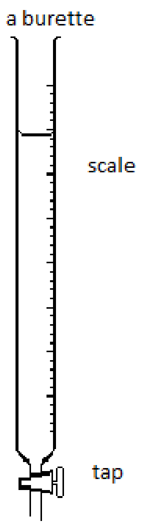
Burette

Burette – use to accurately measure the volume of liquid needed in a reaction



Rinse the burette with some of the *solution that you are going to use in your titration*. Don't use water!

Don't forget to check that there are **no air gaps below the tap** – drain some of the liquid through until all air has gone!

Burette Scales

Burette Scales – read to the bottom of the meniscus – you can read to 0.05 mL (half way between the 0.1 mL divisions. Eye is level with the bottom of the curve. Some say you can read to 0.02 mL with care and

Eye is <u>too low</u> in the first picture <u>and</u> <u>too high</u> on the third. The middle gives **correct reading** of 25.65 (mL)

Example results table

Example results table – the volume delivered (the titre) is the <u>difference</u> between the last scale reading and the first (initial) scale reading. Answers must not be negative!

<u>Example</u>

	Rough	1st	2nd	3rd
Final volume (mL)	15.30	30.10		
Initial Volume (mL)	0.00	15.30		
Volume used (mL)	15.30			

Record volumes to 2 decimal places. Your initial reading does not have to start at 0.00 mL

You are aiming for **3 results within 0.20 mL of each other**. It should be possible to get them **within 0.10 mL**. These will then be classed as concordant results. **<u>You use concordant results to calculate the average titre.</u>**

Pipette

Pipette - used to accurately measure a volume of solution and deliver into a conical flask.

- Volumes measured are usually 20.0 or 25.0 mL. At our school we use Diji pipettes.

Make sure you are familiar with the type of pipette that you will use in your assessment.

You rinse a pipette before use with a little of the solution you will be using it with.

Diji example

Diji example – deliver a 20.0 mL sample into a conical flask

Pipette Techniques – may vary according to the type of pipette you use at your school

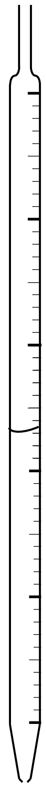
Keep pipette vertical

Use a slow smooth action

Have your eye level with the bottom of the meniscus.

Touch tip of pipette on side of conical flask at end of delivery.

Avoid having unexpected air bubbles when drawing up the liquid.



Selecting your data

You are looking for **3 concordant results – i.e. values that differ from each other by 0.10 mL** – if not then choose the 3 closest values

Expt.	rough	1	2	3	4
Final	14.00	27.20	40.60	13.60	26.90
Initial	0.20	14.00	27.20	0.00	13.60
Volume added (mL)	13.80	13.20	13.40	13.60	13.30

In this case a good choice would be to select the following data values: 13.20 mL, 13.30 mL and 13.40 mL

This would give an **average titre of 13.30 mL** to use in our calculation.

In this example it is advisable to do another titration – can you see why?

Expt.	rough	1	2	3	4
Final	15.70	30.60	46.20	15.30	30.60
Initial	0.00	15.70	30.60	0.20	15.30
Volume added (mL)					

Titre values will be 15.70 ; 14.90; 15.60; 15.10 and 15.30 mL - still need 3 within 0.10 mL

Example calculation

Remember that c = n/V
c = concentration in mol L^{-1}
n = amount of a substance in mol
V = volume of solution used in Litres (L)
Rearrange to give n=cV when required.

Steps involved

1) Identify the **known** and the **unknown** in the problem.
2) Find the **amount (n)** of the **known** using the equation **n=cV**
3) Look at the balanced equation (always supplied) to find the **amount (n)** of the **unknown** reacting
4) From **amount (n)** and **volume (V)** of the unknown solution use **c=n/V** to find the concentration of the unknown in mol L^{-1}

To convert mL to L divide by 1000
or multiply by 10^{-3} e.g. 18.0 mL = 18.0 x 10^{-3} L
Don't forget to do this!

Eg 20.0 mL of unknown concentration of NaOH(aq) was reacted with 10.0 mL of a solution of 0.150 mol L^{-1} HCl (aq)
Equation NaOH + HCl $\longrightarrow$ NaCl + H_2O

1) **Known** = HCl and **unknown** = NaOH
2) n(HCl) = cV = 0.150 mol L^{-1} x 10.0 x 10^{-3} L
= 1.50 x 10^{-3} mol of HCl reacted
3) ratio HCl : NaOH = 1:1 so n(NaOH) is also 1.50 x 10^{-3} mol reacted
4) c(NaOH) = n/V = 1.50 x 10^{-3}mol/20.0 x10^{-3} L
Answer = 0.0750 mol L^{-1} (3 s.f.)

A M or E?

Achievement	Achievement with Merit	Achievement with Excellence
• Carry out quantitative analysis.	• Carry out an in-depth quantitative analysis.	• Carry out a comprehensive quantitative analysis.

For achievement of the standard:

- at least three recorded titre values must fall within a range of 0.4 mL; the average titre value must be within 0.8 mL of the teachers answer.
- solving quantitative problems that use the relationships *n=m/M* and *c=n/V* to calculate one variable given the other two (the relationships are not given). Molar masses for substances may be provided. Calculations must be carried out using appropriate procedures (not provided).

For achievement with merit:

- at least three titre values must fall within a range of 0.4 mL; the average titre value must be within 0.5 mL of the expected outcome.
- solving quantitative problems that involve at least two steps and require application of relationships such as *n=m/M* and *c=n/V*. Titration calculations must be carried out correctly using only concordant titre values.

For achievement with excellence:

- at least three titre values must fall within a range of 0.2 mL; the average titre value must be within 0.2 mL of the expected outcome.
- solving quantitative problems that involve more than two steps, and the use of stoichiometric principles. Answers to calculations must demonstrate correct units and appropriate use of significant figures.

Quantitative analysis* involves collecting primary data from an acid-base titration, *and processing both primary and secondary data to solve quantitative problems.

- The standard solution to be used in the titration may be provided. The titration procedure and balanced equations will be provided.
- Student selected data will be used in determining the accuracy of the titration.