義守大學九十二學年度轉學生入學招生考試
『普通化學』參考試題

請依題序，標明題號清楚做答，否則不予計分。

I. Multiple choice questions: (60%，單選題，請選擇最適當的答案)

1. Which of the following compounds would be expected to be the best solvent for sodium fluoride?

   A. HF(l) **B**. BF_3(l) **C**. CF_4(l) **D**. PF_5(l)

2. Which of the following solids would have the highest melting point? **A**. NaF **B**. NaCl **C**. NaBr **D**. NaI

3. Which of the following atom has the largest atomic radius? **A**. Al **B**. K **C**. S **D**. As

4. Which of the following compounds is expected to have the highest vapor pressure?

   A. $C_2H_5OC_2H_5$ **B**. CH_3CH_2OH **C**. $CH_3CH_2CH_3$ **D**. $CHCl_3$

5. Three 1.0-L flasks are filled with H_2, O_2, and Ne, respectively, at STP. Which of the following statements is true? **A**. There are twice as many O_2 and H_2 molecules as Ne atoms. **B**. The velocity of the gas molecules is the same in all flasks. **C**. The densities of all the gases are the same. **D**. All the flasks have the same number of gas molecules.

6. Which of the following does *not* have a standard enthalpy of formation equal to zero at 25 ℃ and 1.0 atm?

   A. F_2(g) **B**. Al(s) **C**. H_2O(l) **D**. H_2(g)

7. All of the following species would be expected to be able to function as Lewis bases except **A**. OH^- **B**. H_2O **C**. CH_3^+ **D**. NH_3.

8. Which one of the following is a polar molecule? **A**. PBr_5 **B**. CCl_4 **C**. BrF_5 **D**. XeF_2

9. What is the hybridization of the As atom in the AsF_5 molecule? **A**. sp **B**. sp^2 **C**. sp^3 **D**. sp^3d

10. Which one of the following is true with respest to a 0.01 M formic acid solution, HCOOH(aq)?

    A. $[H^+(aq)] < [HCOO^-(aq)]$ **B**. $[H^+(aq)] > [HCOO^-(aq)]$ **C**. pH = 2.0 **D**. pH > 2.0

11. The pH of 0.1 M NH_3 is approximately **A**. 11 **B**. 3 **C**. 7 **D**. 13.

12. Which of the following processes is endothermic? 1. $Li_{(s)} \rightarrow Li_{(g)}$ 2. $Li_{(g)} \rightarrow Li^+_{(g)} + e$ 3. $Cl_{2(g)} \rightarrow 2\ Cl_{(g)}$ **A**. 1, 2, and 3 **B**. 1 and 2 only **C**. 1 only **D**. 2 and 3 only

13. Calcium carbonate is most soluble in: **A**. 0.1 M HCl **B**. 0.1 M NaOH **C**. 0.1 M $CaCl_2$ **D**. water

14. Consider the molar solubility (s) of silver sulfate. Which one of the following relationships is correct? **A**. $2\ [Ag^+] = s$ **B**. $[Ag^+]^2 = s$ **C**. $2\ [SO_4^{2-}] = s$ **D**. $[SO_4^{2-}] = s$

15. Which radiation has the lowest frequency? **A**. gamma rays **B**. X rays **C**. UV light **D**. red light

16. A reaction must be nonspontaneous at all temperatures when **A**. ΔG is negative **B**. ΔH is positive and ΔS is positive **C**. ΔH is positive and ΔS is negative **D**. ΔH is negative and ΔS is negative

17. How many isomeric alcohols with the molecular formula $C_4H_{10}O$ are there? **A**. 5 **B**. 4 **C**. 3 **D**. 2

18. Polymers of amino acid units are called **A**. carbohydrates **B**. proteins **C**. nucleic acids **D**. lipids

19. How many atoms are there in a body-centered cubic unit cell of tungsten? **A**. 1 **B**. 2 **C**. 4 **D**. 6
20. DNA may be represented as a double-coiled chain with the two strands held together by **A**. disulfide bonds. **B**. ionic bonds. **C**. covalent bonds. **D**. hydrogen bonds.

II. Sodium peroxide, Na_2O_2, consists of Na^+ and O_2^{2-} ions.

1. Write Lewis structure of peroxide ion. (2%)
2. Write the molecular orbital energy level diagram of peroxide ion. (4%)
3. Indicate the bond order and magnetic property of peroxide ion. (2%)

III. The reaction A + 2 B $\rightarrow$ C + 2 D is found to be first order in A and first order in B. A proposed mechanism for the reaction involves the following first step: A + B $\rightarrow$ I + 2 D

1. Write a plausible second step in a two-step mechanism. (3%)
2. Is the second step slower or faster than the first step? Explain clearly. (5%)

IV. Miscellaneous:

1. Write equations for the hydrolysis reaction occur in the following solutions, and predict whether the solution is acidic, basic, or neutral. (8%)
   a. CH_3COOK b. $Mg(NO_3)_2$

2. Write the oxidation reaction and the overall cell reaction for the following voltaic cell.
   $Pt \mid H_2(g) \mid H^+(aq) \,//\, Br_2(l) \mid Br^-(aq) \mid Pt$ (8%)

3. Use the following equations
   $C(graphite) + O_2(g) \rightarrow CO_2(g)$ $\Delta H^o = -393.5$ kJ
   $2\ CO(g) + O_2(g) \rightarrow 2\ CO_2(g)$ $\Delta H^o = -566.0$ kJ
   Calculate the standard enthalpy of formation of CO(g). (8%)