How do chemists use balanced chemical equations?

Why?

Chemists use balanced chemical equations as a basis to calculate how much reactant is needed or product is formed in a reaction. This is called Stoichiometry- (stoi-key-ah-meh-tree) Another way of looking at it is using the mole ratio from the balanced equation and information about one compound in the reaction to determine information about another compound in the equation. A mole ratio is a conversion factor derived from the coefficients of a balanced chemical equation interpreted in terms of moles. In chemical calculations, mole ratios are used to convert between moles of one thing and moles of another.

Purpose: In this activity we will address the question: How do I convert between different chemical species in a given reaction?
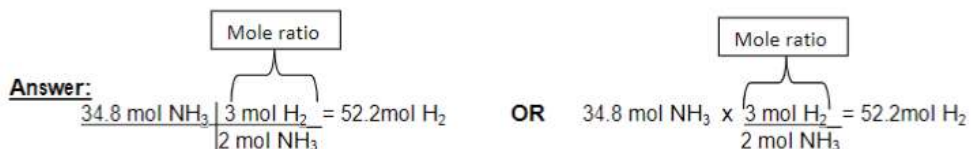
MODEL 1: Mole-to-Mole Stoichiometry (1-step)

Example: mole-to-mole

Question: Given the following equation:

$$1 \text{ N}_2 (g) + 3 \text{ H}_2 (g) \rightarrow 2 \text{ NH}_3 (g)$$
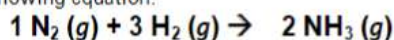
How many moles of H_2 are needed to produce 34.8 moles of NH_3?

Mole ratio

Answer:

$$34.8 \text{ mol NH}_3 \left| \frac{3 \text{ mol H}_2}{2 \text{ mol NH}_3} \right. = 52.2 \text{mol H}_2 \quad \textbf{OR} \quad 34.8 \text{ mol NH}_3 \times \frac{3 \text{ mol H}_2}{2 \text{ mol NH}_3} = 52.2 \text{mol H}_2$$
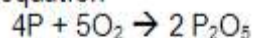
Key questions:

1. What was the given in the example above?

2. Where did the $\dfrac{3 \text{ mol H}_2}{2 \text{ mol NH}_3}$, come from?

3. Double check to see if 52.2 moles of H_2 is the correct answer. SHOW the math below.

flip

You Try...
4. Given the following chemical equation
$$4P + 5O_2 \rightarrow 2 P_2O_5$$

(a) How many **moles of P_2O_5** are formed from **3.4 moles of O_2**? SHOW the math below

(b) How many **moles of P** are needed to react with **30.1 moles of O_2**? SHOW the math below.

5. Aluminum reacts with copper(II) chloride to make aluminum chloride and copper
(a) Write the balanced equation

(b) Given 6 **moles** of $CuCl_2$, how many **moles** of $AlCl_3$ were made? SHOW the math below

(c) If 4.5 **moles** of $AlCl_3$ were made, how many **moles** of $CuCl_2$ were used? SHOW the math below

6. Methane (CH_4) and sulfur (S_8) react to produce carbon disulfide and hydrogen sulfide, a liquid often used in the production of cellophane
(a) Write the balanced equation

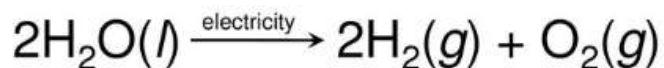(b) Calculate the **moles** of CS_2 produced when 1.50 **mol** of S_8 are used. SHOW the math below

(c) How many **moles** of H_2S are produced? SHOW the math below

7. Summarize model 1 in 2-3 sentences:

More Practice:

1. How many moles of H_2O are needed to produce 7 moles of H_2 in the electrolysis of water?

$$2H_2O(l) \xrightarrow{\text{electricity}} 2H_2(g) + O_2(g)$$

Show your work

2. When Nitrogen gas combines with hydrogen gas, nitrogen trihydride (ammonia) gas is produced.
   a. Write the balanced equation for the reaction described above.

   b. How many moles of hydrogen gas are needed to produce 636.9 moles of nitrogen trihydride (ammonia) gas? Show your work below.