

國立屏東大學 106 學年度研究所碩士班入學考試

化學 試題

(應用化學系碩士班)

※請注意：1.本試題共四頁。

2.答案題號須標示清楚，並寫在答案卷上，否則不予計分。

一、選擇題 (每題 3 分，共 75 分)

1. The formula of a salt is XCl_2 . The X-ion in this salt has 28 electrons. The metal X is _____.

- (A) Ni
- (B) Zn
- (C) Fe
- (D) V
- (E) Pd

2. The net ionic equation for formation of an aqueous solution of NiI_2 accompanied by evolution of CO_2 gas via mixing solid NiCO_3 and aqueous hydriodic acid is _____.

- (A) $2\text{NiCO}_3(\text{s}) + \text{HI}(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) + 2\text{Ni}^{2+}(\text{aq})$
- (B) $\text{NiCO}_3(\text{s}) + \text{I}^-(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) + \text{Ni}^{2+}(\text{aq}) + \text{HI}(\text{aq})$
- (C) $\text{NiCO}_3(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) + \text{Ni}^{2+}(\text{aq})$
- (D) $\text{NiCO}_3(\text{s}) + 2\text{HI}(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) + \text{NiI}_2(\text{aq})$
- (E) $\text{NiCO}_3(\text{s}) + 2\text{HI}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) + \text{Ni}^{2+}(\text{aq}) + 2\text{I}^-(\text{aq})$

3. Which electron configuration represents a violation of the Pauli exclusion principle?

- (A)

1s	2s	2p		
↑↓	↑↓	↑		
- (B)

1s	2s	2p		
↑↓	↑↓	↑	↑↓	
- (C)

1s	2s	2p		
↑↓	↑↓	↑↑	↑	↑
- (D)

1s	2s	2p		
↑↓	↑			
- (E)

1s	2s	2p		
↑	↑	↑	↑	↑

4. Which statement about ideal behavior of gases is false?
- (A) At low densities all gases have similar properties.
 - (B) Volume of 2.00 moles of oxygen gas, O_2 , is assumed to be the same as that of 2.00 moles of carbon dioxide gas, CO_2 , as long as the temperature and pressure conditions are the same.
 - (C) Gas ideality assumes that there are no interactions between gas particles.
 - (D) All particles in the ideal gas behave independently of each other.
 - (E) Low pressures and high temperatures typically cause deviations from the ideal gas behavior.
5. For a given substance that exhibits liquid-crystalline properties, the liquid-crystalline state exists _____.
- (A) at one particular temperature below the melting point of the solid
 - (B) in a range of temperatures below the melting point of the solid
 - (C) at one particular temperature above the melting point of the solid
 - (D) in a range of temperatures above the melting point of the solid
 - (E) in a range of temperatures from below the melting point to above the melting point
6. The equilibrium constant for reaction 1 is K . The equilibrium constant for reaction 2 is _____.
- (1) $SO_2(g) + (1/2)O_2(g) \rightleftharpoons SO_3(g)$
 (2) $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$
- (A) K^2
 - (B) $2K$
 - (C) $1/2K$
 - (D) $1/K^2$
 - (E) $-K^2$
7. Photoionization processes (e.g., $N_2 + hv \rightarrow N_2^+ + e^-$) remove UV of <150 nm. Which photoreaction is the principal absorber of UV in the 150-200 nm range in the upper atmosphere?
- (A) $N_2 + hv \rightarrow 2N$
 - (B) $O_2 + hv \rightarrow 2O$
 - (C) $O_3 + hv \rightarrow O_2 + O$
 - (D) $N_2 + O_2 + hv \rightarrow 2NO$
 - (E) $NO + O_2 + hv \rightarrow NO_3$
8. Which substance is serving as the reducing agent in the following reaction?
- $$14H^+ + Cr_2O_7^{2-} + 3Ni \rightarrow 3Ni^{2+} + 2Cr^{3+} + 7H_2O$$
- (A) Ni
 - (B) H^+
 - (C) $Cr_2O_7^{2-}$
 - (D) H_2O
 - (E) Ni^{2+}
9. Atoms with the same atomic number and different mass numbers
- (A) do not exist.
 - (B) are isomers.
 - (C) are isotopes.
 - (D) are allotropes
 - (E) are resonance structures.
10. The correct name for $Na_3[CoF_6]$ is _____.
- (A) trisodium hexakisfluorocobalt(III)
 - (B) trisodium hexakisfluorocobalt(II)
 - (C) trisodium hexakisfluorocobalt(IV)
 - (D) sodium hexafluorocobaltate(III)
 - (E) sodium hexafluorocobaltate(IV)

11. What is the chemical symbol for manganese?
 (A) Hg
 (B) Mg
 (C) Mn
 (D) Na
12. Which subatomic particle has the **smallest** mass?
 (A) a proton
 (B) a neutron
 (C) an electron
 (D) an alpha particle
13. The reaction $\text{Na}_3\text{PO}_4(aq) + 3 \text{AgNO}_3(aq) \rightarrow \text{Ag}_3\text{PO}_4(s) + 3 \text{NaNO}_3(aq)$ is best classified as a(n)
 (A) acid-base neutralization reaction.
 (B) oxidation-reduction reaction.
 (C) precipitation reaction.
 (D) single replacement reaction.
14. Write a balanced net ionic equation for the reaction of $\text{AgNO}_3(aq)$ with $\text{KBr}(aq)$.
 (A) $\text{AgNO}_3(aq) + \text{KBr}(aq) \rightarrow \text{AgBr}(aq) + \text{KNO}_3(s)$
 (B) $\text{Ag}^+(aq) + \text{NO}_3^-(aq) + \text{K}^+(aq) + \text{Br}^-(aq) \rightarrow \text{Ag}^+(aq) + \text{Br}^-(aq) + \text{KNO}_3(s)$
 (C) $\text{Ag}^+(aq) + \text{NO}_3^-(aq) + \text{K}^+(aq) + \text{Br}^-(aq) \rightarrow \text{AgBr}(s) + \text{K}^+(aq) + \text{NO}_3^-(aq)$
 (D) $\text{Ag}^+(aq) + \text{Br}^-(aq) \rightarrow \text{AgBr}(s)$
15. Which contains covalent bonds?
 (A) NaH and HCl
 (B) only HCl
 (C) only NaCl
 (D) only NaH
16. Which molecule has the weakest bonds?
 (A) CF_4
 (B) CCl_4
 (C) CBr_4
 (D) Cl_4
17. Which is the most acceptable electron dot structure for N_2H_2 ?
 (A) $\text{H} - \overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{N}}} - \overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{N}}} - \text{H}$
 (B) $\text{H} - \overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{N}}} = \overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{N}}} - \text{H}$
 (C) $\text{H} - \text{N} \quad \text{N} - \text{H}$
 (D) $\text{H} - \overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{N}}} \equiv \overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{N}}} - \text{H}$
18. Which depends only on the initial and final state?
 (A) q
 (B) w
 (C) $q + w$
 (D) $q - w$
19. Which is the **smallest** quantity of pressure?
 (A) 1 atm
 (B) 1 centimeter of Hg
 (C) 1 mm Hg
 (D) 1 pascal

20. Which has a dipole moment?
(A) CO₂
(B) CO₃²⁻
(C) SO₂
(D) SO₄²⁻
21. When two similar liquids mix to form a solution, the entropy of solution (ΔS_{soln}) is expected to be
(A) negative.
(B) zero.
(C) positive.
(D) negative at low temperatures but positive at high temperatures.
22. When dissolved in water, which of the following compounds is an Arrhenius base?
(A) CH₃OH
(B) HOCl
(C) KOH
(D) KCl
23. For a galvanic cell, the cathode has a _____ sign and is the site of _____.
(A) negative, oxidation
(B) negative, reduction
(C) positive, oxidation
(D) positive, reduction
24. What species is oxidized in the reaction: $\text{CuSO}_4(aq) + \text{Fe}(s) \rightarrow \text{FeSO}_4(aq) + \text{Cu}(s)$?
(A) CuSO₄ (aq)
(B) Fe (s)
(C) FeSO₄ (aq)
(D) Cu (s)
25. What is the oxidation number of N in NH₃?
(A) -3
(B) -1
(C) +1
(D) +3

二、問答題 (共 25 分)

1. 試說明影響平衡常數之因素。(10%)
2. 何謂活化能? 試畫圖說明活化能在化學反應動力學上扮演的角色與重要性?(10%)
3. 請寫出小蘇打(NaHCO₃)的熱裂解反應式。(5%)