Chem 226/ Dr. Rusay

Olfaction [Part II: Odors and Molecular Formulas]

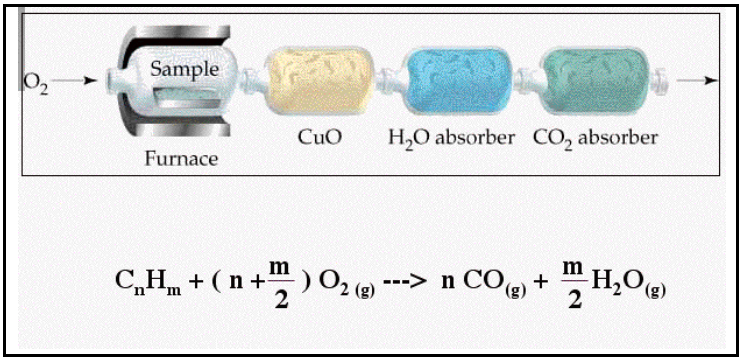
Most of the flavors and fragrances that you are familiar with such as some of those used in Part I come from natural sources. It has long been an interest of science to determine what is smell and odor. A molecular theory of and a model for smell has evolved, which produced a Nobel prize in 2004. For background references see:

http://chemconnections.org/organic/chem226/Labs/Smell/smell-links.html

Your group is now to consider the question: *Is there a correlation between odor and molecular formula?* The molecular identity of an organic compound is determined from its physical properties and data from various chemical and instrumental methods of analysis. A common method that is still used today is combustion analysis, which produces weight percent data for a pure sample that is used to calculate the compound's molecular formula. I have calculated the molecular formula for certain compounds. They are included in the Table that is to be turned in. Your group is to complete the entire Table from the data provided. Each member should individually do at least one calculation. If you don't recall the calculations consult a General Chemistry textbook for an example. There are a few in the lab for your use. After obtaining all of the formulas, complete the accompanying form, compare the molecular formulas to the accepted categories assigned to the samples from **Part I**, which are provided. Under comments, report whether or not there is any correlation between a certain smell and a general type of molecular formula. Turn in the form before leaving the lab. Include the names of those group members who participated. Keep a separate copy for your group's reference.

Individually, answer the questions that follow the group form. They are to be turned in at the start of the next lab period.

A combustion apparatus is illustrated below with the representative generic reaction stoichiometry for the combustion of a hydrocarbon.



$$C_nH_m + \left(n + \frac{m}{2}\right) O_{2\,(g)} \longrightarrow n\,CO_{(g)} + \frac{m}{2} H_2O_{(g)}$$

Combustion data for O-7:

A sample of **O-7** weighing 0.3339 g was burned as above, producing 0.8329 g of CO_2 and 0.4120 g of water. The mass of the molecule was determined from the molecular ion in its mass spectrogram. It is 88.15 amu which is equivalent to 88.15 g / mol. (NOTE: The molecule has a general formula of $C_xH_yO_z$.)

Name: _____ Sec. _____

Olfaction [Part II (Individual)]: Odor and Molecular Formulas
(Individual assignment: Everyone is to turn in a form.)

1. Show your calculation for the molecular formula of O-7.

2. Sketch your interpretation of the process involved in smell on a molecular level, where a person detects a molecule of compound ***X*** which has a shape that is a *sphere*. Your sketch should show how molecule ***X*** interacts with the cells and tissue in your nose to ultimately produce a signal that is transduced (transmitted) to your brain resulting in a memory of that molecular-odor stimulus. Label the drawing.
   Consult: *http://chemconnections.org/organic/chem226/Labs/Smell/smell-links.html*

3. Provide a second drawing on a molecular level that can explain odor selectivity and a short sentence or two describing your theory accounting for different smells; i.e., why there are different smells for different molecules. Use simple geometrical shapes to illustrate your model.