

Example completed at end of lecture on 10/10/07:

Note Update ↓

Combustion Analysis Example

Caproic acid, the compound responsible for the unpleasant aroma of dirty socks, contains only C, H, and O.

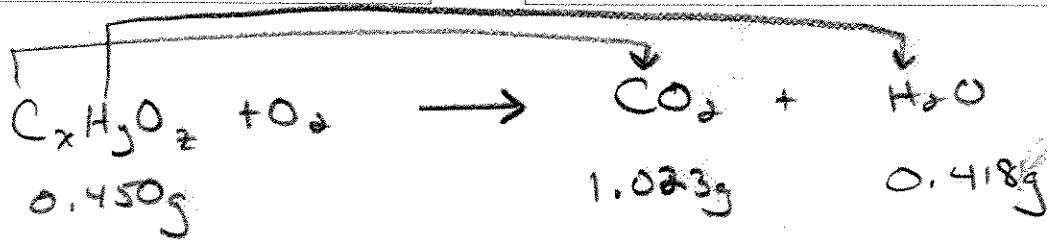
When a 0.450-g sample of the compound is burned in oxygen, 1.023 g of CO<sub>2</sub> and 0.418 g of H<sub>2</sub>O are collected.

What is the empirical formula of the compound?

Combustion Analysis Example (continued):

1. Consider the reaction occurring:
2. Calculate the moles of C in the CO<sub>2</sub>:
3. Calculate the moles of H in the H<sub>2</sub>O:
4. Calculate the mass of O in the compound:  
4b) calculate mole O
5. Calculate the moles of each element in the compound and their ratios to find the empirical formula:

Step 1



Step 2

$$\frac{1.023g CO_2}{44.01g CO_2} \times \frac{1 mol CO_2}{1 mol CO_2} \times \frac{1 mol C}{1 mol CO_2} = 0.02324 mol C$$

Step 3

$$\frac{0.418g H_2O}{18.02g H_2O} \times \frac{1 mol H_2O}{1 mol H_2O} \times \frac{2 mol H}{1 mol H_2O} = 0.0464 mol H$$

Step 4a

$$\text{Mass C from cpd} = \frac{0.02324 mol}{1 mol C} \times 12.01g C = 0.279g C$$

$$\text{Mass H from cpd} = \frac{0.0464 mol H}{1 mol H} \times 1.008g H = 0.0469g H$$

$$\begin{aligned} \text{Mass O} &= \text{mass compound} - \text{mass C} - \text{mass H} \\ &= 0.450 - 0.279 - 0.0469 = 0.124g O \end{aligned}$$

Step 4b

$$\frac{0.124g O}{16.00g O} \times \frac{1 mol O}{1 mol O} = 0.00775 mol O$$

(continued) →

(example continued)

Step 5

$$0.02324 \text{ mol C} / 0.00775 = \textcircled{3}$$

$$0.0464 \text{ mol H} / 0.00775 = \textcircled{6}$$

$$0.00775 \text{ mol O} / 0.00775 = \textcircled{1}$$

