GCSE Chemistry required practical activity 2: Neutralisation (chemistry only)

Student sheet – Foundation Tier

Required practical activity	Apparatus and techniques
Determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration.	AT 1, AT 8

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

In this investigation you will use the colour change in an acid-base indicator to find the volume of dilute sulfuric acid needed to exactly neutralise 25cm^3 of sodium hydroxide solution.

Learning outcomes
1
2
Teachers to add these with particular reference to working scientifically

Method

You are provided with the following:

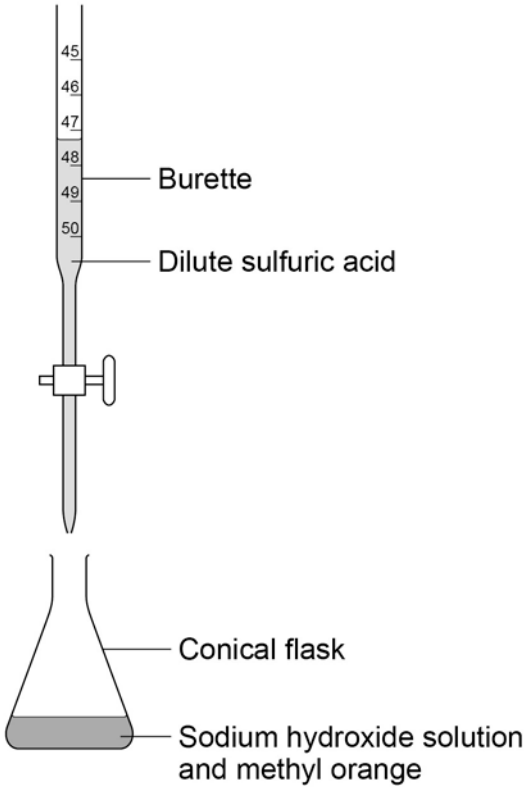
- 25cm^3 volumetric pipette and pipette filler
- Burette, small funnel and clamp stand
- 250cm^3 conical flask
- White tile
- Dilute sulfuric acid
- Sodium hydroxide solution
- Methyl orange indicator

Risk assessment

Safety goggles must be worn throughout

You should read these instructions carefully before you start work.

1. Use the pipette and pipette filler to put exactly 25cm^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, so that there is just enough room underneath for the conical flask and tile.
3. Making sure the burette tap is closed; use the small funnel to carefully fill the burette with dilute sulfuric acid to the 0cm^3 line. You should do this at a low level so that you are not pouring acid from above head height – for example, with 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 dropwise rate. Whilst adding acid, constantly swirl the flask and look for a colour change from yellow to red in the indicator.
6. When there are signs that the colour change is close to being permanent, 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 in the first blank space in the table below.

8. Repeat the whole investigation twice more and record the results of your repeats in the second and third blank spaces.

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

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

GCSE Chemistry required practical activity 2: Neutralisation (chemistry only)

Student sheet – Higher Tier

Required practical activity	Apparatus and techniques
Higher Tier only Determination of the concentration of one of the solutions in mol/dm3 and g/dm3 from the reacting volumes and the known concentration of the other solution.	AT 1, AT 8

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

In this investigation you will use the colour change in an acid-base indicator to find the volume of dilute sulfuric acid of unknown concentration needed to exactly neutralise 25cm^3 of 0.5 mol/dm^3 sodium hydroxide solution. You will then calculate the concentration of the acid used in mol/dm^3 and g/dm^3.

Learning outcomes
1 **2** **Teachers to add these with particular reference to working scientifically**

Method

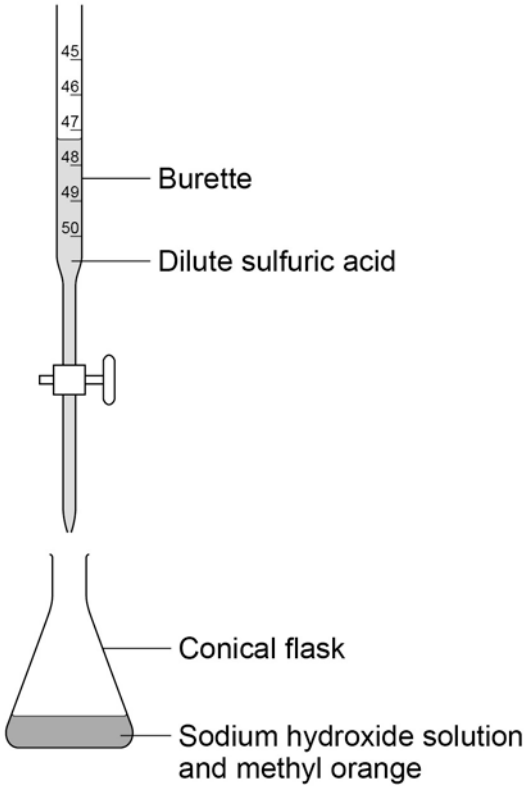
You are provided with the following:

- 25cm^3 volumetric pipette and pipette filler
- Burette, small funnel and clamp stand
- 250cm^3 conical flask
- White tile
- Dilute sulfuric acid of unknown concentration
- 0.1 mol/dm^3 sodium hydroxide solution
- Methyl orange indicator

Risk assessment

Safety goggles must be worn throughout.

You should read these instructions carefully before you start work.



1. Use the pipette and pipette filler to put exactly 25cm^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, so that there is just enough room underneath for the conical flask and tile.
3. Making sure the burette tap is closed; use the small funnel to carefully fill the burette with dilute sulfuric acid to the 0cm^3 line. You should do this at a low level so that you are not pouring acid from above head height – for example, with 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 dropwise rate. Whilst adding acid, constantly swirl the flask and look for a colour change from yellow to red in the indicator.

6. When there are signs that the colour change is close to being permanent, 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 in the first blank space in the table below.
8. Repeat the whole investigation twice more and record the results of your repeats in the second and third blank spaces.
9. Calculate the mean value for the volume of acid needed to neutralise 25cm^3 of the sodium hydroxide solution.

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

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

Calculations

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

Step 1:

Moles of sodium hydroxide in $25cm^3$ = concentration x volume = 0.1 mol/dm^3 x (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) = 32
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