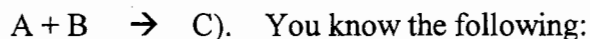


※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

### 一、選擇題：(30%，每題 3 分)

1. Consider a reaction in which two reactants make one product (for example, consider the unbalanced



2.0 mol A (with an excess of B) can make a maximum of 2.0 mol C

3.0 mol B (with an excess of A) can make a maximum of 4.0 mol C

If you react 2.0 mol A and 3.0 mol B, what is the maximum amount of C that can be produced?

(A) 2.0 mol ; (B) 4.0 mol ; (C) 5.0 mol ; (D) 6.0 mol ; (E) More information is needed.

2. Which of the following pairs of substances could form polyester?

(A)  $H_2C=CHCH_3 + CH_3CH_2CH_2COOH$  ; (B)  $HOOC(CH_2)_4COOH + H_2NCH_2CH=CHCH_3$

(C)  $H_2C=CHCN + H_2C=CHCH_3$  ; (D)  $HOCH_2CH_2OH + HOOCCH_2COOH$

(E)  $H_2NCH_2COOH + H_2NCH_2CH_2COOH$

3. Which types of processes are likely when the neutron-to-proton ratio in a nucleus is too large?

I.  $\alpha$  decay ; II.  $\beta$  decay ; III. positron production; IV. electron capture

(A) I, II ; (B) II, III ; (C) III, IV ; (D) II only ; (E) IV only.

4. How many unpaired electrons are found in  $MnCl_4^{2-}$  (tetrahedral)? (Mn:  $[Ar] 4s^2 3d^5$ )

(A) 0 ; (B) 1 ; (C) 2 ; (D) 4 ; (E) 5

5. Choose the correct molecular structure for  $NO_3^-$ .

(A) trigonal bipyramidal ; (B) trigonal planar ; (C) tetrahedral ; (D) octahedral ; (E) None of these

6. Which of the following molecules does *not* have a dipole moment?

(A)  $H_2S$  ; (B)  $H_2O$  ; (C)  $H_2Xe$  ; (D) All of these have a dipole moment. ;

(E) None of these has a dipole moment

7. How many electrons can be described by the quantum numbers  $n = 4, l = 3, m_l = -1, m_s = -1/2$ ?

(A) 0 ; (B) 2 ; (C) 6 ; (D) 8 ; (E) 12

8. The solubility of  $AgCl$  in water is \_\_\_\_\_ the solubility of  $AgCl$  in strong acid at the same temperature.

(A) greater than ; (B) about the same as ; (C) less than ; (D) cannot be determined

9. How many of the following gases at STP are less dense than air at STP?

$NH_3, He, Kr,$  and  $F_2$

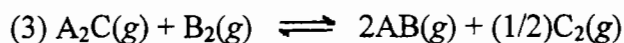
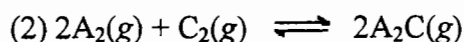
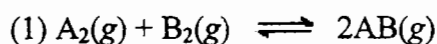
(A) 0 ; (B) 1 ; (C) 2 ; (D) 3 ; (E) 4

系所組別：地科系、生科系、化工系、材料系、環工系

考試科目：普通化學

考試日期：0714，節次：1

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10. For the hypothetical reactions (1) and (2),  $K_1 = 10^2$  and  $K_2 = 10^{-4}$ .What is the value for  $K$  for reaction 3?

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

**二、問答與計算題 (70 % ; 計算與問答題需寫過程否則不予計分)**

- (a) Please provide a simple method to distinguish the strong electrolyte solution, weak electrolyte solution and non-electrolyte solution. (5 %)  
(b) Briefly describe how to obtain the electron mass in the past century. (5 %)
- (a) The conversion of solid carbon from graphite form to its diamond form (i.e.  $C_{\text{graphite}}(s) \rightarrow C_{\text{diamond}}(s)$ ) is very difficult to be measured in a calorimeter (卡計). Now, you are an excellent chemistry. Please provide a simple method to measure the  $\Delta H$  of this reaction. (Hint: Hess's law) (6 %)  
(b) Illustrate four gases which can lead to the "greenhouse effect". (4 %)
- (a) Justify:  $\Delta G = \text{maximum of the useful work at constant pressure and temperature}$  (5%);  
(b) Simply describe the Second Law of Thermodynamics? (3 %)  
(c). Calculate the entropy of a perfect crystal at  $T = 0 \text{ K}$ . (2 %)
- Use the molecular orbital model and draw MO energy-level diagrams to predict the magnetism and bond order of  $C_2$  molecule and  $O_2^{2+}$  ion. (10 %)
- (a) What is the principal driving force for the rule "like dissolves like."? (3 %)  
(b) Based on the thermodynamic concept, please briefly describe why the non-polar molecules do not have a tendency to dissolve in water. (4 %)  
(c) Use the Henry's law to explain the fizzing(冒泡泡) when opening a can of soda. (3%)
- (a) Briefly describe how to get the activation energy of a reaction. (3 %)  
(b) Derive the integrated rate law of the **second-order reaction**. (5 %)  
(c) Draw a **concentration vs. time** plot for a **zero-order** reaction. (2 %)
- (a) How to get the lattice size of a crystal. (3 %)  
(b) Please briefly describe how to get the  $\Delta H_{\text{vap}}$  of a liquid from vapor pressure at different temperature. (4 %)  
(c) Draw the phase diagram of water, in which including the  $T_3$  (triple point) and  $T_c$  (critical temperature) points. (3 %)

**本試題結束**