Energy changes in neutralisation – teacher notes

In this experiment students do reactions at dropscale on thermometer strips and observe temperature changes.

Topic

Energy changes in reaction

Timing

20 minutes

Equipment

Apparatus

- Student worksheet
- One thermometer strip per group

Chemicals

Solutions should be contained in plastic pipettes. See the accompanying guidance on apparatus and techniques for microscale chemistry (https://rsc.li/3qUzFpS), which includes instructions for preparing a variety of solutions.

- Hydrochloric acid, 2 mol dm^{-3}
- Sodium hydroxide, 2 mol dm^{-3}
- Magnesium ribbon

Procedure

1. Put two drops of dilute hydrochloric acid on each marked section of the temperature strip.
2. Add a small piece of magnesium ribbon to each drop.
3. Observe and explain your findings.
4. Wipe the strip clean with tissue paper.
5. Put one drop of hydrochloric acid on the strip in each of the places marked by the arrows.
6. Add one drop of sodium hydroxide to each drop of acid.
7. Observe and explain your findings.

Health, safety and technical notes

- Read our standard health and safety guidance (https://rsc.li/3UpwpQX).
- Wear eye protection throughout (splash-resistant goggles to BS EN166 3).
- Hydrochloric acid, 2 mol dm^{-3} HCl(aq), is of low hazard.
- Sodium hydroxide solution, 2 mol dm^{-3} NaOH(aq), is CORROSIVE.
- Magnesium ribbon is FLAMMABLE.

Observations

In both cases – the reaction of the piece of magnesium with the hydrochloric acid and the neutralisation reaction – it should be apparent that energy has been given out as heat since the numbers under the drops should illuminate. The highest green number can be regarded as the highest temperature reached.

It might be possible to obtain a value for the enthalpy change of the neutralisation of a strong acid by a strong base. Students know the concentration of the reagents and will be able to observe the temperature rise. They will need to know the volumes involved – the volume of one drop is ca 0.02 cm^3.