

“In The Name of God”

Second Trimester Exam

10<sup>th</sup> Grade

Chemistry

February, 2007

*Read every question carefully and answer the questions based on what you are asked.*

*Do not leave any question blank and show your work.*

*You may not leave the exam early; even if you are finished, review the test until the end of the designated time.*

*Show your work on the paper and make sure you write units.*

*Please do not ask any unnecessary questions during the test.*

***Alireza Shirazian***



## Part (II)

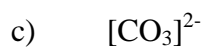
Consider the following bonds and intermolecular forces: 1) ionic 2) polar covalent 3) covalent 4) metallic 5) coordinate covalent 6) London dispersion forces 7) hydrogen bonding 8) van der Waals forces

- 1) Organize all 8 choices from strongest to weakest interactions
- 2) When the electronegativity difference between two elements is more than 2 units, which of the above is most likely to form?
- 3) If two atoms are bonded in a way that one member of the pair is supplying both electrons that are shared, what is this type of bond called?
- 4) Which two forces hold water molecules together and which one of those accounts for water's abnormally high boiling point?
- 5) Which one of the above mentioned forces/bonds exist between molecules of non-polar compounds?
- 6) Which of the two forces (6) or (8) would you expect to see between ionic compounds rather than covalent compounds?
- 7) What is a hydrogen bond? Draw an example of hydrogen bond between two molecules:

- 8) For compounds with similar intermolecular forces, how does the boiling point change as the molar mass of the substance is increased?
- 9) Suppose we have the following two compounds:  $C_6H_{12}O_6$  and  $C_6H_{12}S_6$ . Which one would you expect to have a higher boiling point and why?
- 10) State whether each the following phase changes is exothermic or endothermic and give your reasoning for your answer:
- a) Sublimation
  - b) Freezing
  - c) Melting
  - d) Boiling
  - e) Condensation

### Part (III)

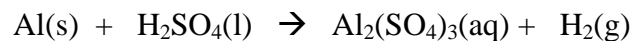
Write the Lewis structures and shapes of the following molecules. Please note that each of these have only ONE central atom



### Part (IV)

- 1) Suppose the empirical formula of a compound is  $B_2H_2$  and the molar mass is 54 grams per mol; what is the molecular formula?
- 2) Determine the empirical formula for a compound that is 77.3% silver, 7.4% phosphorus and 15.3% oxygen:
- 3) Determine the percent composition of sodium in  $Na_2C_2O_4$
- 4) Calculate the number of molecules in 1.05 mol of phosphorous trichloride:
- 5) If 1.05 mol of phosphorus trichloride separates into individual ions, how many moles of chlorine would we have?

6) Aluminum will react with sulfuric acid in the following reaction:



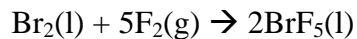
- Balance the equation
  - How many moles of  $\text{H}_2\text{SO}_4$  will react with 18 mol of Al?
- 7) Write the equation for combustion of  $\text{C}_3\text{H}_8$  and balance it; then find how many grams of  $\text{CO}_2$  would form from 3.85 mol of  $\text{C}_3\text{H}_8$ :

8) Consider the following balanced equation:



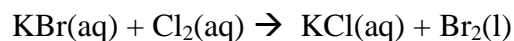
- What type of reaction is this?
- What mass of oxygen is produced from 1.840 mol of  $\text{H}_2\text{O}_2$ ?
- How many *milliliters* of oxygen is that given that the density of oxygen is 1.429 g/L

9) Consider the reaction below:



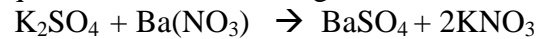
- How many molecules of  $\text{Br}_2$  react with  $1.11 \times 10^{20}$  molecules of  $\text{F}_2$ ?
- How many moles of  $\text{BrF}_5$  will be produced?

10) Consider the reaction:

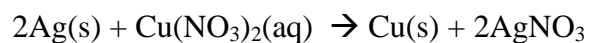


- Balance the reaction
- When 0.855 grams of  $\text{Cl}_2$  and 3.205 grams of  $\text{KBr}$  are mixed in solution, find how many grams of  $\text{Br}_2$  are formed (after determining the limiting reagent)
- What is the percent yield if only 1.24 grams of  $\text{Br}_2$  is formed?
- What would have been the limiting reagent had we used 0.5 mol of  $\text{KBr}$  and 0.25 mol of  $\text{Cl}_2$

11) Write the net ionic equation for the following reaction:

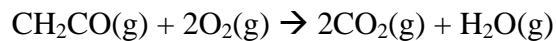


12) Based on the activity series chart, is the following reaction possible? Why or why not?

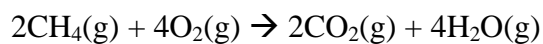


### Part(V)

Consider the following two reactions:

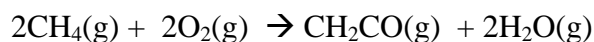


And



- 1) Use enthalpy of formation values (given to you along with the periodic table) to calculate the enthalpy change in each of the above reactions

- 2) Suppose the above equations are 2 steps for the overall reaction:



Use Hess's law and values that you found in part (a) to find the enthalpy change for the overall reaction.

- 3) Use values for entropy of formation to calculate the entropy of the overall reaction that was given in part (b)





## Part (VII)

- 1) Explain Rutherford's experiment
- 2) What is a calorimeter and what do we use it for?
- 3) Using Gibb's free energy equation, mention the 4 conditions with respect to enthalpy and entropy changes that would result in spontaneous or non-spontaneous reactions (in other words, explain how you would determine whether a reaction is spontaneous)
- 4) Define heat and define temperature and state how they are different:
- 5) What do you understand by looking at  $\Delta H$  value of a reaction? How about  $\Delta S$ ?  
How about  $\Delta G$ ?

- 6) What is the relationship between bond length, bond energy and bond strength?
- 7) What 3 differences between ionic compounds, metallic compounds and covalent compounds (in terms of composition, electrical conduction, heat conduction or other)

**Extra Credit Questions:**

- 1) Write the electron configuration of Ho?
- 2) After mixing 4.65 grams of sodium sulfide and 8.95 grams of lead(II) nitrate, what mass of precipitate will form? (First write and balance the reaction)
- 3) Perform the calculations to determine the empirical formula of a CHNO compound that is analyzed and found to contain 52.63% carbon, 7.02% hydrogen and 12.28% nitrogen
- 4) A 5.024 mg of a compound, upon combustion yields 13.90 mg of CO<sub>2</sub> and 6.048 mg of H<sub>2</sub>O. What is the empirical formula of this compound if the percent yield is 90%?
- 5) What is the hybridization of C<sub>2</sub>H<sub>2</sub>?