

國立屏東教育大學 103 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.本試題共五頁。

2.答案須寫在答案卷上，否則不予計分。

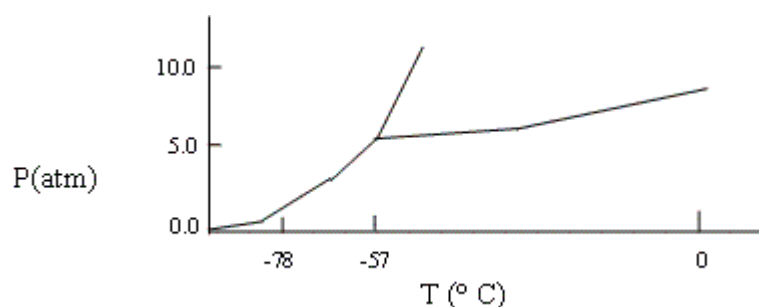
一、選擇題 (每題 3 分，共 75 分)

1. An atom of ^{17}O contains _____ protons.
(A) 8
(B) 25
(C) 9
(D) 11
(E) 17
2. There are _____ mol of carbon atoms in 4 mol of dimethylsulfoxide ($\text{C}_2\text{H}_6\text{SO}$).
(A) 2
(B) 6
(C) 8
(D) 4
(E) 3
3. The internal energy of a system _____.
(A) is the sum of the kinetic energy of all of its components
(B) is the sum of the rotational, vibrational, and translational energies of all of its components
(C) refers only to the energies of the nuclei of the atoms of the component molecules
(D) is the sum of the potential and kinetic energies of the components
(E) none of the above
4. How many unpaired electrons are there in an O^{2-} ion?
(A) 0
(B) 1
(C) 2
(D) 3
(E) This cannot be predicted.

5. The substance with the largest heat of vaporization is _____.
- (A) I_2
 - (B) Br_2
 - (C) Cl_2
 - (D) F_2
 - (E) O_2
6. The rate of a reaction depends on _____.
- (A) collision frequency
 - (B) collision energy
 - (C) collision orientation
 - (D) all of the above
 - (E) none of the above
7. The effect of a catalyst on an equilibrium is to _____.
- (A) increase the rate of the forward reaction only
 - (B) increase the equilibrium constant so that products are favored
 - (C) slow the reverse reaction only
 - (D) increase the rate at which equilibrium is achieved without changing the composition of the equilibrium mixture
 - (E) shift the equilibrium to the right
8. Which one of the following pairs cannot be mixed together to form a buffer solution?
- (A) C_5H_5N , C_5H_5NHCl
 - (B) $HC_2H_3O_2$, $NaOH$ ($C_2H_3O_2^-$ = acetate)
 - (C) KOH , HI
 - (D) NH_2CH_3 , HCl
 - (E) $NaClO$, HNO_3
9. Compounds found in fossil fuels that contain _____ are primarily responsible for acid rain.
- (A) sulfur
 - (B) carbon
 - (C) hydrogen
 - (D) phosphorus
 - (E) neon
10. A reaction that is spontaneous as written _____.
- (A) is very rapid
 - (B) will proceed without outside intervention
 - (C) is also spontaneous in the reverse direction
 - (D) has an equilibrium position that lies far to the left
 - (E) is very slow
11. The electrode at which oxidation occurs is called the _____.
- (A) oxidizing agent
 - (B) cathode
 - (C) reducing agent
 - (D) anode
 - (E) voltaic cell

12. For which compound does 0.256 mole weigh 12.9 g?
- (A) C_2H_4O
 (B) CO_2
 (C) CH_3Cl
 (D) C_2H_6
 (E) $C_2H_4O_2$
13. Which gas has the highest density?
- (A) He
 (B) Cl_2
 (C) CH_4
 (D) NH_3
 (E) All the gases have the same density.
14. The equilibrium constant for $A + 2B \rightleftharpoons 3C$ is 1.0×10^{-6} . Determine the equilibrium constant for $4A + 8B \rightleftharpoons 12C$.
- (A) 4×10^{-6}
 (B) 1.0×10^{-24}
 (C) 1.0×10^{-6}
 (D) 4×10^{-24}
 (E) 1.0×10^{24}
15. At $25^\circ C$, the following heats of reaction are known:
- | | $\Delta H(kJ/mol)$ |
|---|--------------------|
| $2ClF + O_2 \rightarrow Cl_2O + F_2O$ | 167.4 |
| $2ClF_3 + 2O_2 \rightarrow Cl_2O + 3F_2O$ | 341.4 |
| $2F_2 + O_2 \rightarrow 2F_2O$ | -43.4 |
- At the same temperature, calculate ΔH for the following reaction:
- $ClF + F_2 \rightarrow ClF_3$
- (A) -217.5 kJ/mol
 (B) -130.2 kJ/mol
 (C) +217.5 kJ/mol
 (D) -108.7 kJ/mol
 (E) none of these
16. Which of the following is true?
- (A) As long as the disorder of the surroundings is increasing, a process will be spontaneous.
 (B) For any process, ΔS_{surr} and ΔS_{sys} have opposite signs.
 (C) If $\Delta S_{surr} = -\Delta S_{sys}$, the process is at equilibrium.
 (D) ΔH° is zero for a chemical reaction at constant temperature.
 (E) none of these
17. Which of the following would be the best reducing agent?
- (A) Cl_2
 (B) F_2
 (C) Na
 (D) Na^+
 (E) F^-

18. Choose the compound with the most ionic bond.
- LiF
 - KF
 - NaBr
 - RbBr
 - KBr
19. Which of the following is polar?
- XeF₄
 - KrF₂
 - BBr₃
 - NBr₃
 - SBr₆
20. What is the hybridization of the nitrogen atom?
- sp
 - sp²
 - sp³
 - dsp³
 - d²sp³
21. Which of the following compounds has the lowest boiling point?
- CH₄
 - C₂H₆
 - C₃H₈
 - C₄H₁₀
 - C₅H₁₂
22. A crystal of NaCl is
- soft, low-melting, and a good electrical conductor.
 - hard, high-melting, and a good electrical conductor.
 - soft, low-melting, and a poor electrical conductor.
 - hard, high-melting, and a poor electrical conductor.
 - soft, high-melting, and a poor electrical conductor.
23. A sample consisting of CO₂(g) and CO₂(s) at equilibrium at -78°C and 1 atm pressure is heated to -30°C, and the pressure is increased to 8 atm. Based on the phase diagram below, what will happen?



- At equilibrium, only CO₂(g) will be present.
- All the CO₂ will be converted to CO₂(l).
- At equilibrium, CO₂(g) and CO₂(l) will be present.
- The melting point of the CO₂(s) will decrease.
- none of these

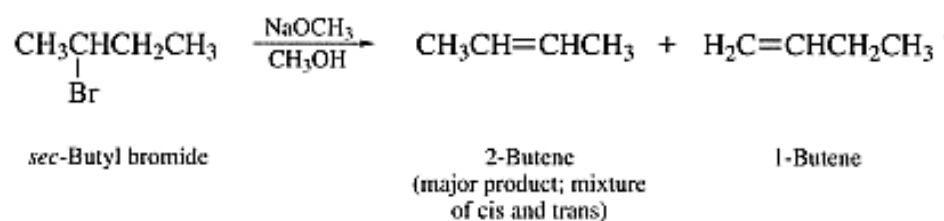
24. A 50.0-g sample of ethyl alcohol (C₂H₅OH) is dissolved in 75.0 g of water. What is the mole fraction of ethyl alcohol??
- (A) 0.207
 (B) 0.414
 (C) 0.342
 (D) 0.667
 (E) none of these
25. Which of the following chemical or physical changes is an endothermic process?
- (A) the evaporation of water
 (B) the combustion of gasoline
 (C) the mixing of sulfuric acid and water
 (D) the freezing of water
 (E) none of these

二、問答題（每題 5 分，共 25 分）

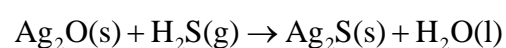
(一) 請解釋 Buffered solutions，並說明其特性。(5%)

(二) 請說明勒沙特列原理(Le Châtelier's Principle)。(5%)

(三) 解釋以下反應的主要產物為何是 2-Butene ? (5%)



(四) 試計算下列反應的 $\Delta H^\circ_{\text{rxn}}$ 。(5%)



Substance	ΔH_f° (kJ/mol)
Ag ₂ O (s)	-31.0
Ag ₂ S (s)	-32.6
H ₂ S (g)	-20.6
H ₂ O (l)	-286

(五) 影響層析管柱分離效率的因素有那些?(5%)