Microscale precipitation and neutralisation reactions

These technician notes are part of a collection of microscale chemistry resources at: rsc.li/4iiljbl. Integrated instructions are also available. Download a PowerPoint 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 for learners to refine their observation skills.

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

Technician notes

Equipment (per group)

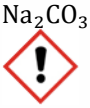
- Integrated instruction sheets, laminated or in a plastic wallet
- 2 x dropping pipettes
- 2 x micro spatulas
- Paper towel for clearing up
- Universal indicator solution
- Water
- Citric acid, a few crystals (WARNING: irritant)
- Anhydrous sodium carbonate, a few crystals (WARNING: irritant)
- Lead(II) nitrate(V), a few crystals (DANGER: harmful and toxic)
- Potassium iodide, a few crystals

Safety equipment

- Eye protection: safety glasses

Safety and preparation

- Read our standard health and safety guidance and carry out a risk assessment before running any live practical (rsc.li/3zyJLkx).
- Refer to SSERC/CLEAPSS Hazcards and recipe sheets.
- Hazard classification may vary depending on supplier.

Chemical supplied for the practical	Preparation
Universal indicator solution  WARNING Flammable CLEAPSS Hazcard 032.	Universal indicator solution Either use a commercial universal indicator or prepare a solution following CLEAPSS recipe sheet RB047. Follow the recipe in conjunction with the advice on CLEAPSS Hazcards 032 and 040A.
Citric acid, solid 2-Hydroxypropane-1,2,3-tricarboxylic acid  WARNING Irritant (skin, eyes) May cause respiratory irritation. CLEAPSS Hazcard 036C.	N/A
Anhydrous sodium carbonate $Na_2CO_3(s)$  WARNING Causes serious eye irritation. CLEAPSS Hazcard 095A.	N/A
Lead(II) nitrate(V) $Pb(NO_3)_2(s)$  WARNING Harmful if swallowed or inhaled. May damage the unborn child. Toxic to aquatic life. CLEAPSS Hazcard 057A.	N/A
Potassium iodide $KI(s)$ Not usually classified as hazardous but classification/labelling varies. Can be irritating to eyes. CLEAPSS Hazcard 047b.	N/A

Disposal

- Wipe down the laminated sheet/plastic wallet with a paper towel and dispose of the towel in laboratory waste.
- Rinse and dry the laminated sheet/plastic wallet.

Method

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 to the large central circle.
4. Carefully push the crystals into the edges of the water. Observe the dissolution of the crystals and the formation of lead iodide.

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 to the large central circle. Add 1 drop of universal indicator solution to the water.
4. Carefully, push the crystals into the edges of the water. Observe the dissolution of the crystals, the change in colour of the indicator and the formation of carbon dioxide bubbles.

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 precipitation reaction

- 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 neutralisation reaction

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