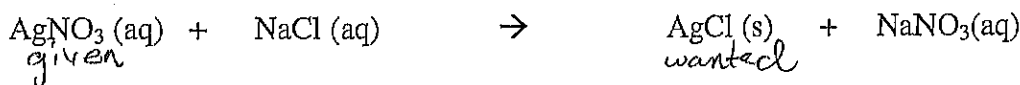


# STOICHIOMETRY 5 - ANSWER KEY

Solution stoichiometry – Calculations using molarity and a balanced chemical equation.

**Example 1:** You add 500 ml of 0.100 M AgNO<sub>3</sub> solution to a solution containing an excess of Cl<sup>-</sup> ion. How much AgCl precipitate will you form?

Molar masses:	169.88 g	58.44 g	143.32	85.00
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given:  
 500 mL AgNO<sub>3</sub>  
 0.500 L AgNO<sub>3</sub>  
 0.100 M AgNO<sub>3</sub>

$$0.500 \text{ L AgNO}_3 \times \frac{0.100 \text{ mol AgNO}_3}{1 \text{ L}} = 0.0500 \text{ mol AgNO}_3$$

$$0.0500 \text{ mol AgNO}_3 \times \frac{1 \text{ mol AgCl}}{1 \text{ mol AgNO}_3} = 0.0500 \text{ mol AgCl}$$

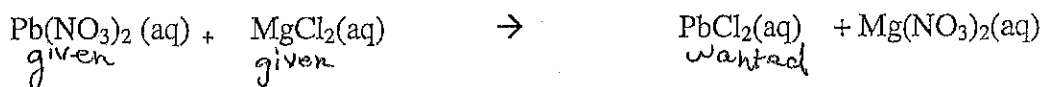
wanted:  
 g AgCl

$$0.0500 \text{ mol AgCl} \times \frac{143.32 \text{ g AgCl}}{1 \text{ mol}} = 7.17 \text{ g AgCl}$$

rounded 7g AgCl

**Example 2:** If you mix 200 ml of 0.100 M Pb(NO<sub>3</sub>)<sub>2</sub> and 300 ml of 0.200 M MgCl<sub>2</sub>, how much PbCl<sub>2</sub> precipitate will you form?

Molar masses:	331.22g	95.21 g	278.10 g	148.33 g
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given:  
 200 mL Pb(NO<sub>3</sub>)<sub>2</sub>  
 0.2 L Pb(NO<sub>3</sub>)<sub>2</sub>  
 0.100 M Pb(NO<sub>3</sub>)<sub>2</sub>

limiting reactant → smallest mol PbCl<sub>2</sub>

$$\textcircled{1} 0.2 \text{ L Pb}(\text{NO}_3)_2 \times \frac{0.100 \text{ mol Pb}(\text{NO}_3)_2}{1 \text{ L}} \times \frac{1 \text{ mol PbCl}_2}{1 \text{ mol Pb}(\text{NO}_3)_2} = 0.02 \text{ mol PbCl}_2 \text{ (smallest)}$$

300 mL MgCl<sub>2</sub>  
 0.300 L MgCl<sub>2</sub>  
 0.200 M MgCl<sub>2</sub>

$$\textcircled{2} 0.3 \text{ L MgCl}_2 \times \frac{0.200 \text{ mol MgCl}_2}{1 \text{ L}} \times \frac{1 \text{ mol PbCl}_2}{1 \text{ mol MgCl}_2} = 0.06 \text{ mol PbCl}_2$$

wanted:  
 g PbCl<sub>2</sub>

Pb(NO<sub>3</sub>)<sub>2</sub> = limiting reactant.

$$0.02 \text{ mol PbCl}_2 \times \frac{278.10 \text{ g PbCl}_2}{1 \text{ mol}} = 6 \text{ g PbCl}_2$$

\* calculate excess mL MgCl<sub>2</sub> → 200 mL MgCl<sub>2</sub> x S

Titration problems

**Example 3:** How many moles of water form when 25.0 mls of 0.100 M HNO<sub>3</sub> (nitric acid) solution is completely neutralized by NaOH (a base)?

Molar masses:	63.02 g	40.00 g		85.00 g	18.02 g
	HNO <sub>3</sub> (aq)	+ NaOH(aq)	→	NaNO <sub>3</sub> (aq)	+ H <sub>2</sub> O(l)

given:  
 25.0 mL HNO<sub>3</sub>  
 → 0.0250 L HNO<sub>3</sub>  
 0.100 M HNO<sub>3</sub>  
 wanted:  
 mol H<sub>2</sub>O

$$0.0250 \text{ mL HNO}_3 \times \frac{0.100 \text{ mol HNO}_3}{\text{L}} = 0.00250 \text{ mol HNO}_3$$

$$0.00250 \text{ mol HNO}_3 \times \frac{1 \text{ mol H}_2\text{O}}{1 \text{ mol HNO}_3} = 0.00250 \text{ mol H}_2\text{O}$$

**Example 4:** What is the concentration (M) of a sulfuric acid solution, 125.0 mL of which required 37.5 mL of a 0.0125 M NaOH solution for neutralization

Molar masses:	98.08 g	40.00 g		142.04 g	18.02 g
	H <sub>2</sub> SO <sub>4</sub> (aq)	+ 2NaOH(aq)	→	Na <sub>2</sub> SO <sub>4</sub> (aq)	+ 2H <sub>2</sub> O(l)

given:  
 125 mL H<sub>2</sub>SO<sub>4</sub>  
 → 0.125 L H<sub>2</sub>SO<sub>4</sub>  
 37.5 mL NaOH  
 → 0.0375 L NaOH  
 0.0125 M NaOH  
 wanted:  
 M H<sub>2</sub>SO<sub>4</sub>  
 →  $\frac{\text{mol H}_2\text{SO}_4}{\text{L}}$

$$0.0375 \text{ L NaOH} \times 0.0125 \frac{\text{mol NaOH}}{\text{L}} = 0.000469 \text{ mol NaOH}$$

$$0.000469 \text{ mol NaOH} \times \frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol NaOH}} = 0.000234 \text{ mol H}_2\text{SO}_4$$

$$M = \frac{0.000234 \text{ mol H}_2\text{SO}_4}{0.125 \text{ L H}_2\text{SO}_4} = 0.00188 \text{ M H}_2\text{SO}_4$$