

Exam #1
Chem 121

Name _____
October 10, 2005

$$N_A = 6.022 \times 10^{23} \text{ entities/mol}$$

Please express your answers with the proper units and the appropriate number of significant figures.

1. (10) A cup of coffee contains about 125 mg of caffeine ($C_8H_{10}N_4O_2$).

(a) Express this mass in grams.

(b) What is the molar mass of caffeine?

(c) How many moles of caffeine molecules are in a cup of coffee?

(d) How many caffeine molecules are in a cup of coffee?

2. (10) Consider the following substances. Mark each with all the terms that apply. For example, if the substance is an element that contains covalent bonds, and none of the other categories apply, mark it "E, CB."

E = element

C = compound

IC = ionic compound

IB = contains ionic bonds

CB = contains covalent bonds

M = exists as molecules



3. (16) In one or two complete sentences, define or explain each of the following terms. In addition, give an example to illustrate each term.

(a) chemical change

(b) isotope

(c) ionic bond

(d) homogeneous mixture

4. (10) A compound of bromine and fluorine contains 58.37 % bromine and 41.63 % fluorine.

(a) Determine the empirical formula of the compound.

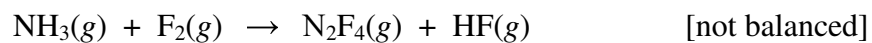
(b) Give two possible molecular formulas that would be consistent with the empirical formula you determined.

5. (10) A 0.150 M NaCl solution is referred to as a physiological saline solution because it has the same concentration of salts as normal human blood.

(a) Calculate the mass of NaCl needed to prepare 275.0 mL of a physiological saline solution.

(b) If the solution in part (a) is to be prepared by dilution of a 1.0 M NaCl solution, what volume of 1.0 M NaCl will be needed?

6. (16) Ammonia will react with fluorine to produce dinitrogen tetrafluoride and hydrogen fluoride (used in production of aluminum, in uranium processing, and in frosting of light bulbs).



(a) Balance the equation above.

(b) If 111 g NH_3 and 222 g F_2 are combined, which reagent will be limiting? Be sure to show your work.

(c) How many grams of HF can be formed?

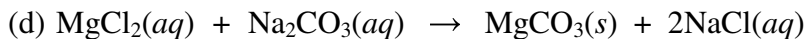
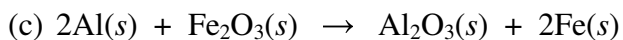
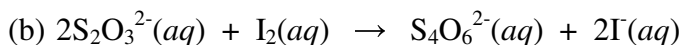
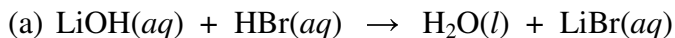
(d) If the percent yield of HF is 83.6%, how many grams of HF are actually produced?

7. (20) Classify each of the following reactions as acid/base, redox, or precipitation. If the reaction is:

a precipitation reaction, write the net ionic equation.

an acid/base reaction, circle the acid.

a redox reaction, assign oxidation numbers to all atoms in the reaction, and circle the oxidizing agent.



8. (8) Mark each of the following statements true or false.

___ (a) All neutral atoms of tin have 50 protons and 50 electrons.

___ (b) Ionic compounds may carry a net positive or negative charge.

___ (c) When a metal combines with a non-metal, a covalent bond is normally formed.

___ (d) Some molecular compounds dissolve in water to produce solutions that conduct electricity.