Microscale precipitation and neutralisation reactions

This resource supports the article **Teaching observation skills at 11–14** (rsc.li/40MS340) and **Explicitly teach learners how to make observations** (rsc.li/3Kn6LcE), part of the Teaching science skills series from *Education in Chemistry*. Both articles offer and ideas and tips for supporting your learners to develop their observations skills.

Download the student sheet with integrated instructions and view videos of both experiments at rsc.li/3dl7WbA

Learning objectives

1 Make detailed and accurate observations of chemical reactions.

2 Use your observations to infer what is happening as these reactions take place.

Introduction

Small and microscale chemistry practicals provide plenty of variety and opportunity to refine observation skills.

In this activity learners will observe two microscale reactions: neutralising citric acid and creating a lead iodide precipitate. Following integrated instructions, students will observe the dissolution of the crystals, colour change of the indicator and formation of the product.

Technician notes

Equipment (per student/group)

- student sheets, laminated or in a plastic wallet (from rsc.li/3dl7WbA)
- 2 x dropping pipettes
- 2 x micro spatulas
- paper towel for clearing up
- universal indicator solution
- water

- citric acid, a few crystals (WARNING: irritant)
- anhydrous sodium carbonate, a few crystals (WARNING: irritant)
- lead(II) nitrate(V), a few crystals (DANGER: harmful and toxic)
- potassium iodide, a few crystals

- safety glasses

Preparation

- Read our standard health and safety guidance (rsc.li/3zyJLkx) and carry out a risk assessment before running any live practical.
- A guide to apparatus and equipment for microscale chemistry can be found at rsc.li/3TVSp6j
- You can view both experiments in the videos on our site at rsc.li/3dl7WbA

Health and safety

- Wear eye protection
- Ensure hands are washed after the activity
- Lead(II) nitrate(V) is harmful and toxic. Sodium carbonate is irritant. Citric acid is irritant. Only very small quantities of the solids are being used, reducing the risk.
- Indicator solutions can be flammable depending on the solvent used.
- Check CLEAPSS/SSERC or another reputable source for full risk assessment guidance.

Disposal

Wipe down the laminated sheet/plastic wallet with a paper towel and dispose of the towel in normal refuse. Rinse and dry the laminated sheet/plastic wallet.

Running the investigation

This microscale practical involves mixing chemicals in small drops of water on the instruction sheet and observing the reactions. Following the integrated instructions and carrying out the reactions in microscale will allow learners to complete both investigations and allow time for discussion in one lesson.

Reaction 1: Precipitation of lead iodide

1. Add a few crystals of potassium iodide to the left-hand small circle.
2. Add a few crystals of lead(II) nitrate(V) to the right-hand small circle.
3. Add 10 drops of water into the large central circle.
4. Carefully push the crystals into the edges of the drop of water.
5. Observe the dissolution of the crystals and the formation of lead iodide.

The potassium iodide and lead(II) nitrate(V) crystals will dissolve into the water. Yellow lead(II) iodide crystals will form in the centre of the drop over time as the ions diffuse towards each other.

Reaction 2: Neutralisation of citric acid

1. Add a few crystals of anhydrous sodium carbonate to the left-hand small circle.

2. Add a few crystals of citric acid to the right-hand small circle.
3. Add 10 drops of water into the large central circle.
4. Add 1 drop of universal indicator solution to the central drop of water.
5. Carefully push the crystals into the edges of the drop of water.
6. Observe the dissolution of the crystals, the change in colour of the indicator, and the formation of carbon dioxide bubbles.

The sodium carbonate will dissolve into solution, turning the green indicator to blue/purple. The citric acid will dissolve into solution, turning the green indicator orange/red. Where the solutions meet, neutralisation will occur, and bubbles of carbon dioxide gas will form over time.

Discussion

From their observations, encourage learners to make inferences on what is happening at the sub-microscopic level. It is helpful to frame the discussion as, firstly, *what did you observe?* Then use the prompt questions below to discuss, *what can you infer from what you have observed?*

Prompt questions for reaction 1

- What has happened to the lead nitrate crystals?
- What has happened to the potassium iodide?
- What is the yellow band appearing in the drop?
- Why is the yellow band nearer to one side than the other?

Prompt questions for reaction 2

- What do the changes to the colour of the indicator on each side of the drop show?
- What is happening where the solutions meet?