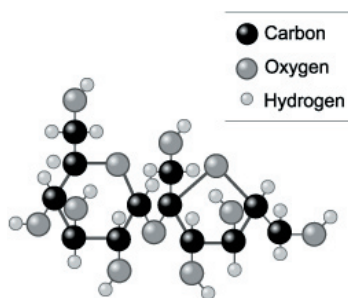


Sample Problem — Determining Percentage Composition

What is the percentage composition of a sugar with the formula $C_{12}H_{22}O_{11}$?

What to Think about

1. Calculate the sugar's molar mass.
2. Thus one mole of this sugar contains 144 g C, 22 g H, and 176 g O.
3. Express each element's percentage of the molar mass.



A sugar molecule with 12 carbon atoms, 22 hydrogen atoms, and 11 oxygen atoms.

How to Do It

$$\begin{aligned}12 \text{ C} &= (12 \times 12.0 \text{ g})/\text{mol} = 144.0 \text{ g/mol} \\22 \text{ H} &= (22 \times 1.0 \text{ g})/\text{mol} = 22.0 \text{ g/mol} \\11 \text{ O} &= (11 \times 16.0 \text{ g})/\text{mol} = \underline{176.0 \text{ g/mol}} \\ \text{Total} & \quad \underline{342.0 \text{ g/mol}}\end{aligned}$$

$$\% \text{ C} = \frac{144.0 \text{ g/mol}}{342.0 \text{ g/mol}} \times 100 = 42.1 \%$$

$$\% \text{ H} = \frac{22.0 \text{ g/mol}}{342.0 \text{ g/mol}} \times 100 = 6.4 \%$$

$$\% \text{ O} = \frac{176.0 \text{ g/mol}}{342.0 \text{ g/mol}} \times 100 = 51.5 \%$$

Practice Problems — Determining Percentage Composition

1. Ibuprofen is a common pain reliever and anti-inflammatory. Its formula is $C_{13}H_{18}O_2$. What is its percentage composition?
2. Ammonium sulphate, $(NH_4)_2SO_4$, is a common fertilizer used to lower the pH of soil. Calculate its percentage composition.
3. Many salts are hydrated, which means they have water molecules incorporated into their ionic crystal lattice in a fixed ratio. Magnesium sulphate heptahydrate, $MgSO_4 \cdot 7 H_2O$, has seven water molecules incorporated into the crystal lattice for each magnesium ion and sulphate ion. Calculate the percentage of water by mass in $MgSO_4 \cdot 7 H_2O$.