10.2 Stoichiometric Calculations

Foundation

All stoichiometric calculations MUST begin with a balanced chemical equation.

Process Overview

Resource Page 6 shows this general procedure:

Mass Known → Moles Known → **Mole Ratio** → Moles Seeking → Mass Seeking

If you're given mass, start here!

If you're given moles, start here!

If you must find moles, end here!

If you must find mass, end here!

You can stop at any point in the process.

Template:

$$\text{Mass (Known)} \times \frac{\text{1 Mole (Known)}}{\text{Mol. Mass (Known)}} \times \frac{\text{Moles (Seeking)}}{\text{Moles (Known)}} \times \frac{\text{Mol. Mass (Seeking)}}{\text{1 Mole (Seeking)}} = \text{Mass (Seeking)}$$

1. Mole to Mole Guided Example

Potassium and water react, producing potassium hydroxide and hydrogen gas.

Step 0: Balance the equation!

$$2\ K + 2\ H_2O \rightarrow 2\ KOH + H_2$$

How many moles of hydrogen gas will be produced from 0.04 moles of potassium?

What is known? 0.04 mol K

What are you seeking? mol H_2

Mole to Mole $2\ K + 2\ H_2O \rightarrow 2\ KOH + H_2$

What mole ratio will you use?

You want hydrogen, you know potassium (0.04 mol).

Use $\frac{1\,mol\,H_2}{2\,mol\,K}$: moles of potassium cancel out.

Result:

$$0.04\,\cancel{mol\,K} \cdot \frac{1\,mol\,H_2}{2\,\cancel{mol\,K}} = 0.02\,mol\,H_2$$

2. Mass to Mass Guided Example

Calcium carbide (CaC_2) and water react, producing acetylene (C_2H_2) and calcium hydroxide ($Ca(OH)_2$).

Step 0. – Balanced reaction:

$$CaC_2 + 2\,H_2O \rightarrow C_2H_2 + Ca(OH)_2$$

How many grams of acetylene can be produced by reacting 2.50 grams of calcium carbide with water?

What is given? 2.50 g CaC_2.

What do you seek? Mass C_2H_2

Mass to Mass $CaC_2 + 2\,H_2O \rightarrow C_2H_2 + Ca(OH)_2$

Note Color Coding!

A. Insert molar mass of CaC_2 (64.10 g/mol):

B. Insert mole ratio from mol CaC_2 to mol C_2H_2:

$$\frac{1\ mol\ C_2H_2}{1\ mol\ CaC_2}$$

C. Insert molar mass C_2H_2 (26.04 g/mol):

Finally, cancel units and compute.

$$2.50\,g\,CaC_2 \cdot \frac{1\,mol\,CaC_2}{64.10\,g\,CaC_2} \cdot \frac{1\,mol\,C_2H_2}{1\,mol\,CaC_2} \cdot \frac{26.04\,g\,C_2H_2}{1\,mol\,C_2H_2} = 1.02\,g\,C_2H_2$$

Homework

10.2 Booklet Problems.
Due Next Class.