



# TITRATIONS 1

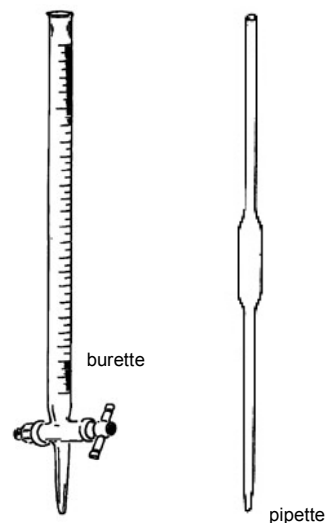
## Carrying out a titration

Titration is a very accurate way of measuring the concentration of acids and alkalis.

In a titration, we measure the volume of an acid (or alkali), measured in a burette, needed to exactly neutralise an alkali (or acid) which has been carefully measured into a conical flask with a pipette.

We use an indicator to judge the exact volume required to do this.

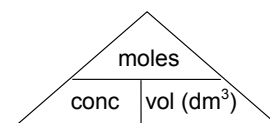
- 1) Place some alkali (or acid) into a conical flask using a pipette.
- 2) Place the acid (or alkali) into a burette.
- 3) Add a suitable indicator (e.g. phenolphthalein which works for most titrations)
- 4) Add the acid (or alkali) from the burette to the conical flask until the colour changes. Do this drop by drop near the end point.
- 5) Note the final reading.
- 6) Repeat.



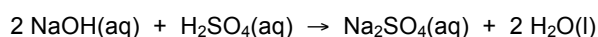
## Titration calculations

- a) Use the volume and concentration of one reactant to calculate the moles.
- b) Use the chemical equation to find the moles of the other reactant.
- c) Calculate the volume or concentration as required of that reactant.

$$\text{concentration (mol/dm}^3\text{)} = \frac{\text{moles}}{\text{volume (dm}^3\text{)}}$$



e.g. 25.0 cm<sup>3</sup> of sulfuric acid reacts with 30.0 cm<sup>3</sup> of 0.150 mol/dm<sup>3</sup> sodium hydroxide. Find the concentration of the acid in both mol/dm<sup>3</sup> and g/dm<sup>3</sup>.



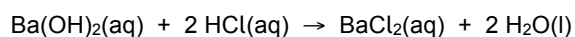
$$\text{moles NaOH} = \text{conc} \times \text{vol (dm}^3\text{)} = 0.150 \times \frac{30.0}{1000} = 0.00450 \text{ mol}$$

$$\text{moles H}_2\text{SO}_4 = \frac{1}{2} \times \text{moles of NaOH} = \frac{1}{2} \times 0.00450 = 0.00225 \text{ mol}$$

$$\text{conc H}_2\text{SO}_4 = \frac{\text{moles}}{\text{volume (dm}^3\text{)}} = \frac{0.00225}{\frac{25.0}{1000}} = 0.0900 \text{ mol/dm}^3$$

$$\text{conc H}_2\text{SO}_4 = 98 \times 0.0900 = 8.82 \text{ g/dm}^3$$

- 1 25.0 cm<sup>3</sup> of 0.200 mol/dm<sup>3</sup> barium hydroxide solution reacted with 22.8 cm<sup>3</sup> of hydrochloric acid. Calculate the concentration of the hydrochloric acid in mol/dm<sup>3</sup>. Give your answer to 3 significant figures.



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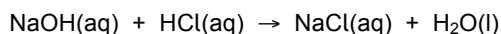
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2 22.5 cm<sup>3</sup> of sodium hydroxide solution reacted with 25.0 cm<sup>3</sup> of 0.100 mol/dm<sup>3</sup> hydrochloric acid.



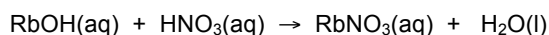
a) Calculate the concentration of the sodium hydroxide solution in mol/dm<sup>3</sup>. Give your answer to 3 significant figures.

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b) Calculate the concentration of the sodium hydroxide solution in g/dm<sup>3</sup>. Give your answer to 3 significant figures.

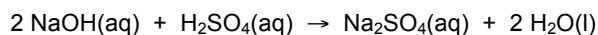
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3 What volume of 0.150 mol/dm<sup>3</sup> rubidium hydroxide reacts with 25.0 cm<sup>3</sup> of 0.240 mol/dm<sup>3</sup> nitric acid? Give your answer to 3 significant figures.



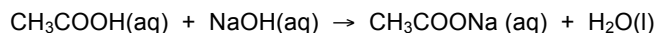
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4 25.0 cm<sup>3</sup> of 0.200 mol/dm<sup>3</sup> sodium hydroxide solution reacted with 28.7 cm<sup>3</sup> sulfuric acid. Calculate the concentration of the sulfuric acid in mol/dm<sup>3</sup>. Give your answer to 3 significant figures.



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5 25.0 cm<sup>3</sup> of 0.150 mol/dm<sup>3</sup> sodium hydroxide reacted with 30.3 cm<sup>3</sup> of a solution of ethanoic acid.



a) Calculate the concentration of the ethanoic acid in mol/dm<sup>3</sup>. Give your answer to 3 significant figures.

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b) Calculate the concentration of the ethanoic acid in g/dm<sup>3</sup>. Give your answer to 3 significant figures.

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Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Uses equation for other reactant moles			Does not round too much		
Shows suitable working			Can find concentration of other reagent			Can use sig figs		
Can work out moles from conc & vol			Can convert mol/dm <sup>3</sup> to g/dm <sup>3</sup>			Gives units		