GCSE Chemistry required practical activity 4: Temperature changes

Student sheet

Required practical activity	Apparatus and techniques
Investigate the variables that affect temperature changes in reacting solutions such as, eg acid plus metals, acid plus carbonates, neutralisations, displacement of metals.	AT 1, AT 3, AT 5, AT 6

Investigation of the temperature changes which take place when an acid is neutralised by an alkali.

In this investigation you will monitor the temperature rise as small volumes of sodium hydroxide solution are added to dilute hydrochloric acid in an insulated cup. You will then plot a graph of your results and work out how much sodium hydroxide was needed to fully react with the acid.

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

Method

You are provided with the following:

- 2M dilute hydrochloric acid
- 2M sodium hydroxide solution
- Expanded polystyrene cup and lid
- 250cm^3 beaker
- 10cm^3 and 50cm^3 measuring cylinders.
- thermometer

Risk Assessment

Safety goggles must be worn throughout.

You should read these instructions carefully before you start work.

1. Use the large measuring cylinder to put 30cm^3 dilute hydrochloric acid into the polystyrene cup.
2. Stand the cup inside the beaker. This will make it more stable.
3. Use the thermometer to measure the temperature of the acid. Record it in the first blank column of the table on the back of this sheet.
4. Put 5cm^3 sodium hydroxide solution into the small measuring cylinder.
5. Pour the sodium hydroxide into the cup, quickly fit the lid and gently stir the solution with the thermometer through the hole. When the reading on the thermometer **stops changing**, write the temperature in the next space in the table.
6. Repeat steps 4 and 5 to add further 5cm^3 portions of sodium hydroxide to the cup until a total of 40cm^3 has been added. The last few additions should produce a temperature fall rather than a rise.
7. Repeat the **whole investigation** (steps 1 – 6) and record the results in the second blank column of the table.
8. Calculate the **mean** maximum temperature reached for each of the sodium hydroxide volumes and record it in the third blank column.
9. Plot a line graph of total volume of sodium hydroxide added in cm^3 (x axis) against mean maximum temperature in °C (y axis). Draw two straight lines of best fit - one through the points which are increasing, and another through those which are decreasing. Ensure the two lines are extended so they cross each other.
10. Use the graph to estimate how much sodium hydroxide solution was needed to neutralise 25cm^3 dilute hydrochloric acid.

Total volume of sodium hydroxide added (cm^3)	**Maximum temperature (°C)**		
	First trial	**Second trial**	**Mean**
0			
5			
10			
15			
20			
25			
30			
35			
40			