Chemistry
Chapter 3
Matter Problem Solving

Conservation of mass problems: Mass is **conserved**, so these problems typically involve simple addition and subtraction:

Example #1: 28.0 g of nitrogen gas combine completely with 6.0 g of hydrogen to form ammonia. **What is the mass of ammonia formed?**

Solution: 28.0 + 6.0 g = 34.0 gram of ammonia

Example #2: If 45.98 g of sodium combines with chlorine gas to form 116.89 g of sodium chloride, what mass of chlorine was used in the reaction?

Solution: 116.89 g – 45.98 = 70.91 g of chlorine must have been used

Law of Definite Proportions: $\%\text{ by mass} = \frac{\text{mass of element}}{\text{mass of compound}} \times 100$

Example #3: A 78.0 g sample of an unknown compound contains 12.4 g of hydrogen. What is the percent by mass of hydrogen in the compound?

$$\frac{12.4}{78.0} \times 100 = 15.9\% \text{ hydrogen}$$

Example #4: If 3.5 g of X reacts with 10.5 g of Y to form compound XY, what is the percent by mass of X in this compound?

$$\frac{3.5}{3.5 + 10.5} \times 100 = 25\% \text{ by mass of X in compound XY}$$

Don't forget to sum up X and Y for the TOTAL mass

Law of Multiple Proportions: Applies to compounds made up of the same elements but in **different** proportions. For example, compare H_2O to H_2O_2. They have the **same** amount of hydrogen but **different** amounts of oxygen. In fact H_2O_2 has twice the amount of oxygen than H_2O, relatively speaking.

Example #5: Carbon reacts with oxygen to form two different compounds. **Compound I** contains 4.82 g C for every 6.44 g O, while **Compound II** contains 20.13 g C for every 53.7 g O. What is the ratio of carbon to a fixed mass of oxygen for the two compounds?

Compound I $\frac{4.82\ C}{6.44\ O} = .75$ $\qquad .375 = \frac{20.13\ C}{53.7\ O}$ **Compound II**

$$\frac{.75}{.375} = \mathbf{2:1\ ratio}$$

This small whole # ratio confirms the law