

## A simple thermometric titration

### Aims

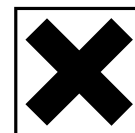
To study the changes in temperature when an alkali is neutralised by an acid.



### Apparatus

Goggles  
Bench mat  
Polystyrene cup  
Teat pipette  
25cm<sup>3</sup> measuring cylinder

Thermometer  
Dilute hydrochloric acid ☒  
Dilute sodium hydroxide solution ☒  
Phenolphthalein indicator ☒ (this is pink in alkali, but colourless in acid)



### Methods

1. Make a table in your book with these headings:

Volume of acid added (cm <sup>3</sup> )	Temperature of reaction mixture (°C)	Colour of indicator
0		
2		
⋮		
40		

Allow 21 lines for your results. Fill in the first column from 0 to 40, counting up in twos.

- Use the measuring cylinder to add 20cm<sup>3</sup> of dilute sodium hydroxide solution to the polystyrene cup. Add a few drops of phenolphthalein indicator to get a pink colour.
  - Record the temperature and colour of the mixture in the polystyrene cup.
  - Use the teat pipette to add 2cm<sup>3</sup> of dilute hydrochloric acid to the cup, then stir briefly with the thermometer. Record the new temperature and colour.
  - Repeat step 4 until you have added a total of 40cm<sup>3</sup> of acid to the beaker.
- Tidy away carefully, then analyse your results as described below.

Take great care not to knock the polystyrene cup over. Do not let the thermometer tip it over or make a hole in it.

### Analysis

- Plot a graph of your results. The vertical axis should be the temperature, and the horizontal axis should be the volume of dilute acid added. Label each axis and include the units (°C or cm<sup>3</sup>).
- Draw two **straight** lines of best fit: one where the points go up, and one where they go down. Make sure that the two lines cross each other. The alkali should be neutralised where the lines cross.
- What volume of acid was needed to neutralise the alkali?
  - What was the temperature where the lines cross?
  - Is neutralisation an exothermic reaction or an endothermic reaction? Explain your answer.

Volume of acid added (cm <sup>3</sup> )	Temperature of reaction mixture (°C)	Colour of indicator
0		
2		
4		
6		
8		
10		
12		
14		
16		
18		
20		
22		
24		
26		
28		
30		
32		
34		
36		
38		
40		

Volume of acid added (cm <sup>3</sup> )	Temperature of reaction mixture (°C)	Colour of indicator
0		
2		
4		
6		
8		
10		
12		
14		
16		
18		
20		
22		
24		
26		
28		
30		
32		
34		
36		
38		
40		