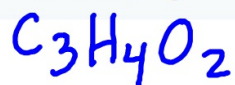


73. Calculate the percent composition by mass of the following compounds that are important starting materials for synthetic polymers:

CH.3

a. $C_3H_4O_2$ (acrylic acid, from which acrylic plastics are made)



$$\% C = \frac{(12.01 \times 3)}{72.06} \times 100 = 50.00 \% C$$

$$\% H = \frac{(1.008 \times 4)}{72.06} \times 100 = 5.595 \% H$$

$$\% O = \frac{(16 \times 2)}{72.06} \times 100 = 44.41 \% O$$

83. A compound that contains only carbon, hydrogen, and oxygen is 48.64% C and 8.16% H by mass. What is the empirical formula of this substance?



$$\frac{48.64 \text{ g C} / 1 \text{ mol C}}{12.01 \text{ g C}} = 4.04995 \text{ mol C} = \frac{2.7}{1.5 \text{ mol C} \times 2 = 3 \text{ mol C}}$$

$$\frac{8.16 \text{ g H} / 1 \text{ mol H}}{1.01 \text{ g H}} = 8.0792 \text{ mol H} = \frac{2.7}{3 \text{ mol H} \times 2 = 6 \text{ mol H}}$$

$$100\% - 48.64\% - 8.16\% = 43.2\% O = 43.2 \text{ g O}$$

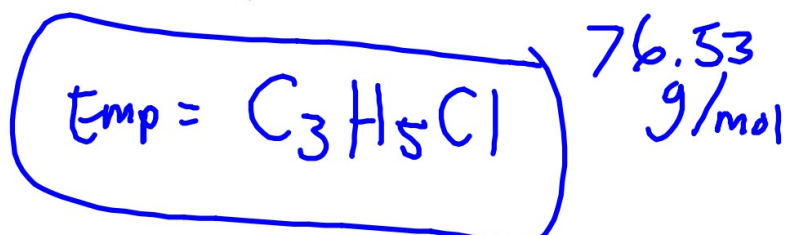
$$\frac{43.2 \text{ g O} / 1 \text{ mol O}}{16 \text{ g O}} = \frac{2.7 \text{ mol O}}{1 \text{ mol O} \times 2 = 2 \text{ mol O}}$$

89. A compound contains 47.08% carbon, 6.59% hydrogen, and 46.33% chlorine by mass; the molar mass of the compound is 153 g/mol. What are the empirical and molecular formulas of the compound?

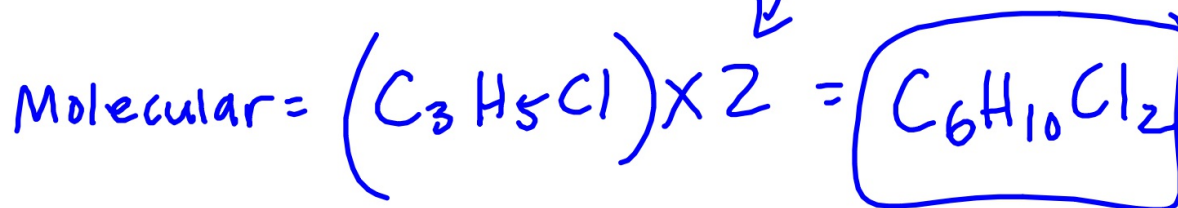
$$\frac{47.08 \text{ g C} / 1 \text{ mol C}}{12.01 \text{ g C}} = \frac{3.92006 \text{ mol C}}{1.3069} = 3 \text{ mol C}$$

$$\frac{6.59 \text{ g H} / 1 \text{ mol H}}{1.01 \text{ g H}} = \frac{6.52475 \text{ mol H}}{1.3069} = 5 \text{ mol H}$$

$$\frac{46.33 \text{ g Cl} / 1 \text{ mol Cl}}{35.45 \text{ g Cl}} = \frac{1.3069 \text{ mol Cl}}{1.3069} = 1 \text{ mol Cl}$$



$$\frac{\text{molecular mass}}{\text{empirical mass}} = \frac{153}{76.53} = 2$$



4

A compound contains 50 percent sulfur and 50 percent oxygen by mass. Which of the following is the empirical formula of the compound?

(A) SO

(B) SO_2

(C) SO_3

(D) SO_4

(E) S_2O

