

Finding concentration by titration

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab

Name: _____ Date: _____ Class: _____

A bottle of sodium hydroxide solution has lost its label. This lab uses a titration against hydrochloric acid of known concentration to find out how concentrated the alkali is, using good technique and several concordant titres.

Level: Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** GCSE C4 RP

Aim

To find the concentration of a sodium hydroxide solution by titrating it with hydrochloric acid of known concentration.

Equipment

- 50 cm³ burette, stand and funnel
- 25.0 cm³ pipette and pipette filler
- 250 cm³ conical flask, white tile, wash bottle
- 0.100 mol/dm³ hydrochloric acid
- Sodium hydroxide solution of unknown concentration
- Phenolphthalein indicator with a dropper

Safety

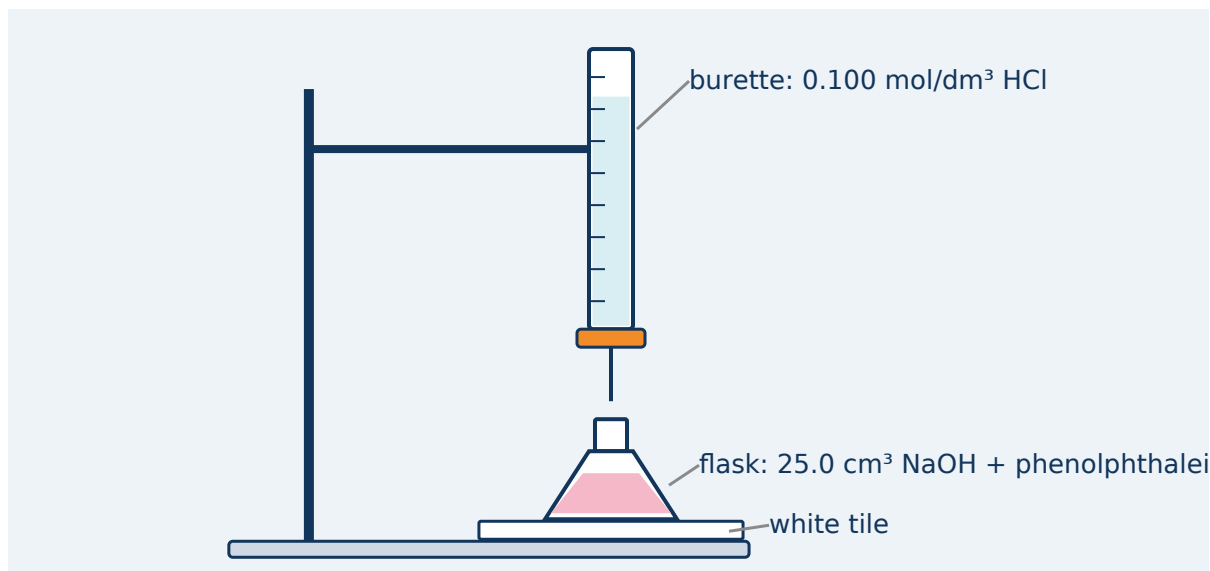
Safety

Wear safety goggles. Sodium hydroxide is corrosive: wash any splash on skin or eyes with plenty of water. Never pipette by mouth. Remove the funnel from the burette before reading it, because drips change the reading.

Method

1. Rinse the burette with a little acid, fill it above zero and run acid through the tip until there is no air bubble and the level is at or below 0.00 cm³.
2. Rinse the pipette with sodium hydroxide, then pipette 25.0 cm³ into the conical flask and add three drops of phenolphthalein.
3. Record the starting reading and run in acid while swirling until the pink just disappears (rough titration).
4. Repeat with fresh alkali, adding acid drop by drop within 2 cm³ of the rough value.

5. Repeat until two or three titres are concordant.



Titration set-up for the lab.

Results

Run	Start (cm ³)	Final (cm ³)	Titre (cm ³)
Rough	0.00	20.80	20.80
1	0.00	20.10	20.10
2	20.10	40.15	20.05
3	0.10	20.10	20.00

Analysis questions

Question 1 Select the concordant titres

State which titres should be used in the mean and why.

Question 2 Mean titre

Calculate the mean titre.

Question 3 Moles of acid

Calculate the moles of HCl in the mean titre.

Question 4 Concentration of NaOH

$\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$. Calculate the concentration of the sodium hydroxide in mol/dm³.

Question 5 Concentration in g/dm³

Convert the answer to g/dm³ (Ar: Na = 23, O = 16, H = 1).

Question 6 Uncertainty

Each burette reading has an uncertainty of $\pm 0.05 \text{ cm}^3$. Calculate the percentage uncertainty in the mean titre.

Question 7 Why swirl and go slowly

Explain why the acid is added drop by drop near the end point.

Question 8 Improving the lab

Suggest two improvements to reduce error.