

# 中山醫學大學 100 學年度碩士班入學招生考試試題

## 應用化學系碩士班

考試科目：普通化學

時間：80 分鐘

※請注意本試題共( 7 )張，如發現頁數不足，應當場請求補齊，否則缺頁部份概以零分計算。第( )頁

本試題共二大題，總分 100 分。

一、選擇題：(每題 3 分)(60%)

1. Ethylenediamine (en) is a bidentate ligand. What is the coordination number of cobalt in  $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$ ?  
(A) four (B) five (C) seven (D) eight (E) six
2. Addition of  $\text{AgNO}_3$  to aqueous solutions of the complex results in a cloudy white precipitate, presumably  $\text{AgCl}$ . You dissolve 0.1000 g of the complex in  $\text{H}_2\text{O}$  and perform a precipitation titration with 0.0500 M  $\text{AgNO}_3$  as the titrant. Using an electrode that is sensitive to  $[\text{Ag}^+]$ , you reach the endpoint after 9.00 mL of titrant are added. How many grams of chloride ion were present in the 0.1000-g sample?  
(A)  $4.50 \times 10^{-4}$  (B)  $5.00 \times 10^{-3}$  (C)  $1.77 \times 10^{-3}$  (D)  $6.38 \times 10^{-2}$  (E)  $1.60 \times 10^{-2}$
3. What is the electron configuration of the  $\text{Mn}(\text{II})$  ion?  
(A)  $[\text{Ar}] 4s^2 3d^2$  (B)  $[\text{Ar}] 4s^1 3d^5$  (C)  $[\text{Ar}] 4s^2 3d^3$  (D)  $[\text{Ar}] 3d^5$   
(E) none of these
4. No atoms are lost from starting material in making which kind of polymer?  
(A) condensation polymer (B) polyester polymer (C) addition polymer  
(D) vulcanized polymer (E) branched polymer
5. A polypeptide is  
(A) an addition polymer of amino acids.  
(B) a condensation polymer of amino acids.  
(C) a polymer of sugar molecules.  
(D) a part of nucleic acids.  
(E) none of these

# 中山醫學大學 100 學年度碩士班入學招生考試試題

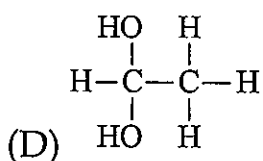
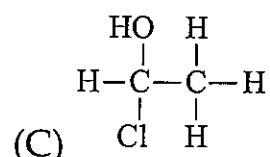
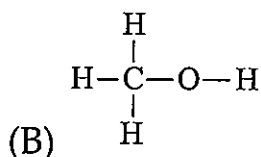
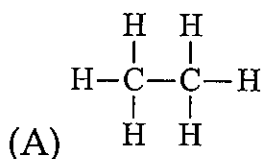
應用化學系碩士班

考試科目：普通化學

時間：80 分鐘

※請注意本試題共( 7 )張，如發現頁數不足，應當場請求補齊，否則缺頁部份概以零分計算。 第( 2 )頁

6. Pick the optically active molecule among the following:



(E) none of these

7. In 1932, James Chadwick bombarded beryllium-9 with alpha particles. One product was a neutron. This led to the direct experimental verification of the existence of neutrons. The other product of Chadwick's nuclear reaction was (A) nitrogen-14 (B) carbon-12 (C) boron-12 (D) helium-4 (E) none of these.

8. A strip of copper is placed in a 1 M solution of copper nitrate and a strip of silver is placed in a 1 M solution of silver nitrate. The two metal strips are connected to a voltmeter by wires and a salt bridge connects the solutions. The following standard reduction potentials apply:



When the voltmeter is removed and the two electrodes are connected by a wire, which of the following does not take place?

- (A) Electrons flow in the external circuit from the copper electrode to the silver electrode.
- (B) The silver electrode increases in mass as the cell operates.
- (C) There is a net general movement of silver ions through the salt bridge to the copper half-cell.
- (D) Negative ions pass through the salt bridge from the silver half-cell to the copper half-cell.
- (E) Some positive copper ions pass through the salt bridge from the copper half-cell to the silver half-cell.

中山醫學大學 100 學年度碩士班入學招生考試試題

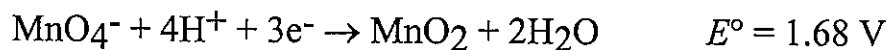
應用化學系碩士班

考試科目：普通化學

時間：80 分鐘

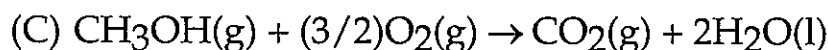
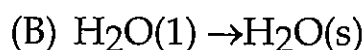
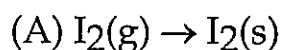
※請注意本試題共( 7 )張，如發現頁數不足，應當場請求補齊，否則缺頁部份概以零分計算。 第( 3 )頁

9. Which of the following is the strongest oxidizing agent?



- (A)  $\text{MnO}_4^-$       (B)  $\text{I}_2$       (C)  $\text{Zn}^{2+}$       (D)  $\text{Zn}$       (E)  $\text{MnO}_2$

10. In which reaction is  $\Delta S^\circ$  expected to be positive?



(E) none of these

11. Which among the following represent a set of isotopes? Atomic nuclei containing:

I. 20 protons and 20 neutrons.

II. 21 protons and 19 neutrons.

III. 22 neutrons and 18 protons.

IV. 20 protons and 22 neutrons.

V. 21 protons and 20 neutrons.

(A) I, II, III      (B) III, IV      (C) I, V      (D) I, IV and II, V

(E) No isotopes are indicated.

12. Which of the following is incorrectly named?

# 中山醫學大學 100 學年度碩士班入學招生考試試題

## 應用化學系碩士班

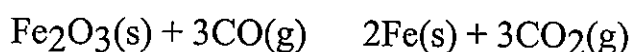
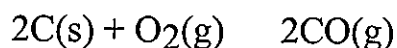
考試科目：普通化學

時間：80 分鐘

※請注意本試題共( 7 )張，如發現頁數不足，應當場請求補齊，否則缺頁部份概以零分計算。 第( 4 )頁

- (A)  $\text{Pb}(\text{NO}_3)_2$ , lead(II) nitrate
- (B)  $\text{NH}_4\text{ClO}_4$ , ammonium perchlorate
- (C)  $\text{PO}_4^{3-}$ , phosphate ion
- (D)  $\text{Mg}(\text{OH})_2$ , magnesium hydroxide
- (E)  $\text{NO}_3^-$ , nitrite ion

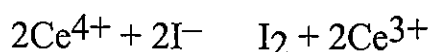
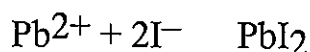
13. Iron is produced from its ore by the reactions:



How many moles of  $\text{O}_2(\text{g})$  are needed to produce 1 mole of  $\text{Fe}(\text{s})$ ?

- (A) 0.5 mole  $\text{O}_2$       (B) 0.75 mole  $\text{O}_2$       (C) 1 mole  $\text{O}_2$       (D) 1.5 mole  $\text{O}_2$
- (E) none of these

14. The following reactions:



are examples of (A) acid-base reactions. (B) unbalanced reactions. (C) precipitation, acid-base, and redox reactions, respectively. (D) redox, acid-base, and precipitation reactions, respectively. (E) precipitation, redox, and acid-base reactions, respectively.

中山醫學大學 100 學年度碩士班入學招生考試試題

應用化學系碩士班

考試科目：普通化學

時間：80 分鐘

※請注意本試題共( 7 )張，如發現頁數不足，應當場請求補齊，否則缺頁部份概以零分計算。 第( 5 )頁

15. It is found that 250. mL of gas at STP has a mass of 1.00 g. What is the molar mass?

- (A) 89.6 g/mol (B) 28.0 g/mol (C) 14.0 g/mol (D) 22.4 g/mol  
(E) 11.2 g/mol

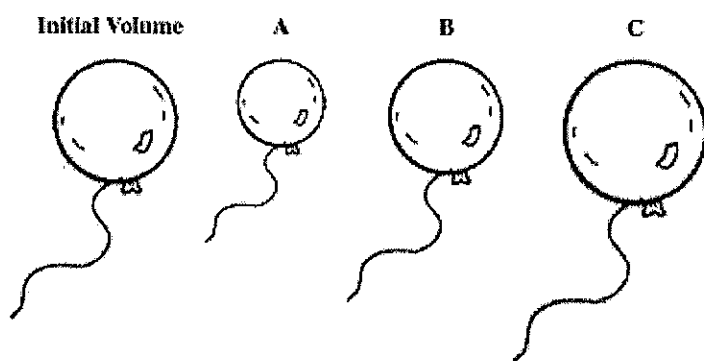
16. An element has the electron configuration  $[\text{Kr}]4d^{10}5s^25p^2$ . The element is a(n)

- (A) nonmetal. (B) transition element. (C) metal. (D) lanthanide.  
(E) actinide.

17. Which of the following molecules has a nonlinear structure?

- (A)  $\text{XeF}_2$  (B)  $\text{BeCl}_2$  (C)  $\text{O}_3$  (D)  $\text{CO}_2$  (E)  $\text{N}_2\text{O}$  (central atom is N)

18. A balloon is filled with helium gas. The temperature is changed from  $50^\circ\text{C}$  to  $-150^\circ\text{C}$  at constant pressure. Select the letter of the balloon diagram that corresponds to the given change in conditions. (A) A (B) B (C) C (D) none of above (E) unchanged.



19. Which of the following is the correct order of boiling points for  $\text{KNO}_3$ ,  $\text{CH}_3\text{OH}$ ,

$\text{C}_2\text{H}_6$ , Ne?

- (A)  $\text{Ne} < \text{CH}_3\text{OH} < \text{C}_2\text{H}_6 < \text{KNO}_3$

- (B)  $\text{KNO}_3 < \text{CH}_3\text{OH} < \text{C}_2\text{H}_6 < \text{Ne}$

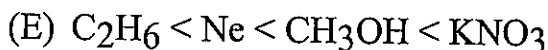
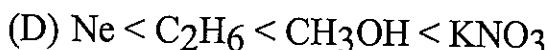
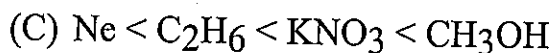
# 中山醫學大學 100 學年度碩士班入學招生考試試題

## 應用化學系碩士班

考試科目：普通化學

時間：80 分鐘

※請注意本試題共( 7 )張，如發現頁數不足，應當場請求補齊，否則缺頁部份概以零分計算。 第( 6 )頁



20. Consider the following system at equilibrium:



Which of the following changes will shift the equilibrium to the right?

- I. increasing the temperature
- II. decreasing the temperature
- III. increasing the volume
- IV. decreasing the volume
- V. removing some  $\text{NH}_3$
- VI. adding some  $\text{NH}_3$
- VII. removing some  $\text{N}_2$
- VIII. adding some  $\text{N}_2$

(A) I, IV, VI, VII

(B) II, III, V, VIII

(C) I, VI, VIII

(D) I, III, V, VII

(E) II, IV, V, VIII

二、問答題：(40%)

1. Describe the preparation of 50 mL of 6.0 M HCl from a concentrated HCl (36.5 g/mol) solution that has a specific gravity of 1.18 and is 37 % (w/w). (10%)
2. Suppose we mix equal volumes of 0.2M  $\text{Pb}(\text{NO}_3)_2(\text{aq})$  and  $\text{KI}(\text{aq})$  at 25°C. Will lead (II) iodide precipitate? ( $K_{\text{sp}}=1.4 \times 10^{-8}$  for  $\text{PbI}_2$  at 25°C) (10%)

# 中山醫學大學 100 學年度碩士班入學招生考試試題

## 應用化學系碩士班

考試科目：普通化學

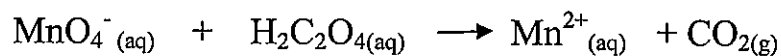
時間：80 分鐘

※請注意本試題共( 7 )張，如發現頁數不足，應當場請求補齊，否則缺頁部份概以零分計算。 第( 7 )頁

3. Chose the correct molecular structure for each compound from the given choices  
(A) Linear (B) trigonal pyramidal (C) trigonal planar (D) tetrahedral (E) octahedral  
(F) none of these (10%)

(1)BF<sub>3</sub> (2)SF<sub>6</sub> (3)CO<sub>2</sub> (4)SO<sub>3</sub><sup>2-</sup> (5)NF<sub>3</sub>

4. Permanganate ions react with oxalic acid in acidic aqueous solution, producing manganese (II) ions and carbon dioxide. The skeletal equation is



Balance the net ionic equation for this reaction. (10%)