|----------------------|--|
| 1.00 | 1.00 | 1.00 | 4.0×10^{-3} |
| 2.00 | 1.00 | 1.00 | 8.0×10^{-3} |
| 2.00 | 2.00 | 1.00 | 8.0×10^{-3} |
| 1.00 | 2.00 | 2.00 | 8.0×10^{-3} |

- a. $\text{Rate} = k[\text{CH}_3\text{COCH}_3][\text{H}^+]$
- b. $\text{Rate} = k[\text{CH}_3\text{COCH}_3][\text{Br}_2][\text{H}^+]$
- c. $\text{Rate} = k[\text{Br}_2][\text{H}^+]$
- d. $\text{Rate} = k[\text{CH}_3\text{COCH}_3][\text{Br}_2][\text{H}^+]^2$
- e. $\text{Rate} = k[\text{CH}_3\text{COCH}_3][\text{Br}_2]$

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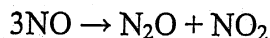
科目：普通化學(分「普通化學(A)」及「普通化學(B)」兩部份計分，各佔100分)(共4頁，第3頁)

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8. The reaction



is found to obey the rate law $\text{Rate} = k[\text{NO}]^2$. If the first half-life of the reaction is found to be 3.5 s, what is the length of the fourth half-life?

- a. 21 s
 - b. 6.6 s
 - c. 53 s
 - d. 14 s
 - e. 56 s
9. Which of the following compounds has the lowest boiling point?
- a. CH_4
 - b. C_2H_6
 - c. C_5H_{12}
 - d. C_3H_8
 - e. C_4H_{10}
10. In which of the following processes is energy evolved as heat?
- a. vaporization
 - b. crystallization
 - c. melting
 - d. sublimation
 - e. none of these

二、普通化學(B)，計算題(5題，每題20分，共100分)

1. Adipic acid contains 49.32% C, 43.84% O, and 6.85% H by mass. What is the empirical formula?
2. The concentration of a 228.0-mL sample of a calcium chloride solution is 0.490 M. What is the mass of the solute?
3. Air is 79% N_2 and 21% O_2 by volume. Calculate the density of air at 1.0 atm, 25°C

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4. For the reaction $2\text{NCl}_3(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + 3\text{Cl}_2(\text{g})$, the equilibrium pressures are

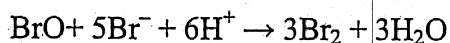
$$P(\text{NCl}_3) = 0.136 \text{ atm}$$

$$P(\text{N}_2) = 2.32 \text{ atm}$$

$$P(\text{Cl}_2) = 0.0580 \text{ atm}$$

Determine K_p for this reaction.

5. The balanced equation for the reaction of bromate ion with bromide in acidic solution is



At a particular instant in time, the value of $-\Delta[\text{BrO}_3^-]/\Delta t$ is $2.0 \times 10^{-3} \text{ mol/L} \cdot \text{s}$. What is the value of $\Delta[\text{Br}_2]/\Delta t$ in the same units?