

C. Mass-Mass Relationship

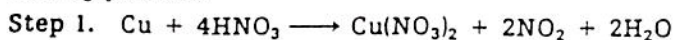
To complete a mass-mass problem, four steps must be performed correctly.

1. Write the balanced equation.
2. Find the number of moles of the given substance.
3. Inspect the balanced equation to determine the ratio of moles of required substance to moles of given substance.
4. Express the moles of required substance in terms of grams.

EXAMPLE: Mass-Mass

How many grams of copper(II) nitrate would be produced from 4.30 g of copper metal reacting with excess nitric acid?

Solving process:



Step 2. $\frac{4.30 \text{ g Cu}}{63.5 \text{ g Cu}} \times 1 \text{ mol Cu}$

Step 3. $\frac{4.30 \text{ g Cu}}{63.5 \text{ g Cu}} \times \frac{1 \text{ mol Cu}}{1 \text{ mol Cu}} \times 1 \text{ mol Cu}(\text{NO}_3)_2$

Step 4. $\frac{4.30 \text{ g Cu}}{63.5 \text{ g Cu}} \times \frac{1 \text{ mol Cu}}{1 \text{ mol Cu}} \times \frac{1 \text{ mol Cu}(\text{NO}_3)_2}{1 \text{ mol Cu}} \times 187.5 \text{ g Cu}(\text{NO}_3)_2 = 12.7 \text{ g Cu}(\text{NO}_3)_2$

1. When copper(II) nitrate reacts with sodium hydroxide, copper(II) hydroxide is produced. How many grams of $\text{Cu}(\text{OH})_2$ can be prepared from 12.7 g of $\text{Cu}(\text{NO}_3)_2$ and excess NaOH ?
2. When $\text{Cu}(\text{OH})_2$ is heated, it decomposes to black CuO and H_2O . How many grams of CuO will be formed from the decomposition of 6.59 g of $\text{Cu}(\text{OH})_2$?
3. When 5.37 g of the black copper(II) oxide are mixed with excess sulfuric acid, the solution turns a clear blue, indicating the formation of copper(II) sulfate. How many grams of copper(II) sulfate will be formed in this double displacement reaction?
4. If an excess of zinc metal is placed in a copper(II) sulfate solution, the zinc will displace the copper. If 10.8 g of copper(II) sulfate is reacted, how many grams of copper metal will be recovered from the solution? (Hint: $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$.)
5. Compare the amount of copper that was recovered in problem 4 to the amount of copper with which you began this series of reactions in the example. Explain any differences.