

Percent Yield

Theoretical Yield

- * **Theoretical yield: the amount of product predicted calculations**
- * ****This value is calculated.**

Actual Yield

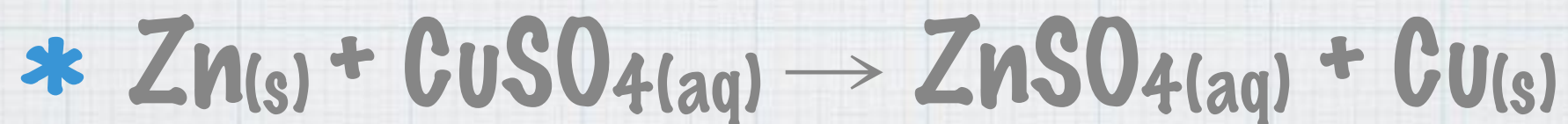
- * **Actual yield:** The actual amount of product that is recovered after a reaction is complete.
- * ****This value is measured**

Calculating Percent Yield

$$\text{Percentage Yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

Let's Try . . .

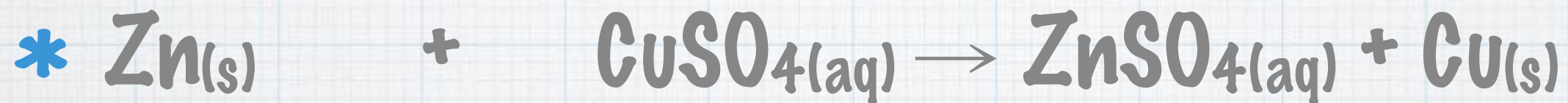
* In a laboratory experiment, 109.28 g of zinc sulfate is produced when 130.76g of zinc is added to 478.83g of copper (II) sulfate solution. What is the percent yield of copper.



Make a Plan

- * 1) Find limiting reagent.
- * 2) Using limiting reagent, use stoichiometry to solve for theoretical yield (amount of product).
- * 3) Use theoretical yield to calculate percent yield.

Limiting Reagent



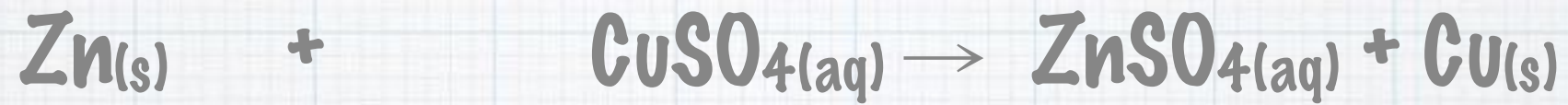
$$m_{\text{Zn}} = 130.76 \text{ g}$$

$$M_{\text{Zn}} = 65.38 \text{ g/mol}$$

$$m_{\text{CuSO}_4} = 478.83 \text{ g}$$

$$M_{\text{CuSO}_4} = 159.61 \text{ g/mol}$$

Determine Limiting Reagent



List given values

$$m_{\text{Zn}} = 130.76 \text{ g}$$
$$M_{\text{Zn}} = 65.38 \text{ g/mol}$$

$$m_{\text{CuSO}_4} = 478.83 \text{ g}$$
$$M_{\text{CuSO}_4} = 159.61 \text{ g/mol}$$

Convert from mass to moles

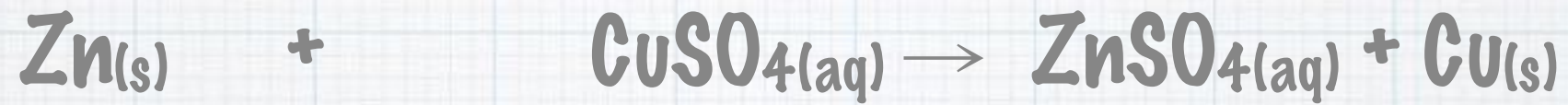
$$n = m/M$$
$$n = \frac{130.76 \text{ g}}{65.38 \text{ g/mol}}$$
$$n = 2.00 \text{ mols}$$

$$n = 2.00 \text{ mols}$$

$$n = m/M$$
$$n = \frac{478.83 \text{ g}}{159.61 \text{ g/mol}}$$
$$n = 3.00 \text{ mols}$$

$$n = 3.00 \text{ mols}$$

Determine Limiting Reagent



List given values

$$m_{\text{Zn}} = 130.76 \text{ g}$$
$$M_{\text{Zn}} = 65.38 \text{ g/mol}$$

$$m_{\text{CuSO}_4} = 478.83 \text{ g}$$
$$M_{\text{CuSO}_4} = 159.61 \text{ g/mol}$$

Convert from mass to moles

$$n = m/M$$
$$n = \frac{130.76 \text{ g}}{65.38 \text{ g/mol}}$$
$$n = 2.00 \text{ mols}$$

$$n = m/M$$
$$n = \frac{478.83 \text{ g}}{159.61 \text{ g/mol}}$$
$$n = 3.00 \text{ mols}$$

$$n = 2.00 \text{ mols}$$

$$n = 3.00 \text{ mols}$$

Molar Ratio

$$\frac{1}{1} = \frac{2 \text{ mol}}{n_{\text{ZnSO}_4}}$$

$$n_{\text{ZnSO}_4} = 2 \text{ mol}$$

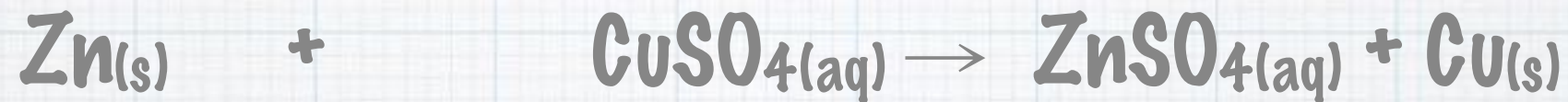
$$\frac{1}{1} = \frac{3 \text{ mol}}{n_{\text{CuSO}_4}}$$

$$n_{\text{ZnSO}_4} = 3 \text{ mol}$$

Limiting Reagent

The limiting reagent is zinc, we use the mass of zinc to determine the mass of the product.

Determine Theoretical Yield



List given values

$$m_{\text{Zn}} = 130.76 \text{ g}$$
$$M_{\text{Zn}} = 65.38 \text{ g/mol}$$

$$m_{\text{ZnSO}_4} = ?$$
$$M_{\text{ZnSO}_4} = 161.47 \text{ g/mol}$$

Convert from mass to moles

$$n = m/M$$

$$n = \frac{130.76 \text{ g}}{65.38 \text{ g/mol}}$$

$$n = 2.00 \text{ mols}$$

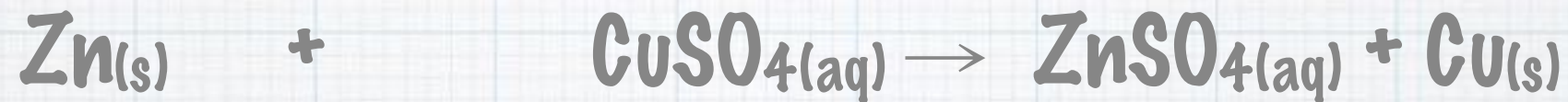
Molar Ratio

$$n = 2.00 \text{ mols}$$

$$n = 2.00 \text{ mols}$$

$$\frac{\text{Ratio Zn}}{\text{Ratio ZnSO}_4} = \frac{n_{\text{Zn}}}{n_{\text{ZnSO}_4}} \rightarrow \frac{1}{1} = \frac{2 \text{ mol}}{n_{\text{ZnSO}_4}} \rightarrow n_{\text{ZnSO}_4} = 2.00 \text{ mols}$$

Determine Theoretical Yield



List given values

$$m_{\text{Zn}} = 130.76 \text{ g}$$
$$M_{\text{Zn}} = 65.38 \text{ g/mol}$$

$$m_{\text{ZnSO}_4} = n = 322.94 \text{ g}$$
$$M_{\text{ZnSO}_4} = 161.47 \text{ g/mol}$$

Convert from mass to moles

$$n = m/M$$
$$n = \frac{130.76 \text{ g}}{65.38 \text{ g/mol}}$$
$$n = 2.00 \text{ mols}$$

Convert from moles to mass

$$m = n \times M$$
$$m = 2.00 \text{ g} \times \frac{161.47 \text{ g}}{\text{mol}}$$
$$m = 322.94 \text{ g}$$

Molar Ratio

$$n = 2.00 \text{ mols}$$

$$n = 2.00 \text{ mols}$$

$$\frac{\text{Ratio Zn}}{\text{Ratio ZnSO}_4} = \frac{n_{\text{Zn}}}{n_{\text{ZnSO}_4}} \rightarrow \frac{1}{1} = \frac{2 \text{ mol}}{n_{\text{ZnSO}_4}} \rightarrow n_{\text{ZnSO}_4} = 2.00 \text{ mols}$$

Limiting Reagent

- * Therefore, the theoretical yield of zinc sulfate is 322.94g.

Determine Percent Yield

$$\text{Percentage Yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

Given

Theoretical Yield: 322.94g

Actual Yield: 109.28

Determine Percent Yield

$$\text{Percentage Yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

Determine Percent Yield

$$\text{Percentage Yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

Given

Theoretical Yield: 322.94g

Actual Yield: 109.28

$$\text{Percentage Yield} = \frac{109.28 \text{ g}}{322.94 \text{ g}} \times 100$$

$$\text{Percentage Yield} = 33.84\%$$

The end is near . . .

- * Therefore, the percentage yield of zinc sulfate considering 130.76g of zinc is 33.84%.

To make you smile again

...

**I just met you,
and this is crazy.**



6.0221415×10^{23}

**but here's my number,
so call me maybe.**