Chemistry 2720 Fall 2001 Assignment 1

Due: Tuesday, Sept. 11, 9:25 a.m.

This assignment is intended to help you recognize the basic skills you will need to succeed in this course. The skills tested here are things you should be able to do without the assistance of reference materials (textbooks, periodic tables, etc.). Of course, you may find that you need to do a little review to complete this assignment, but if you experience serious difficulty then you will need to spend a significant amount of effort reviewing the material from prerequisite courses.

Note that you are of course not expected to memorize the values of constants such as the ideal gas constant, properties of water, thermodynamic quantities, etc. You can look up any data you need for this assignment which is not given here in your textbook.

1. Give chemical formulas for each of the following chemical species: [1 mark each]
   (a) barium fluoride
   (b) sodium carbonate
   (c) carbonic acid
   (d) lead (II) acetate decahydrate
   (e) sodium ion
   (f) ammonia
   (g) dichlorine heptoxide
2. Balance the following chemical reactions: [2 marks each]
   (a) The combustion of methanol (CH_3OH).
   (b) Sodium chloride dissolves in water.
   (c) The reaction of carbon dioxide with water to form a common acid.
   (d) The precipitation which occurs when a solution of bismuth (III) nitrate is mixed with a solution of sodium sulfide. (Sulfur is in the same group as oxygen.)

3. A 20.5 mL aqueous sample was found to contain 1.3 ng of lead. What is the molarity of lead in the sample? [2 marks]

4. Lead (II) carbonate is highly insoluble in water. One strategy for removing lead from solution is therefore to add a soluble carbonate. A solution with a volume of 1.4 L contains 0.034 mol/L of lead (II) ions. What is the minimum volume of 0.5 mol/L sodium carbonate solution required to remove all the lead, assuming 100% yield? [4 marks]

5. A glass bulb with a volume of 600 mL holds a pressure of 0.80 atm of nitrogen gas at 20°C. What is the mass of gas in the bulb? [5 marks]

6. A strong acid reacts with a strong base. Using the thermodynamic tables (Appendix B) in your textbook, estimate the enthalpy change per mole of base neutralized. [2 marks]

   Note: For reasons which we will discuss in class, the enthalpy of formation of a hydrogen ion is 0.

7. Calculate the heat required to take 1.2 g of liquid water at 20°C and completely convert it to steam at 120°C. [5 marks]

   Hint: The data you need is in Appendix C of your textbook.

8. Evaluate the following mathematical expressions: [2 marks each]

   (a) $\frac{d}{dx}\left(3x^3+2x^2+x+1\right)$

   (b) $\int_4^5 \frac{dx}{x}$

   (c) $\int_1^2 \frac{2x^2+1}{x^2}dx$