# PRACTICE #5 STOICHIOMETRY MADNESS!!!!!!

1. Calculate the percent composition of $C_{12}H_{22}O_{11}$.

2. When a mixture of 10.0 g. of acetylene ($C_2H_2$) and 10.0 g. of oxygen ($O_2$) is ignited, the resultant combustion reaction produces $CO_2$ and $H_2O$.

    a. Write the balanced chemical equation for this reaction.
    b. Which is the limiting reactant?
    c. How many grams of $C_2H_2$, $O_2$, $CO_2$, and $H_2O$ are present after this reaction is complete?

3. A particular high sulfur coal contains 2.5% sulfur by mass. When this coal is burned, the sulfur is converted into sulfur dioxide gas. To remove this sulfur dioxide gas from the exhaust (which will combine with water in the upper atmosphere to form sulfuric acid) scientists have devised a way to chemically treat it. The sulfur dioxide reacts with calcium oxide to form solid calcium sulfite.
    a. Write the balanced chemical equation(s) for this reaction(s).
    b. If the coal is burned in a power plant that uses 2000 tons of coal per day, what is the daily production of calcium sulfite?

4. If an automobile travels 125 miles with a gas mileage of 19.5 mi/gal, how many kilograms of $CO_2$ are produced? Assume that the gasoline is composed of pure octane, $C_8H_{18}(l)$, with a density of 0.69g/ml.

5. Combustion analysis of toluene, a common organic solvent, gives 5.86 mg of $CO_2$ and 1.37 mg of $H_2O$. If the compound contains only carbon and hydrogen,
    a. What is its empirical formula?

6. Menthol, the substance we can smell in a mentholated cough drop, is composed of C, H, and O. A 0.1005 gram sample of menthol is combusted, producing 0.2829 g. of $CO_2$ and 0.1159 g. of $H_2O$.
    a. What is the empirical formula for menthol?
    b. If the compound has a molecular mass of 156 g/mol, what is its molecular formula?

ANSWERS TO STOICH MADNESS:

1. 42.10% C, 6.49% H, 51.41% O

2A. $2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

2B. Oxygen is the limiting reagent

2C. $O_2$ is all used up(limiting reagent), 11.00 g. $O_2$, 6.74 g. $C_2H_2$, 2.25 g. $H_2O$

3A. $S + O_2 \rightarrow SO_2$ or $S_8 + 8O_2 \rightarrow 8SO_2$

$SO_2 + CaO \rightarrow CaSO_3$

3B. 187.36 tons of $CaSO_3$ per day.

4. 51.59 kg of $CO_2$

5. Empirical formula calculations give you a 1.14 H : 1.00 C ratio

So, multiply by seven for 8H : 7C. Empirical formula is $C_7H_8$.

6. Hint: All of the carbon in the carbon dioxide had to come from the fuel. Likewise, all of the hydrogen in the water had to come from the fuel. Oxygen was used to combust the fuel, as well as being a component of the fuel itself. So the amount of oxygen that came from the fuel cannot be distinguished from the oxygen used in combustion. Therefore, the oxygen amount can only be determined by analyzing how much mass of the fuel is left after the carbon and hydrogen have been subtracted. The remaining mass has to be oxygen mass.

A. $C_{10}H_{20}O$ (empirical formula)

B. B. The molecular formula is the same as the empirical, $C_{10}H_{20}O$