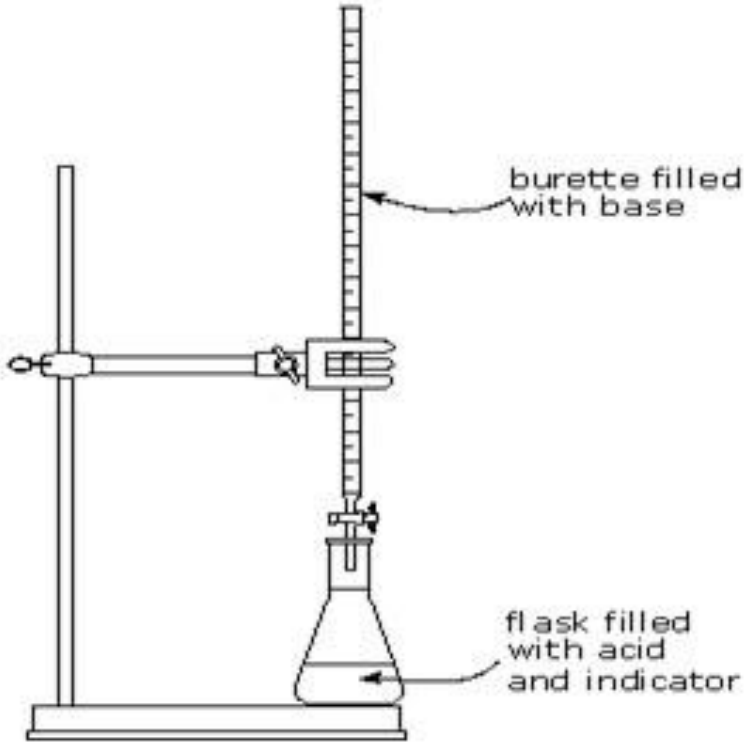
Required Practical Review

SCIENCE WELLSWAY MULTI ACADEMY TRUST

Chemistry - Separate Only - Titration

Free Science video: https://www.youtube.com/watch?v=saRBT5oZfh8
GCSE Pod Video: https://members.gcsepod.com/shared/podcasts/title/11591

Know it



1. Use the pipette and pipette filler to add 25 cm^3 of alkali to a clean conical flask.
2. Add a few drops of *indicator* and put the conical flask on a white tile (so you can see the colour of the indicator more easily).
3. Fill the *burette* with acid and note the starting volume.
4. Slowly add the acid from the burette to the alkali in the conical flask, swirling to mix.
5. Stop adding the acid when the end-point is reached (the appropriate colour change in the indicator happens). Note the final volume reading.
6. Repeat steps 1 to 5 until you get concordant results

Concordant results: Results within 0.1cm^3 of each other

Review it

Complete the tasks below into your book.

Up to grade 4

- Draw a table to show how you would record your results.
- How would you tell if a result was anomalous?
- What should you do with anomalous data?

Grade 5-7

- Identify the possible sources of error in the practical
- Why is it better to repeat the experiment and calculate a mean than just do the experiment once?
- Describe how you could reduce or remove the source of error if you were to repeat the practical.

Grade 7+

- Explain why it is important to fill the space below the tap in the burette with Solution A before beginning an accurate titration.
- Explain how (i) the titre and (ii) the value calculated for the concentration of the acid will be affected if you do not fill the space below the tap

Test it

Answer the exam questions below into your book.

Q1.

Sodium hydroxide neutralises sulfuric acid.

The equation for the reaction is:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

(a) Sulfuric acid is a strong acid.

What is meant by a strong acid?

_____

_____

_____

(2)

(b) Write the ionic equation for this neutralisation reaction. Include state symbols.

_____

(2)

(c) A student used a pipette to add 25.0 cm^3 of sodium hydroxide of unknown concentration to a conical flask.

The student carried out a titration to find out the volume of 0.100 mol / dm^3 sulfuric acid needed to neutralise the sodium hydroxide.

Describe how the student would complete the titration.

You should name a suitable indicator and give the colour change that would be seen.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(d) The student carried out five titrations. Her results are shown in the table below.

	Titration 1	Titration 2	Titration 3	Titration 4	Titration 5
Volume of 0.100 mol / dm^3 sulfuric acid in cm^3	27.40	28.15	27.05	27.15	27.15

Concordant results are within 0.10 cm^3 of each other.

Use the student's concordant results to work out the mean volume of 0.100 mol / dm^3 sulfuric acid added.

_____

_____

Mean volume = _____ cm^3

(2)

(e) The equation for the reaction is:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

Calculate the concentration of the sodium hydroxide.

Give your answer to three significant figures.

_____

_____

_____

_____

_____

Concentration = _____ mol / dm^3

(4)

(f) The student did another experiment using 20 cm^3 of sodium hydroxide solution with a concentration of 0.18 mol / dm^3.

Relative formula mass (M_r) of NaOH = 40

Calculate the mass of sodium hydroxide in 20 cm^3 of this solution.

_____

_____

_____

Mass = _____ g

(2)

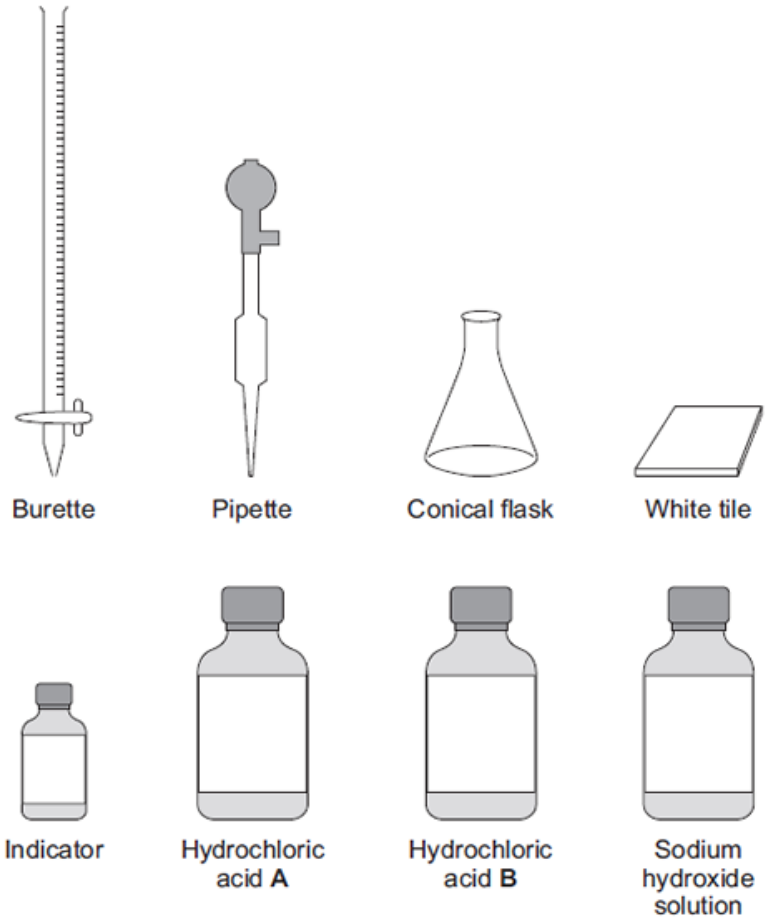
(Total 16 marks)

Q2.

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student has to check if two samples of hydrochloric acid, **A** and **B**, are the same concentration.

Describe how the student could use the apparatus and the solutions in the diagram below to carry out titrations.



(Total 6 marks)

Mark it

Q1.

(a) (sulfuric acid is) completely / fully ionised

1

In aqueous solution **or** when dissolved in water

1

(b) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

allow multiples

***1** mark for equation*

***1** mark for state symbols*

2

(c) adds indicator, eg phenolpthalein / methyl orange / litmus added to the sodium hydroxide (in the conical flask)

*do **not** accept universal indicator*

1

(adds the acid from a) burette

1

with swirling **or** dropwise towards the end point **or** until the indicator just changes colour

1

until the indicator changes from pink to colourless (for phenolphthalein) or yellow to red (for methyl orange) or blue to red (for litmus)

1

(d) titrations 3, 4 and 5

or

$$\frac{27.05 + 27.15 + 27.15}{3}$$

1

27.12 cm^3

*accept 27.12 with no working shown for **2** marks*

1

*allow 27.1166 with no working shown for **2** marks*

(e) Moles H_2SO_4 = conc × vol = 0.00271

allow ecf from 8.4

1

Ratio H_2SO_4:NaOH is 1:2

or

Moles NaOH = Moles H_2SO_4 × 2 = 0.00542

1

Concentration NaOH = mol / vol = 0.00542 / 0.025 = 0.2168

1

0.217 (mol / dm^3)

*accept 0.217 with no working for **4** marks*

1

*accept 0.2168 with no working for **3** marks*

(f) $\frac{20}{1000}$ × 0.18 = no of moles

or

0.15 × 40 g

1

0.144 (g)

1

*accept 0.144g with no working for **2** marks*

[16]

Q2.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

Level 3 (5 – 6 marks)
There is a description of titrations that would allow a comparison to be made between the two solutions of hydrochloric acid.

Level 2 (3 – 4 marks)
There is a description of an experimental method including addition of acid to alkali which may include an indicator or colour change and may include a measurement of volume.

Level 1 (1 – 2 marks)
There is a simple description of using some of the apparatus.

0 marks
No relevant content.

examples of chemistry points made in the response could include:

- acid in burette **or** flask
- alkali/sodium hydroxide **or** acid in burette **or** flask
- volume of acid **or** alkali measured using the pipette
- indicator in flask
- white tile under the flask
- slow addition
- swirling/mixing
- colour change of indicator
- burette volume measured

[6]