Chemistry 140 Name(s):

Exercise 5 : Chemical equations, stoichiometry and making solutions

1. **Translate** the following phrases into the proper chemical symbols:

a. two moles of carbon dioxide gas

b. one mole of diatomic hydrogen gas

c. two moles of monatomic hydrogen metal

d. two moles of carbonate ion in solution

2. Balance the following **chemical equations**:

a. _____ C_5H_{12} (l) + _____ O_2 (g) → _____ CO_2 (g) + _____ H_2O (l)

b. _____ $C_6H_{12}O_6$ (s) + _____ O_2 (g) → _____ CO_2 (g) + _____ H_2O (l)

c. _____ Al_2O_3 (s) + _____ H_2SO_4 (aq) → _____ $Al_2(SO_4)_3$ (s) + _____ H_2O (l)

d. _____ $(NH_4)_2Cr_2O_7$ (s) → _____ Cr_2O_3 (s) + _____ H_2O (l) + _____ N_2 (g)

3. Given the not-necessarily-balanced equation:

$Na_2CO_3(aq) + CaSO_4(aq) \rightarrow CaCO_3(s) + Na_2SO_4(s)$

a. Balance the equation.

b. If 100.01 g of calcium carbonate are precipitated in this reaction, what mass of sodium carbonate was needed for the reaction?

c. What mass of calcium sulfate was needed?

d. Suppose 200.00 g of sodium carbonate were added to the mass of calcium sulfate you found in part c. How much calcium carbonate would be precipitated?

Biodiesel, the methyl ester of ω-6,9-linoleic acid has the chemical formula $C_{20}H_{36}O_{2.}$

4. Given that chemical formula, determine the percent composition of biodiesel. In other words, find the mass percents of carbon, hydrogen and oxygen in biodiesel. (Hint: there is a built-in check)

5. Write the **balanced equation** for the complete **combustion** of biodiesel. Keep in mind that biodiesel contains some oxygen!

6. If 20.000 g of biodiesel was completely combusted (this means that oxygen gas is in excess), what mass of **carbon dioxide** would be introduced into the atmosphere?

Chemical recipes: There are many different ways of writing these, but the two principal tasks in preparing solutions are given below.

Making a solution from a dry material: "Add ___ grams of (the name of the dry chemical) to a sufficient volume of distilled water. Stir thoroughly to dissolve the solute, then add enough distilled water to make _____ L (or mL) of _____ M (the name of the dry chemical) solution, and stir thoroughly again."

Diluting a concentrated solution: "To a small volume of distilled water, add ____ mL (or L) of ____ M stock (name of chemical) solution. Stir thoroughly, then add enough distilled water to make _____ L (or mL) of _____ M (the name of the chemical) solution, and stir thoroughly again."

For the following questions, decide which type of recipe is needed, then write out the recipe, using the appropriate template above. Note that these are solutions you are using in exercise 5. Assume that you are trying not to make excess reagent in the scenarios below.

7. Each partnership in Chemistry 140 will use 2 mL of 0.1 M HCl for a future lab. There are seventy partnerships in the different sections of Chem 140 this quarter. On the stockroom shelf, you find 12 M stock HCl solution in a bottle.

8. Each partnership in Chemistry 140 will use 2 mL of 0.1 M $AgNO_3$ for the same future lab. There are seventy partnerships in the different sections of Chem 140 this quarter. On the stockroom shelf, you find powdered $AgNO_3$ in a bottle.