

科目：普通化學

適用：應光系

編號：395

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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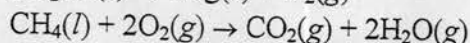
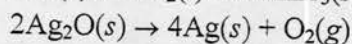
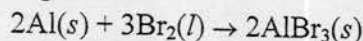
第 1 頁

一、單選題：60%，每小題5%，答錯不倒扣分數

1. The interaction between solute particles and water molecules, which tends to cause a salt to fall apart in water, is called

(A) dispersion
(B) polymerization
(C) polarization
(D) hydration
(E) ionization

2. All of the following reactions



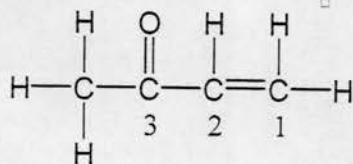
Can be classified

(A) combustion reactions
(B) precipitation reactions
(C) oxidation-reduction reactions
(D) A and B
(E) A and C

3. A sample of nitrogen gas has a volume of 160.0 mL at STP. What volume does the gas occupy if the absolute temperature and pressure are each quadrupled?

(A) 40.0 mL
(B) 640.0 mL
(C) 160.0 mL
(D) 64.0 mL
(E) not enough information.

4. Consider the following Lewis structure. (Lone pairs are not drawn in.)



Which statement about the molecule is *false*?

(A) Oxygen is sp^3 hybridized.
(B) C-2 is sp^2 hybridized with bond angles of 120.
(C) There are 10 sigma and 2 pi bonds.
(D) There are some H-C-H bond angles of about 109° in the molecule.
(E) This molecule contains 28 valence electrons.

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 5. For the hypothetical reactions 1 and 2, $K_1 = 10^2$ and $K_2 = 10^{-4}$.

1. $A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$
2. $2A_2(g) + C_2(g) \rightleftharpoons 2A_2C(g)$
3. $A_2C(g) + B_2(g) \rightleftharpoons 2AB(g) + (1/2)C_2(g)$

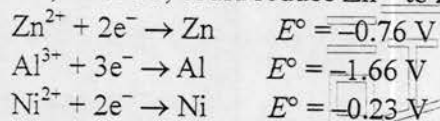
- (A) 10^{-4}
(B) 10^2
(C) 10^6
(D) 10^4
(E) 10^{-2}

6. The sodium salt, NaA, of a weak acid is dissolved in water; no other substance is added. Which of these statements (to a close approximation) is true?

- (A) $[HA] = [OH^-]$
(B) $[H^+] = [A^-]$
(C) $[H^+] = [OH^-]$
(D) $[OH^-] = [A^-]$
(E) none of these

 7. An indicator HIn has $K_a = 1 \times 10^{-8}$. At pH = 6.0, what is the ratio of HIn/In^- ?

- (A) 100/1
(B) 10/1
(C) 1/100
(D) 1/10
(E) 1/1

 8. Which metal, Al or Ni, could reduce Zn^{2+} to $Zn(s)$ if placed in a $Zn^{2+}(aq)$ solution?


- (A) Ni
(B) Al
(C) This cannot be determined
(D) Both Al and Ni would work
(E) none of these

9. Which of the following shows these molecules in order from most polar to least polar?

- (A) $CH_4 > CF_2H_2 > CF_2Cl_2 > CCl_4 > CCl_2H_2$
(B) $CF_2H_2 > CCl_2H_2 > CF_2Cl_2 > CH_4 = CCl_4$
(C) $CH_4 > CF_2Cl_2 > CF_2H_2 > CCl_4 > CCl_2H_2$
(D) $CF_2Cl_2 > CF_2H_2 > CCl_4 > CCl_2H_2 > CH_4$
(E) $CF_2Cl_2 > CF_2H_2 > CCl_2H_2 > CH_4 = CCl_4$

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10. From the following list of observations, choose the one that most clearly supports the conclusion that electrons have wave properties.
- (A) the photoelectric effect
 - (B) the emission spectrum of hydrogen
 - (C) the scattering of alpha particles by metal foil
 - (D) diffraction
 - (E) none of these
11. The elements of Group 5A, the nitrogen family, form compounds with hydrogen that have the boiling points listed below.
- $\text{SbH}_3 -17^\circ\text{C}$, $\text{AsH}_3 -55^\circ\text{C}$, $\text{PH}_3 -87^\circ\text{C}$, $\text{NH}_3 -33^\circ\text{C}$
- The first three elements illustrate a trend where the boiling point decreases as the mass decreases; however, ammonia (NH_3) does not follow the trend because of
- (A) ionic bonding.
 - (B) London dispersion forces.
 - (C) metallic bonding.
 - (D) dipole-dipole attraction.
 - (E) hydrogen bonding.
12. A liquid-liquid solution is called an ideal solution if
- I. it obeys $PV = nRT$.
 - II. it obeys Raoult's law.
 - III. solute-solute, solvent-solvent, and solute-solvent interactions are very similar.
 - IV. solute-solute, solvent-solvent, and solute-solvent interactions are quite different.
- (A) I, II
 - (B) II, III
 - (C) II, IV
 - (D) I, II, III
 - (E) I, II, IV

二、問答題：40%

1. 請解釋何謂共同離子效應(common ion effect)? 並透過舉例之方式，說明如何配製溶液具有共同離子效應。(20%)
2. 請敘述材料與光電科技領域之相關性為何? 發揮你的想像力，盡可能地寫出你的答案。(20%)