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# 淡江大學九十一年度日間部轉學生招生考試試題

系別：化學系三年級

科目：普通化學

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轉學生招生考試

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第一部份：選擇題 (單選, 每題 4 分, 共 20 分)

- 1 Which of the following atomic orbital designations are not possible?  
 (a) 2d                      (b) 3p                      (c) 4d                      (d) 5p                      (e) 6s
- 2 How many valence electrons does a carbon atom have?  
 (a) 1                          (b) 2                          (c) 3                          (d) 4                          (e) 6
- 3 Which of the following species has the highest entropy ( $S^\circ$ ) at 25°C?  
 (a) CO(g)                      (b) CH<sub>4</sub>(g)                      (c) NaCl(s)                      (d) H<sub>2</sub>O(l)                      (e) Fe(s)
- 4 The energy released by the sun is the result of:  
 (a) natural radioactivity                      (b) nuclear fission                      (c) nuclear fusion  
 (d) combustion of hydrogen                      (e) photosynthesis
- 5 Iron objects such as storage tanks and underground pipelines can be protected from corrosion by connecting them through a wire to a piece of:  
 (a) Pb                          (b) Ag                          (c) Sn                          (d) Cu                          (e) Mg

第二部份：填充題 (每格 2 分, 共 40 分)

- 6 Give the chemical symbol for each of the following elements:  
 (a) Iron \_\_\_\_\_                      (b) Mercury \_\_\_\_\_  
 (c) Potassium \_\_\_\_\_                      (d) Sodium \_\_\_\_\_
- 7 Use the VSEPR model to predict the geometric shape of each of the following molecules and ions:  
 (a) BO<sub>3</sub><sup>+</sup> \_\_\_\_\_                      (b) O<sub>3</sub> \_\_\_\_\_  
 (c) PCl<sub>3</sub> \_\_\_\_\_                      (d) PbCl<sub>4</sub> \_\_\_\_\_
- 8 Classify the bonds in each of the following substances as ionic, nonpolar covalent, or polar covalent:  
 (a) Cl<sub>2</sub> \_\_\_\_\_                      (b) PCl<sub>3</sub> \_\_\_\_\_  
 (c) LiCl \_\_\_\_\_                      (d) ClF \_\_\_\_\_

◀ 注意背面尚有試題 ▶

本試題雙面印製

淡江大學九十一年度日間部轉學生招生考試試題

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9 What is the chemical composition of each of the following:

- (a) Soda water \_\_\_\_\_ (b) Natural gas \_\_\_\_\_  
 (c) Carbon black \_\_\_\_\_ (d) Chalk \_\_\_\_\_

10 What is the oxidation number of the halogen in each of the following molecules and ions?

- (a)  $\text{ClO}_3^-$  \_\_\_\_\_ (b)  $\text{H}_5\text{IO}_6$  \_\_\_\_\_  
 (c)  $\text{BrF}_3$  \_\_\_\_\_

第三部份：問答題 (每題 4 分, 共 40 分)

11 Sulfur dioxide can behave both as an oxidizing agent and as a reducing agent. Write a balanced equation to show  $\text{SO}_2$  acting as

- (a) an oxidizing agent (b) a reducing agent.

12 Write a balanced equation for the reaction of each of the following with water.

- (a) phosphorus trichloride (b) lithium hydride

13 Describe in terms of  $\sigma$  and  $\pi$  orbital:

- (a) a double bond (b) a triple bond

14 Make qualitative predictions about each of the following solubilities and explain your predictions:

- (a)  $\text{HCl}(\text{g})$  in water and in pentane,  $\text{C}_5\text{H}_{12}(\text{l})$ .  
 (b) Water in liquid  $\text{HF}$  and in gasoline.

15 Predict the sign of the Gibbs free energy change for the reactions at low temperature, for which

- (a)  $\Delta H$  is negative and  $\Delta S$  is positive  
 (b)  $\Delta H$  is positive and  $\Delta S$  is negative

Explain your predictions.

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- 16 Does the concentration of a homogeneous catalyst appear in the rate law for a catalyzed reaction? Explain.
- 17 Explain why oxalic acid can be used to remove rust stains. Write a balanced equation for the reaction involved.
- 18 The value of equilibrium constant for a reaction increases as the temperature is increased. Is the forward reaction exothermic or endothermic? What can one say about the enthalpy change for the reverse reaction?
- 19 Both sodium chloride and magnesium oxide are ionic solids, yet magnesium oxide melts at a temperature about 2000 K higher than sodium chloride. Explain why.
- 20 Explain why the structural isomers dimethyl ether (bp =  $-23\text{ }^{\circ}\text{C}$ ) and ethanol (bp =  $78.3\text{ }^{\circ}\text{C}$ ) differ significantly in their boiling points? What simple chemical test could be used to distinguish ethanol from dimethyl ether?