

~~10/10~~
1/11 g
1/12

Key

Stoichiometry: Mole to Mass Problems



a. How many grams of HCl are consumed by the reaction of 2.50 moles of magnesium?

Step 1
Mole-Mole

$$2.5 \text{ mol Mg} \left| \begin{array}{c} 2 \text{ HCl} \\ 1 \text{ Mg} \end{array} \right. = 5 \text{ mol HCl} \left| \begin{array}{c} 36 \text{ g HCl} \\ 1 \text{ mol HCl} \end{array} \right. = 180 \text{ g HCl}$$

Mole Ratio Step 2: Mole → Gram

b. What is the mass in grams of H₂ gas when 4.0 moles of HCl is added to the reaction?

$$4 \text{ mol HCl} \left| \begin{array}{c} 1 \text{ H}_2 \\ 2 \text{ HCl} \end{array} \right. = 2 \text{ mol H}_2 \left| \begin{array}{c} 2 \text{ g H}_2 \\ 1 \text{ mol H}_2 \end{array} \right. = 4 \text{ g H}_2$$

Mole Ratio Step 2: Mole → Gram

2. Acetylene gas (C₂H₂) is produced as a result of the following reaction.



a. If 3.20 moles of CaC₂ are consumed in this reaction, how many grams of H₂O are needed?

$$3.2 \text{ mol CaC}_2 \left| \begin{array}{c} 2 \text{ H}_2\text{O} \\ 1 \text{ CaC}_2 \end{array} \right. = 6.4 \text{ mol H}_2\text{O} \left| \begin{array}{c} 18 \text{ g H}_2\text{O} \\ 1 \text{ mol H}_2\text{O} \end{array} \right. = 115.2 \text{ g H}_2\text{O}$$

b. How many grams of Ca(OH)₂ would be formed with 3.20 moles of CaC₂?

$$3.2 \text{ mol CaC}_2 \left| \begin{array}{c} 1 \text{ Ca(OH)}_2 \\ 1 \text{ CaC}_2 \end{array} \right. = 3.2 \text{ mol Ca(OH)}_2 \left| \begin{array}{c} 74 \text{ g Ca(OH)}_2 \\ 1 \text{ mol} \end{array} \right. = 236.8 \text{ g Ca(OH)}_2$$

3. Acetylene gas, C_2H_2 , is used in welding, produces an extremely hot flame when it burns in pure oxygen according to the following reaction.



How many **moles of water** (H_2O) are produced when **25.0 grams** of C_2H_2 burns completely?

$$\frac{25 \text{ g } C_2H_2}{26 \text{ g } C_2H_2 \text{ (Molar Mass)}} \times \frac{1 \text{ mol } C_2H_2}{1 \text{ mol } C_2H_2} = 0.96 \text{ mol } C_2H_2$$

$$\frac{0.96 \text{ mol } C_2H_2}{2 \text{ mol } C_2H_2} \times \frac{2 \text{ mol } H_2O}{2 \text{ mol } C_2H_2} = 0.96 \text{ mol } H_2O$$

Step 1: gram \rightarrow mole
Step 2: Mole A \rightarrow Mole B

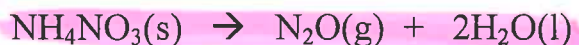
4. $3 Mg + 1 Fe_2O_3 \rightarrow 2 Fe + 3 MgO$

How many **moles of iron**, Fe , are produced with **25.0 grams** of **magnesium**, Mg ?

$$\frac{25 \text{ g } Mg}{24 \text{ g } Mg} \times \frac{1 \text{ mol } Mg}{1 \text{ mol } Mg} = 1.04 \text{ mol } Mg$$

$$\frac{1.04 \text{ mol } Mg}{3 \text{ mol } Mg} \times \frac{2 \text{ mol } Fe}{3 \text{ mol } Mg} = 0.69 \text{ mol } Fe$$

5. Laughing gas (nitrous oxide, N_2O) is sometimes used as an anesthetic in dentistry.



a. How many **moles of NH_4NO_3** are required to produce **33.0g** of N_2O ?

$$\frac{33 \text{ g } N_2O}{44 \text{ g } N_2O} \times \frac{1 \text{ mol } N_2O}{1 \text{ mol } N_2O} = 0.75 \text{ mol } N_2O$$

$$\frac{0.75 \text{ mol } N_2O}{1 \text{ mol } N_2O} \times \frac{1 \text{ mol } NH_4NO_3}{1 \text{ mol } N_2O} = 0.75 \text{ mol } NH_4NO_3$$

b. How many **moles of water** are produced with **45.0g** of N_2O ?

$$\frac{45 \text{ g } N_2O}{44 \text{ g } N_2O} \times \frac{1 \text{ mol } N_2O}{1 \text{ mol } N_2O} = 1.02 \text{ mol } N_2O$$

$$\frac{1.02 \text{ mol } N_2O}{1 \text{ mol } N_2O} \times \frac{2 \text{ mol } H_2O}{1 \text{ mol } N_2O} = 2.04 \text{ mol } H_2O$$