國立屏東教育大學 99 學年度學士班轉學考試
普通化學 試題
(化學生物系)

＊注意事項：
(1) 本試題共 4 頁，答案請「橫式」書寫，並依規定上下翻頁，否則不予計分。
(2) 不必抄題，但請依序將題號標出，並寫在答案紙上。

選擇題（每題 4 分，共 100 分）
1. A separation process that depends on differing abilities of substances to form gases is called __________.
   (A) filtration     (B) solvation    (C) distillation     (D) chromatography
   (E) All of the above are correct.

2. Aluminum reacts with a certain nonmetallic element to form a compound with the general formula AlX. Element X is a diatomic gas at room temperature. Element X must be __________.
   (A) oxygen   (B) fluorine    (C) chlorine   (D) nitrogen     (E) sulfur

3. A compound that is composed of carbon, hydrogen, and oxygen contains 70.6% C, 5.9% H, and 23.5% O by mass. The molecular weight of the compound is 136 amu. What is the molecular formula?
   (A) C₈H₄O₂     (B) C₆H₄O     (C) C₄H₄O     (D) C₉H₁₂O     (E) C₈H₆O₂

4. The concentration of species in 500 mL of a 2.104 M solution of sodium sulfate is __________ M sodium ion and __________ M sulfate ion.
   (A) 2.104, 1.052     (B) 2.104, 2.104    (C) 2.104, 4.208     (D) 1.052, 1.052
   (E) 4.208, 2.104

5. The 4d subshell in the ground state of atomic xenon contains __________ electrons.
   (A) 2     (B) 6     (C) 8     (D) 10     (E) 36
6. Of the following elements, __________ has the most negative electron affinity.
   (A) S   (B) Cl   (C) Se   (D) Br   (E) I

7. "Isothermal" means __________.
   (A) at constant pressure
   (B) at constant temperature
   (C) at variable temperature and pressure conditions
   (D) at ideal temperature and pressure conditions
   (E) that $\Delta H_{\text{rxn}} = 0$

8. Which one of the following exhibits dipole-dipole attraction between molecules?
   (A) XeF$_4$   (B) AsH$_3$   (C) CO$_2$   (D) BCl$_3$   (E) Cl$_2$

9. Of the following, a 0.2 M aqueous solution of __________ will have the highest freezing point.
   (A) (NH$_4$)$_3$PO$_4$   (B) Pb(NO$_3$)$_2$   (C) Na$_3$PO$_4$   (D) Mg(NO$_3$)$_2$   (E) NaCl

10. Which energy difference in the energy profile below corresponds to the activation energy for the forward reaction?

   ![Energy Profile Diagram]

   (A) $x$   (B) $y$   (C) $x + y$   (D) $x - y$   (E) $y - x$

11. How is the reaction quotient used to determine whether a system is at equilibrium?
   (A) The reaction quotient must be satisfied for equilibrium to be achieved.
   (B) At equilibrium, the reaction quotient is undefined.
   (C) The reaction is at equilibrium when $Q < K_{\text{eq}}$.
   (D) The reaction is at equilibrium when $Q > K_{\text{eq}}$.
   (E) The reaction is at equilibrium when $Q = K_{\text{eq}}$. 
12. CFC stands for __________.
(A) chlorinated freon compound
(B) chlorofluorocarbon
(C) carbonated fluorine compound
(D) caustic fluorine carbohydrate
(E) carbofluoro compound

13. Which substance is serving as the reducing agent in the following reaction?

\[ 14H^{+} + Cr_{2}O_{7}^{2-} + 3Ni \rightarrow 3Ni^{2+} + 2Cr^{3+} + 7H_{2}O \]

(A) Ni    (B) H^{+}    (C) Cr_{2}O_{7}^{2-}  (D) H_{2}O    (E) Ni^{2+}

14. Which one of the following is a correct representation of a beta particle?

(A) \( \frac{4}{2} e \)    (B) \( \frac{1}{0} \beta \)    (C) \( \frac{0}{1} e \)    (D) \( \frac{0}{-1} e \)    (E) \( \frac{2}{4} \beta \)

15. The correct name of \( H_{2}CO_{3} \) is __________.

(A) hydrogen carbide
(B) hydrogen carbonate ion
(C) carbonate ion
(D) carbonic acid
(E) carboxylic acid

16. How many protons, neutrons, and electrons does the atom \(^{208}\text{Pb}\) have?

(A) 82 protons, 82 neutrons, 82 electrons.
(B) 82 protons, 82 neutrons, 126 electrons.
(C) 82 protons, 82 neutrons, 208 electrons.
(D) 82 protons, 126 neutrons, 126 electrons.
(E) 82 protons, 126 neutrons, 82 electrons

17. A sample of carbon weighing 4.804 g contains how many moles of iron atoms?

(A) 0.400 moles.  (B) 0.500 moles.  (C) 0.800 moles.  (D) 1.000 moles.  (E) 1.200 moles

18. What is the molar mass of ethanol (C\(_3\)H\(_7\)OH)?

(A) 45.07.  (B) 38.90.  (C) 46.07.  (D) 60.09.  (E) 74.12.

19. A 18.23 g sample of HCl is dissolved in water to give \( 2.0 \times 10^{3} \) mL of solution. The concentration of the solution is
(A) 0.25 M.    (B) 0.5 M.    (C) 1.0 M.    (D) 2.0 M.    (E) 4.0 M.

20. For the reaction \( \text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons 2\text{HCl}(\text{g}) \), what is the relationship between \( K \) and \( K_p \) at temperature \( T \)?
(A) \( K = K_p \).  (B) \( K_p = K(RT)^2 \).  (C) \( K = K_p(RT)^2 \).  (D) \( K_p = K(RT) \).  (E) \( K = K_p(RT) \).

21. Which of the following is a conjugate acid-base pair?
(A) \( \text{HCl/NaCl} \).  (B) \( \text{H}_2\text{SO}_4/\text{SO}_4^{2-} \).  (C) \( \text{NH}_4^+/\text{NH}_4\text{C} \).  (D) \( \text{H}_3\text{O}^+/>\text{OH}^- \).  (E) \( \text{NH}_4^+/\text{NH}_3 \).

22. Consider the following molecule.

\[
\text{C}_1\text{C}_2\equiv\text{C}_3\text{C}_4\text{C}_5\text{C}_6
\]

Specify the hybridization of each carbon atom (in numeric order: \( \text{C}-1 \quad \text{C}-2 \quad \text{C}-3 \quad \text{C}-4 \quad \text{C}-5 \quad \text{C}-6 \)).
(A) \( \text{sp} \quad \text{sp}^2 \quad \text{sp}^3 \quad \text{sp}^3 \quad \text{sp}^3 \quad \text{sp}^3 \).
(B) \( \text{sp}^3 \quad \text{sp} \quad \text{sp} \quad \text{sp}^3 \quad \text{sp}^2 \quad \text{sp}^3 \).
(C) \( \text{sp} \quad \text{sp}^2 \quad \text{sp}^2 \quad \text{sp}^3 \quad \text{sp}^3 \quad \text{sp}^3 \).
(D) \( \text{sp}^3 \quad \text{sp} \quad \text{sp} \quad \text{sp}^3 \quad \text{sp}^3 \quad \text{sp}^3 \).
(E) \( \text{sp} \quad \text{sp} \quad \text{sp}^3 \quad \text{sp}^3 \quad \text{sp}^3 \quad \text{sp}^3 \).

23. The carbon atom in \( \text{CH}_2\text{Cl}_2 \) has what hybridization?
(A) \( \text{sp} \).  (B) \( \text{sp}^2 \).  (C) \( \text{sp}^3 \).  (D) \( \text{sp}^4 \).  (E) they are not hybridized

24. Which of the following statements are true of \( \text{sp} \) orbitals?
(A) Orbitals of the \( \text{sp} \) type are 50% \( s \) and 50% \( p \) character.
(B) They are hybrid orbitals.
(C) They are linear.
(D) They result when one \( s \) orbital and one \( p \) orbital are mixed.
(E) all are correct

25. Which of the following molecules are most likely to be held together by a purely covalent bond?
(A) \( \text{NaCl} \)  (B) \( \text{H}_2 \)  (C) \( \text{HF} \)  (D) \( \text{BH}_3 \)  (E) \( \text{KI} \)