Math Tutor USING MOLE RATIOS

An unbalanced chemical equation tells you what substances react and what products are produced. A balanced chemical equation gives you even more information. It tells you how many atoms, molecules, or ions react and how many atoms, molecules, or ions are produced. The coefficients in a balanced equation represent the relative amounts in moles of reactants and products. Using this information, you can set up a mole ratio. A mole ratio is a conversion factor that relates the amounts in moles of any two substances involved in a chemical reaction.

Problem-Solving *TIPS*

- When solving stoichiometric problems, always start with a balanced chemical equation.
- Identify the amount known from the problem (in moles or mass).
- If you are given the mass of a substance, use the molar mass factor as a conversion factor to find the amount in moles. If you are given the amount in moles of a substance, use the molar mass factor as a conversion factor to find the mass.

SAMPLE

If 3.61 g of aluminum reacts completely with excess $CuCl_2$, what mass of copper metal is produced? Use the balanced equation below.

$$2Al(s) + 3CuCl_2(aq) \longrightarrow 2AlCl_3(aq) + 3Cu(s)$$

You know the mass of aluminum that reacts. If you convert that mass to moles, you can apply the mole ratio of aluminum to copper in this reaction to find the moles of copper produced.

$$\text{mol Al} = 3.61 \text{ g Al} \times \frac{1 \text{ mol Al}}{26.98 \text{ g Al}} = 0.134 \text{ mol Al}$$

$$\text{mol Al} \times \frac{3 \text{ mol Cu}}{2 \text{ mol Al}} = \text{mol Cu}$$
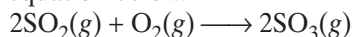
$$0.134 \text{ mol Al} \times \frac{3 \text{ mol Cu}}{2 \text{ mol Al}} = 0.201 \text{ mol Cu}$$

Then, convert moles of Cu to mass of Cu by applying the following factor:

$$\text{mol Cu} \times \frac{\text{molar mass Cu}}{1 \text{ mol Cu}} = \text{mass Cu, or } 0.201 \text{ mol Cu} \times \frac{63.55 \text{ g Cu}}{1 \text{ mol Cu}} = 12.8 \text{ g Cu}$$

PRACTICE PROBLEMS

1. If 12.24 moles of O_2 react with excess SO_2, how many moles of SO_3 are formed? Use the balanced equation below.
$$2SO_2(g) + O_2(g) \longrightarrow 2SO_3(g)$$

2. If 78.50 g $KClO_3$ decomposes, what mass of O_2 is produced? Use the balanced equation below.
$$2KClO_3(s) \longrightarrow 2KCl(s) + 3O_2(g)$$