

# 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，標明題號清楚作答，否則不予計分。

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

- Which of the following compounds would be expected to be the best solvent for sodium fluoride?  
A. HF(l) B. BF<sub>3</sub>(l) C. CF<sub>4</sub>(l) D. PF<sub>5</sub>(l)
- Which of the following solids would have the highest melting point? A. NaF B. NaCl C. NaBr D. NaI
- Which of the following atom has the largest atomic radius? A. Al B. K C. S D. As
- Which of the following compounds is expected to have the highest vapor pressure?  
A. C<sub>2</sub>H<sub>5</sub>OC<sub>2</sub>H<sub>5</sub> B. CH<sub>3</sub>CH<sub>2</sub>OH C. CH<sub>3</sub>CH<sub>2</sub>CH<sub>3</sub> D. CHCl<sub>3</sub>
- Three 1.0-L flasks are filled with H<sub>2</sub>, O<sub>2</sub>, and Ne, respectively, at STP. Which of the following statements is true? A. There are twice as many O<sub>2</sub> and H<sub>2</sub> 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.
- Which of the following does *not* have a standard enthalpy of formation equal to zero at 25 °C and 1.0 atm?  
A. F<sub>2</sub>(g) B. Al(s) C. H<sub>2</sub>O(l) D. H<sub>2</sub>(g)
- All of the following species would be expected to be able to function as Lewis bases except A. OH<sup>-</sup> B. H<sub>2</sub>O C. CH<sub>3</sub><sup>+</sup> D. NH<sub>3</sub>.
- Which one of the following is a polar molecule? A. PBr<sub>5</sub> B. CCl<sub>4</sub> C. BrF<sub>5</sub> D. XeF<sub>2</sub>
- What is the hybridization of the As atom in the AsF<sub>5</sub> molecule? A. sp B. sp<sup>2</sup> C. sp<sup>3</sup> D. sp<sup>3</sup>d
- Which one of the following is true with respect to a 0.01 M formic acid solution, HCOOH(aq)?  
A. [H<sup>+</sup>(aq)] < [HCOO<sup>-</sup>(aq)] B. [H<sup>+</sup>(aq)] > [HCOO<sup>-</sup>(aq)] C. pH = 2.0 D. pH > 2.0
- The pH of 0.1 M NH<sub>3</sub> is approximately A. 11 B. 3 C. 7 D. 13.
- Which of the following processes is endothermic? 1. Li(s) → Li(g) 2. Li(g) → Li<sup>+</sup>(g) + e<sup>-</sup> 3. Cl<sub>2</sub>(g) → 2 Cl(g) A. 1, 2, and 3 B. 1 and 2 only C. 1 only D. 2 and 3 only
- Calcium carbonate is most soluble in: A. 0.1 M HCl B. 0.1 M NaOH C. 0.1 M CaCl<sub>2</sub> D. water
- Consider the molar solubility (s) of silver sulfate. Which one of the following relationships is correct?  
A. 2 [Ag<sup>+</sup>] = s B. [Ag<sup>+</sup>]<sup>2</sup> = s C. 2 [SO<sub>4</sub><sup>2-</sup>] = s D. [SO<sub>4</sub><sup>2-</sup>] = s
- Which radiation has the lowest frequency? A. gamma rays B. X rays C. UV light D. red light
- 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
- How many isomeric alcohols with the molecular formula C<sub>4</sub>H<sub>10</sub>O are there? A. 5 B. 4 C. 3 D. 2
- Polymers of amino acid units are called A. carbohydrates B. proteins C. nucleic acids D. lipids

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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,  $\text{Na}_2\text{O}_2$ , consists of  $\text{Na}^+$  and  $\text{O}_2^{2-}$  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  $\text{A} + 2\text{B} \rightarrow \text{C} + 2\text{D}$  is found to be first order in A and first order in B. A proposed mechanism for the reaction involves the following first step:  $\text{A} + \text{B} \rightarrow \text{I} + 2\text{D}$

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%)

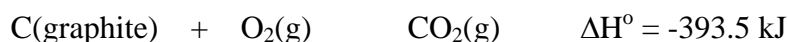
a.  $\text{CH}_3\text{COOK}$

b.  $\text{Mg}(\text{NO}_3)_2$

2. Write the oxidation reaction and the overall cell reaction for the following voltaic cell.

$\text{Pt} \mid \text{H}_2(\text{g}) \mid \text{H}^+(\text{aq}) \parallel \text{Br}_2(\text{l}) \mid \text{Br}^-(\text{aq}) \mid \text{Pt}$  (8%)

3. Use the following equations



Calculate the standard enthalpy of formation of  $\text{CO}(\text{g})$ . (8%)