Name:_____

SCH 3U Formula Quiz

1. Given that a compound is 48.64 % carbon, 8.16 % hydrogen and 43.20 % oxygen by mass and that the mass of one mole of this compound is 296.32 g/mol, show a complete calculation for the molecular formula of this compound.

In a 100 g sample:

C: $48.64\ g \times \frac{1\ mol}{12.01\ g} = 4.050\ mol \div 2.700\ mol = 1.500 \times 2 = 3.000 \simeq 3$

H: $8.17\ g \times \frac{1\ mol}{1.01\ g} = 8.089\ mol \div 2.700\ mol = 2.996 \times 2 = 5.992 \simeq 6$

O: $43.20\ g \times \frac{1\ mol}{16.00\ g} = 2.700\ mol \div 2.700\ mol = 1.000 \times 2 = 2.000 \simeq 2$

Therefore the empirical formula is $C_3H_6O_2$

The empirical mass is:

C: 3 x 12.01 g = 36.03 g
H: 6 x 1.01 g = 6.06 g
O: 2 x 16.00 g = 32.00 g
74.09 g

Number of Empirical Units are:

$\frac{\text{molecular mass}}{\text{empirical mass}} = \frac{296.32\ g}{74.09\ g} \simeq 4$

$\therefore 4 \times C_3H_6O_2 = C_{12}H_{24}O_8$ is the molecular formula

2. Perform a complete percentage my mass calculation for ammonium phosphate ➜ $(NH_4)_3PO_4$

N: 3 x 14.01 = 42.03 g

H: 12 x 1.01 = 12.12 g

P: 1 x 30.97 = 30.97 g

O: 4 x 16.00 = 64.00 g

149.12 g

$$\% N = \frac{\text{mass N}}{\text{mass } (NH_4)_3PO_4} \times 100\%$$

$$\% N = \frac{42.03 \text{ g}}{149.12 \text{ g}} \times 100\%$$

% N = 28.19 % N

$$\% H = \frac{\text{mass H}}{\text{mass } (NH_4)_3PO_4} \times 100\%$$

$$\% H = \frac{12.12 \text{ g}}{149.12 \text{ g}} \times 100\%$$

% H = 8.13% H

$$\% P = \frac{\text{mass P}}{\text{mass } (NH_4)_3PO_4} \times 100\%$$

$$\% P = \frac{30.97 \text{ g}}{149.12 \text{ g}} \times 100\%$$

% P = 20.77 % P

$$\% O = \frac{\text{mass O}}{\text{mass } (NH_4)_3PO_4} \times 100\%$$

$$\% O = \frac{64.00 \text{ g}}{149.12 \text{ g}} \times 100\%$$

% O = 42.92 % O

3. Give an example of a chemical formula that is clearly a molecular formula and not an empirical formula. What is it about this formula that makes it impossible for it to represent a empirical formula.

$C_6H_{12}O_6$, P_4O_{10}, C_2H_6

All of these formula can be reduced (CH_2O, PO_5, CH_3)