

Cold reactions

Download the teacher notes, PowerPoint and student workbook that accompany this resource at rsc.li/3aJlqPc.

Read our health & safety guidance, available from rsc.li/3IAmFA0, and carry out a risk assessment before running any live practical.

The safety equipment suggested is in line with CLEAPSS requirements. For non-hazardous substances, wearing lab coats can help to protect clothes. The safety rules might be different where you live so it is worth checking local and school guidance.

This list assumes 30 learners working in pairs.

The learners will only test all six compounds if time allows. The quantities suggested below may vary depending on time available for this activity.

Acknowledgements

This resource was originally developed by the University of Reading to support outreach work delivered as part of the Chemistry for All project.

To find out more about the project, and get more resources to help widen participation, visit our Outreach resources hub: rsc.li/3CJX7M3.

Note: all hazard symbols images are © Shutterstock.

Activity 1: cold packs






Please set up a large collection beaker for each solution. Learners will be instructed to empty the contents of their beakers into the correct collection beaker for the technician to dispose of appropriately later.

Equipment

- 15 × 50 or 100 cm³ measuring cylinders
- 15 × 0–100°C thermometers
- 15 × spatulas
- 100 × 50 cm³ beakers
- 3 × marker pens for labelling the beakers
- Access to balances (3 minimum)
- Kettle
- Stop clocks (or students can use their phones depending on school policy)

Cold reactions: technician notes

Available from [rsc.li/3aJlqPc](https://www.rsc.li/3aJlqPc)

Chemicals supplied for the practical	Hazards
15 × 5 g ammonium or calcium nitrate	<p>WARNING</p> <ul style="list-style-type: none"> Ammonium sulfate may intensify fire as it is an oxidiser. Can cause serious eye irritation and may cause skin irritation and respiratory irritation. Calcium nitrate is irritating to eyes and skin. <p>Disposal: Pour down a foul-water drain (after treatment and/or dilution).</p>
15 × 5 g sodium chloride Currently not classified as hazardous	<p>Disposal: Pour down a foul-water drain (after treatment and/or dilution).</p>
15 × 5 g sodium hydrogen carbonate Currently not classified as hazardous	<p>Disposal: Neutralise and dilute, then pour down a foul-water drain with further dilution.</p>
15 × 5 g citric acid	<p>WARNING</p> <ul style="list-style-type: none"> Causes serious eye irritation, skin irritation and may cause respiratory irritation. <p>Disposal: Neutralise and dilute, then pour down a foul-water drain with further dilution.</p>
15 × 5 g calcium chloride	<p>WARNING</p> <ul style="list-style-type: none"> Causes serious eye irritation, skin irritation and may cause respiratory irritation. <p>Disposal: Pour down a foul-water drain (after treatment and/or dilution).</p>
15 × 5 g calcium sulfate (plaster of Paris) Currently not classified as hazardous	<p>Disposal: Remove by a registered waste carrier or via special waste section at local recycling facility.</p>

Activity 2: citric acid and sodium hydrogen carbonate


The quantities needed may vary from those listed below depending on whether all of the solids were used in Activity 1.

Equipment

- 15 × 50 or 100 cm³ measuring cylinders
- 15 × 0–100°C thermometer
- 15 × spatulas
- 100 × polystyrene cups
- Access to balances (3 minimum)
- Stop clocks (or students can use their phones depending on school policy)

Preparation

- 15 × 5 g sodium hydrogen carbonate
- 15 × 5 g citric acid

Chemical supplied for the practical	Preparation
15 × 5 g sodium hydrogen carbonate Currently not classified as hazardous	Disposal: Neutralise and dilute, then pour down a foul-water drain with further dilution.
15 × 5 g citric acid	WARNING  Causes serious eye irritation, skin irritation and may cause respiratory irritation. Disposal: Neutralise and dilute, then pour down a foul-water drain with further dilution.

Activity 3: making ice cream

Equipment

- Bag of crushed ice (you may need to build up from ice cubes over the course of a week)
- 15 × zip lock sandwich bags
- 15 × weigh boats

Preparation

- 15 × 150 ml milk
- 15 × 15 g salt

Demonstration: glow sticks

Equipment

- 4 × 100 cm³ measuring cylinders or larger if possible.
- 4 × glow sticks

Preparation

- Crushed ice
- Salt