Put answer key on-line

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

Example 1: You add 500 ml of 0.100 M $AgNO_3$ solution to a solution containing an excess of Cl^- ion. How much AgCl precipitate will you form?

Molar masses:	169.88 g	58.44 g		143.32	85.00

$AgNO_3$ (aq) + NaCl (aq) → AgCl (s) + $NaNO_3$(aq)

500 mL = 0.500 L

$0.500\ L \times 0.1\ M\ AgNO_3 = 0.05\ mol\ AgNO_3$

$0.05\ mol\ AgNO_3 \times \frac{1\ mol\ AgCl}{1\ mol\ AgNO_3} = 0.0500\ mol\ AgCl$

$0.0500\ mol\ AgCl \times \frac{143.3\ g\ AgCl}{1\ mol} = 7.17\ g\ AgCl$

Example 2: If you mix 200 ml of 0.100 M $Pb(NO_3)_2$ and 300 ml of 0.200 M $MgCl_2$, how much $PbCl_2$ precipitate will you form?

Molar masses:	331.22g	95.21 g		278.10 g	148.33 g

$Pb(NO_3)_2$ (aq) + $MgCl_2$(aq) → $PbCl_2$(aq) + $Mg(NO_3)_2$(aq)

200 mL 0.100M $Pb(NO_3)_2$ =

$0.200\ L \left(\frac{0.100\ mol}{L}\right) Pb(NO_3)_2 = 0.0200\ mol\ Pb(NO_3)_2 \times \frac{1\ mol\ PbCl_2}{1\ mol\ Pb(NO_3)_2}$

$= 0.0200\ mol\ PbCl_2$

300 mL 0.200M $MgCl_2 = 0.300\ L \left(\frac{0.200\ mol}{L}\right) MgCl_2 = 0.0600\ mol\ MgCl_2$

$0.0600\ mol\ MgCl_2 \times \left(\frac{1\ mol\ PbCl_2}{1\ mol\ MgCl_2}\right) = 0.0600\ mol\ PbCl_2$

0.0200 mol $PbCl_2$ is smallest therefore

$0.0200\ mol\ PbCl_2 \times \frac{278.10\ g\ PbCl_2}{1\ mol} = 5.56\ g\ PbCl_2$

Titration problems

Example 3: How many moles of water form when 25.0 mls of 0.100 M HNO_3 (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_3 (aq) +	NaOH(aq)	→	$NaNO_3$(aq) +	H_2O(l)

25.0 mL = 0.025 L

$0.025\ L \left(\frac{0.100\ mol}{1\ L}\right) HNO_3 \times \frac{1\ mol\ H_2O}{1\ mol\ HNO_3} = 0.0025\ mol\ H_2O$

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_2SO_4(aq) +	2NaOH(aq)	→	Na_2SO_4(aq) +	$2H_2O$(l)

37.5 mL = 0.0375 L

$0.0375\ L \left(\frac{0.0125\ mol\ NaOH}{L}\right) = 0.000469\ mol\ NaOH$

$0.000469\ mol\ NaOH \times \frac{1\ mol\ H_2SO_4}{2\ mol\ NaOH} = 0.000235\ mol\ H_2SO_4$

$\frac{0.000235\ mol\ H_2SO_4}{0.125\ L} = 0.00188\ \frac{mol}{L}\ H_2SO_4$

125 mL → 0.125 L

H_2SO_4