SEPARATES ONLY - GCSE Chemistry required practical activity: Neutralisation

Student sheet – Foundation Tier

Investigation to find the volume of dilute sulfuric acid needed to neutralise a known volume of sodium hydroxide solution

You will find the volume of dilute sulfuric acid needed to neutralise 25 cm^3 of sodium hydroxide solution. Observing the colour change in an acid-base indicator is used to do this.

Risk assessment

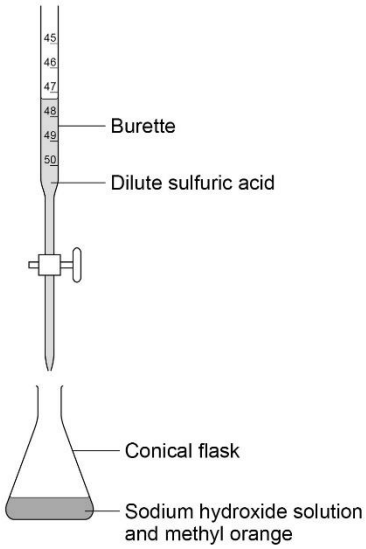
- Safety goggles must be worn throughout**.**

Method

You are provided with the following:

- 25cm^3 volumetric pipette and pipette filler
- Burette, small funnel and clamp stand
- 250cm^3 conical flask
- White tile
- Dilute sulfuric acid
- Sodium hydroxide solution
- Methyl orange indicator.

Read these instructions carefully before you start work.



1. Use the pipette and pipette filler to put exactly 25 cm^3 sodium hydroxide solution into the conical flask. Your teacher will show you how to do this.

   Stand the flask on a white tile.

2. Clamp the burette vertically in the clamp stand about halfway up its length.

   There should be just enough room underneath for the conical flask and tile.

3. Close the burette tap.

   Use the small funnel to carefully fill the burette with dilute sulfuric acid to the 0 cm^3 line.

   You should do this at a low level so that you are not pouring acid from above head height. For example, put the clamp stand temporarily on a lab stool or the floor.

4. Put 5–10 drops of methyl orange indicator into the conical flask. Swirl to mix and place under the burette with the tile.

5. Carefully open the tap so that sulfuric acid flows into the flask at a drop by drop rate.

Constantly swirl the flask when adding the acid. Look for a colour change from yellow to red in the indicator.

6. There will be signs that the colour change is close to being permanent. When this happens use the tap to slow the drops down.

   You need to be able to shut the tap immediately after a single drop of acid causes the colour to become permanently red.

7. Read the burette scale carefully and record the volume of acid you added. You can use a table such as the one below.

Volume of dilute sulfuric acid needed to neutralise 25cm^3 sodium hydroxide solution (cm^3)			
Trial 1	**Trial 2**	**Trial 3**	**Mean**
23.50	23.45	23.40	

8. Repeat steps **1–7** twice more and record the results in the table.

9. Calculate the mean value for the volume of acid needed to neutralise 25 cm^3 of the sodium hydroxide solution. Record this value in the final space in the table.

SEPARATES ONLY - GCSE Chemistry required practical activity: Neutralisation

Student sheet – Higher Tier

Investigation to find the concentration of a dilute sulfuric acid solution using a sodium hydroxide solution of known concentration

You will find the volume of dilute sulfuric acid needed to neutralise 25 cm^3 of 0.5 mol/dm^3 sodium hydroxide solution. Observing the colour change in an acid-base indicator is used to do this.

The sulfuric acid has an unknown concentration. You also calculate the concentration of the sulfuric acid used in mol/dm^3 and g/dm^3.

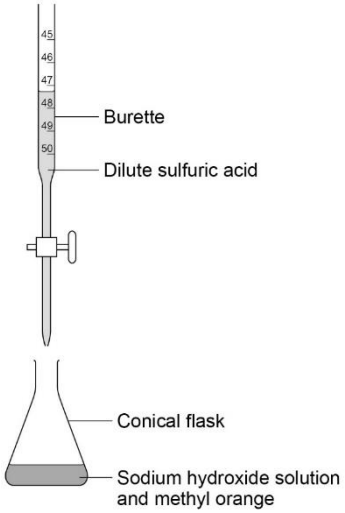
Risk assessment

- Safety goggles should be worn throughout.

Method

You are provided with the following:

- 25 cm^3 volumetric pipette and pipette filler
- burette
- small funnel
- clamp stand
- 250 cm^3 conical flask
- white tile
- dilute sulfuric acid of unknown concentration
- 0.1 mol/dm^3 sodium hydroxide solution
- methyl orange indicator.



Read these instructions carefully before you start work.

1. Use the pipette and pipette filler to put exactly 25 cm^3 sodium hydroxide solution into the conical flask. Your teacher will show you how to do this.

   Stand the flask on a white tile.

2. Clamp the burette vertically in the clamp stand about halfway up its length.

   There should be just enough room underneath for the conical flask and tile.

3. Close the burette tap.

   Use the small funnel to carefully fill the burette with dilute sulfuric acid to the 0 cm^3 line.

   You should do this at a low level so that you are not pouring acid from above head height. For example put the clamp stand temporarily on a lab stool or the floor.

4. Put 5–10 drops of methyl orange indicator into the conical flask. Swirl to mix and place under the burette with the tile.

5. Carefully open the tap so that sulfuric acid flows into the flask at a drop by drop rate.

   Constantly swirl the flask when adding the acid. Look for a colour change from yellow to red in the indicator.

6. There will be signs that the colour change is close to being permanent. When this happens use the tap to slow the drops down.

   You need be able to shut the tap immediately after a single drop of acid causes the colour to become permanently red.

7. Read the burette scale carefully and record the volume of acid you added. You can use a table such as the one below.

Volume of dilute sulfuric acid needed to neutralise 25cm^3 sodium hydroxide solution (cm^3)			
Trial 1	**Trial 2**	**Trial 3**	**Mean**
23.50	23.45	23.40	

8. Repeat steps **1–7** twice more and record the results in the table.

9. Calculate the mean value for the volume of acid needed to neutralise 25 cm^3 of the sodium hydroxide solution. Record this value in the final space in the table.

   Use your mean result to calculate the concentration of the acid in mol/dm^3 and g/dm^3 using the following calculation steps.

Calculations

Step 1

Concentration (mol/dm^3) = number of moles ÷ volume of solution (dm^3)

Moles of sodium hydroxide in 25 cm^3 = concentration × volume = 0.1 mol/dm^3 × (25 ÷ 1000) dm^3

= _____ moles

Step 2

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

This shows that **two** moles of sodium hydroxide neutralise **one** mole of sulfuric acid.

So moles of sulfuric acid used = (answer from step **1**) ÷ 2

= _____ moles

Step 3

Concentration of sulfuric acid (mol/dm^3) = moles ÷ mean volume of acid

= (answer from step **2**) ÷ (mean volume from table ÷ 1000)

= _____ mol/dm^3

Step 4

Number of moles = mass of substance (g) ÷ M_r of substance

A_r (H) = 1; A_r (O) = 16; A_r (S) = 3

M_r (H_2SO_4) = _____

Concentration of sulfuric acid (g/dm^3) = (answer from step **3**) x M_r (H_2SO_4)

= _____ g/dm^3