

科目：普通化學

適用：應化系二

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本 試 題

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第 1 頁

編號：431

一、單選題：(30% total, 3% each)

1. Consider a sample of neon gas in a container fitted with a movable piston (assume the piston is massless and frictionless). The temperature of the gas is increased from 20.0°C to 40.0°C. The density of neon
 - A) decreases less than 10%
 - B) decreases more than 10%
 - C) does not change
 - D) increases more than 10%
 - E) increases less than 10%
2. A 50.0-mL sample of $2.0 \times 10^{-4} M$ CuNO_3 is added to 50.0 mL of 4.0 M NaCN. Cu^+ reacts with CN^- to form the complex ion $\text{Cu}(\text{CN})_3^{2-}$. $\text{Cu}(\text{CN})_3^{2-} \rightleftharpoons \text{Cu}^+ + 3\text{CN}^-$ $K = 1.0 \times 10^{-9}$ The concentration of Cu^+ at equilibrium is
 - A) $2.0 \times 10^{-4} M$
 - B) $1.0 \times 10^{-4} M$
 - C) $5.0 \times 10^{-14} M$
 - D) $1.2 \times 10^{-14} M$
 - E) none of these
3. For the combustion of ethyl alcohol $\text{C}_2\text{H}_5\text{OH}(l) + 3\text{O}_2(g) \rightarrow 2\text{CO}_2(g) + 3\text{H}_2\text{O}(l)$, $\Delta H = -1.37 \times 10^3 \text{ kJ}$, which of the following statements is(are) true?
 - I. The reaction is exothermic.
 - II. The enthalpy change would be different if gaseous water were produced.
 - III. The reaction is not an oxidation-reduction one.
 - IV. The products of the reaction occupy a larger volume than the reactants.
 - A) I only
 - B) I, II
 - C) I, II, III
 - D) I, III, IV
 - E) III, IV
4. At 1 atm, a liquid is heated above its normal boiling point. ΔS_{univ} for this process is
 - A) equal to zero
 - B) less than zero
 - C) greater than zero
 - D) cannot be determined
5. In which of the following cases can E° be equal to zero?
 - A) E°_{cell} can never be equal to zero.
 - B) In a concentration cell.
 - C) In any cell at equilibrium.
 - D) B and C
6. Which of the following frequencies corresponds to light with the longest wavelength?
 - A) $9.12 \times 10^{12} \text{ s}^{-1}$
 - B) $3.20 \times 10^9 \text{ s}^{-1}$
 - C) $8.50 \times 10^{20} \text{ s}^{-1}$
 - D) $3.00 \times 10^{13} \text{ s}^{-1}$
 - E) $4.12 \times 10^5 \text{ s}^{-1}$
7. How many of the following molecules and ions are linear? NF_3 NH_4^+ HCN CO_2 NO_2
 - A) 3
 - B) 4
 - C) 0
 - D) 1
 - E) 2

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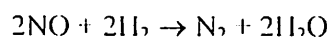
第 2 頁

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8. Which of the following is diamagnetic?

A) F_2^+ B) C_2^+ C) H_2^+ D) N_2 E) N_2^+

9. Initial rate data have been determined at a certain temperature for the gaseous reaction



What is the numerical value of the rate constant?

 $[NO]_0 (M)$ $[H_2]_0 (M)$

Initial Rate (M/s)

0.16

0.32

0.0180

0.16

0.48

0.0270

0.32

0.32

0.0720

A) 6.9

B) 2.2

C) 1.1

D) 0.35

E) 0.11

10. Which of the following should have the highest boiling point?

A) K_2S B) HI C) NH_3 D) O_2 E) C_2H_5OH

二、問答與計算題 (70%)，請列出關鍵公式與計算過程。

1. Pentane (C_5H_{12}) and hexane (C_6H_{14}) form an ideal solution. The vapor pressures of pentane and hexane at $25^\circ C$ are 511 torr and 150 torr, respectively. The mole fraction of hexane in a pentane-hexane solution is 0.50. Calculate the mole fraction of pentane in the vapor that is in equilibrium at $25^\circ C$ with this solution. (4%)
2. Write the formula for (a) hydrosulfuric acid, (b) potassium dichromate, (c) dinitrogen monoxide, and (d) nickel(II) carbonate. (8% total, 2% each)
3. Balance each of the following equations (a) $Al_2(SO_4)_3 + Ca(OH)_2 \rightarrow Al(OH)_3 + CaSO_4$, and (b) $KI + HNO_3 \rightarrow KNO_3 + NO + I_2 + H_2O$ (8% total, 4% each).
4. Explain Pauli principle. (10%)
5. Explain Le Châtelier's principle. (10%)
6. Briefly describe the following terms: (30% total, 3% each)

(1) mean free path	(2) photoelectric effect	(3) electronegativity
(4) buffer capacity	(5) free energy	(6) ionic liquids
(7) osmosis		
(8) London dispersion force	(9) first-order rate law	(10) state function