CHEM 130 Quiz 4

Name _____Fall 2017

Complete the following problems. You must show your work to receive full credit. Show your answers to the correct number of significant figures with the correct units.

- 1. One prescription medication for asthma is an inhaler containing albuterol, whose molecular formula is $C_{13}H_{21}NO_3$. Over 18 million prescriptions for albuterol were filled in 2016, making it the third most prescribed drug in the US. Answer the following regarding albuterol.
 - a. What is the mass percent of nitrogen in albuterol? (8 pts.)

First, you must determine the molar mass of albuterol, which is 239.315 g/mol. Then:

$$\frac{14.0067 \text{ g N}}{239.315 \text{ g albuterol}} \times 100\% = 5.8528\%$$

b. If 100.0 doses of albuterol retail for \$85.00 and each dose contains 180 μg of the active ingredient, what is the price of one mole of albuterol? (8 pts.)

2. Adenine, a component of nucleic acids, has a mass percent composition of 44.45% C, 3.73% H and 51.82% N. Its molecular mass is 135.14 grams per mole. What are the empirical and molecular formulas for adenine? (9 pts.)

There are at least two approaches to this problem. I'll show you two, either approach is fine.

Approach 1:

Let's assume we have 100 g of adenine. Then we will have 44.45g C, 3.73g H and 51.82g N. How many moles of each?

$$44.45 \frac{g \cdot C}{12.011 \frac{g \cdot C}{1}} = 3.70 \text{ mol C}$$
 $3.73 \frac{g \cdot H}{1.00794 \frac{g \cdot H}{1}} = 3.70 \text{ mol H}$

Similarly, we find we have 3.70 mol N.

Therefore, our empirical formula is $C_{3.70}H_{3.70}N_{3.70}$, or $C_1H_1N_1$ (or CHO). If this were also the molecular formula, the formula weight would be equal to the molecular mass. For the empirical formula, the formula weight is 29.02 g/mol, which is one fifth (135.14/27.02 = 5.00) of the molecular mass, therefore, the molecular formula must be $C_5H_5N_5$.

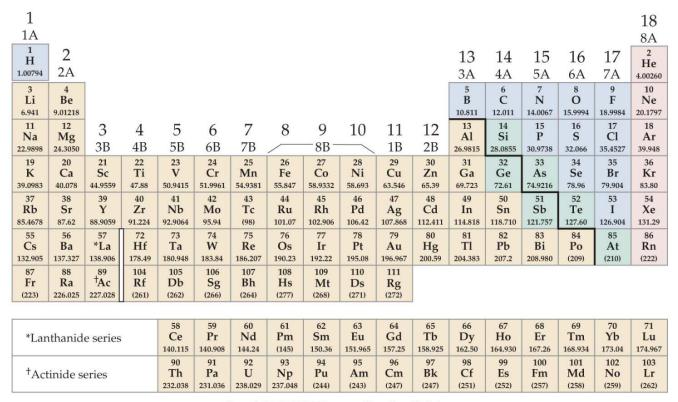
Approach 2:

We know that one mole of adenine has a mass of 135.14 grams and we know the percent composition of adenine, so we can calculate how many moles of each atom must be present in one mole of adenine.

Therefore, our <u>molecular formula</u> must be $C_5H_5N_5$ and the empirical formula is $C_1H_1O_1$ or CHO.

Possibly Useful Information

% by mass = $\frac{\text{g component}}{100 \text{ g sample}}$	$N_A = 6.02 \times 10^{23}$
Don't walk between parked carsor moving ones!	$1 \text{ cm}^3 = 1 \text{ mL}$ $1000 \text{ cm}^3 = 1 \text{ L}$



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