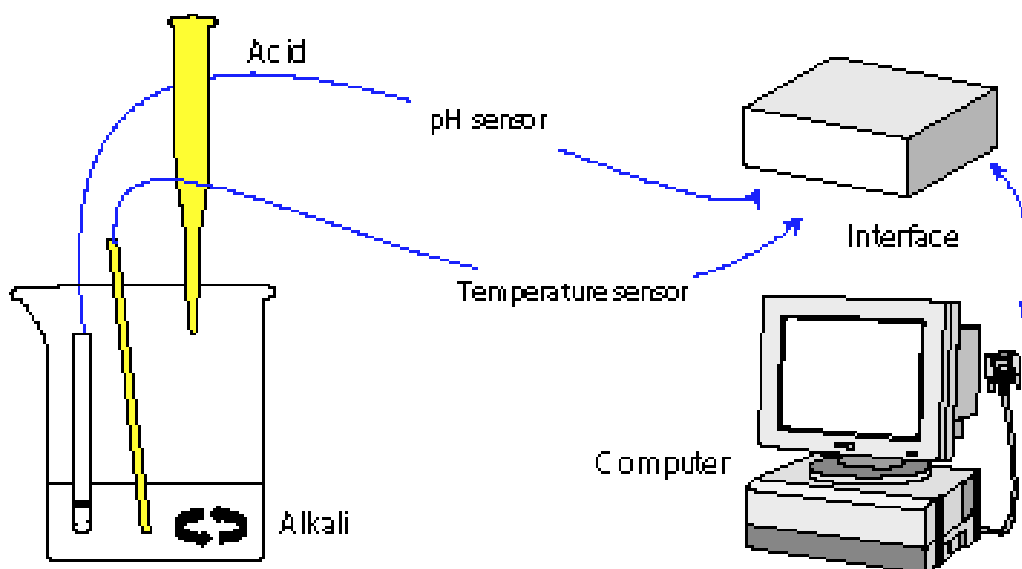


# Thermometric titration



As acid reacts with alkali the pH changes and heat is evolved. This heat of neutralisation can be easily monitored using sensors - to produce a graph of temperature and pH against time. If it is assumed that the burette drains at a constant rate, then the time will be proportional to the volume of acid. Heat production decreases after all the alkali has been neutralised.

## Apparatus

Burette, stand, magnetic stirrer, pH Indicator solution, pH electrode, pH buffer solution, 200 cm<sup>3</sup> 1 M sodium hydroxide NaOH, 50 cm<sup>3</sup> 5M hydrochloric acid HCl, 200 cm<sup>3</sup> beakers, interface, temperature sensor, pH sensor.

## Setting up

Set up a beaker with 20 cm<sup>3</sup> alkali & indicator, place on the stirrer. Fill the burette with acid.

Connect the pH electrode to the pH sensor and the sensor to socket 1 on the interface.

Connect the temperature sensor to socket 2. Place the temperature probe and the pH electrode in the beaker of alkali.

If the temperature sensor is adjustable, set a suitable range of say, up to 40 degrees). You may be able to calibrate the pH sensor to read correctly in known pH buffer solution.

## Recording the data

Record for 2 minutes. Turn on the stirrer. Turn on the burette and let the acid drip in gradually. Ideally try to top up, and maintain the same head of liquid in the burette.

## Using the results

When does the pH change most slowly? Is this at the beginning, the middle or the end of the titration?

When does the pH change most rapidly? What does the graph tell you about the change in pH during a titration?

How does the graph show you the mixture is getting hotter?

When during the reaction is the mixture getting hotter fastest?

At what pH does the mixture start to cool? Why?

Save your data on disk. Print the graph.

