The chemistry of food

Download the teacher notes, PowerPoint presentation and student workbook that accompany this resource at rsc.li/3RGH1cT.

Read our health & safety guidance, available from rsc.li/3IAmFA0, and carry out a risk assessment before running any live practical. Use the specific safety notes for the practicals included in this resource to guide you.

Provide safety glasses for each learner.

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.

Equipment listed is sufficient for each pair or small group of learners.

Each pair or group will need a full set of equipment for each of the three activities. Alternatively, these three activities can be run as a circus, which the learners cycle through.

Remind learners they should never eat or drink in a science laboratory.

Acknowledgements

This resource was originally developed by Liverpool John Moores University 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.

Activity 1: identifying food colourings in soft drinks

Equipment

- Beaker and watch glass to act as a 'solvent tank' for TLC plates
- Cocktail sticks/toothpicks
- Artificial food colourings
- 2 × TLC plates, pencil, ruler
- Paper towels
- Colour 'extracts' – use the listed colours in the drinks to make these up and label with the name of the drink
- Waste pot for used cocktail sticks/toothpicks

Preparation

- Labelled food dye samples and mixtures – each group needs a small quantity of each to dot onto their TLC plate
- Individual food colourings – E102, E110, E122, E127, E131, E133, E142
- Soft drink 'extracts'
  - Relentless® apple and kiwi extract (E142, E110, E133)
  - Powerade® extract (E133, E131)
  - Irn Bru® extract (E110, E127)

Chemical supplied for the practical	Preparation and hazards
1% NaCl solution in tank	Currently not classified as hazardous Disposal: pour down a foul-water drain (after treatment and/or dilution)

Activity 2: finding the vitamin C content of fruit juice

Equipment

- Burette and stand
- 250 cm^3 conical flasks
- White tile
- 100 cm^3 measuring cylinder
- 10 cm^3 syringe for measuring the starch solution
- 100 cm^3 beaker for collecting iodine solution
- Funnel
- Glass rod
- Pasteur pipette

Preparation

- Distilled water for rinsing the conical flask between titrations
- A selection of fruit juices
- 0.00125 M iodine solution
- 0.5% starch solution

Chemical supplied for the practical	Preparation and hazards
0.00125 M iodine solution	At this concentration iodine is non-hazardous but will still stain the skin. The solution may be prepared using iodine solid or iodine solution at 1 M or greater. WARNING: harmful (skin, inhalation) and very toxic to aquatic life. For more information, please refer to CLEAPSS Hazcard HC054 and recipe book RB050.  Disposal: wear eye protection and gloves. Avoid inhaling vapour and use a fume cupboard if necessary. Add the solution to 1 litre of 1 M sodium thiosulfate solution. Dilute the pale-coloured solution further and pour down a foul-water drain.
0.5% starch solution	Currently not classified as hazardous Disposal: place in the normal refuse.

Activity 3: finding the iron content in food

Note: if you do not have the kit available you could skip this activity or use an alternative such as Project 2, available at rsc.li/3XrjIX8. This allows learners to use an alternative to a spectrophotometer and could be adapted for testing iron solutions instead of different blackcurrant concentrations.

Equipment

- UV spectrophotometer set to 480 nm
- Blank control cuvette containing dilution of KSCN in distilled water equivalent to the dilution of the standard solutions (ie 5 $\mathrm{cm^3}$ 1.5 $\mathrm{M\ KSCN}$ added to 10 $\mathrm{cm^3}$ distilled water)
- 5 × plastic cuvettes
- Automatic pipette (5 ml) (if you do not have access to automatic pipettes, normal pipettes can be used instead)
- 5 × teat pipettes
- Distilled water
- 5 × small beakers

Preparation

- 5 × small beakers, each containing exactly 10 $\mathrm{cm^3}$ of one of the $\mathrm{FeCl_3}$ standard solutions labelled **1** (0.5 M), **2** (1.0 M), **3** (1.5 M), **4** (2.0 M) and **5** (0.0025 M)
- 1.5 $\mathrm{M\ KSCN}$ solution (50 $\mathrm{cm^3}$ for each group)
- Three beakers of $\mathrm{FeCl_3}$ solutions labelled:
- ‘Broccoli’ ($0.9 \times 10^{-3}\ \mathrm{M\ FeCl_3}$)
- ‘Spinach’ ($3.6 \times 10^{-3}\ \mathrm{M\ FeCl_3}$)
- ‘Peas’ ($1.8 \times 10^{-3}\ \mathrm{M\ FeCl_3}$)
- Add 5 $\mathrm{cm^3}$ 1.5 $\mathrm{M\ KSCN}$ solution to 10 $\mathrm{cm^3}$ food solution for each group’s food extracts

Chemical supplied for the practical	Preparation and hazards
$FeCl_3$	5 × small beakers, each containing exactly 10 cm^3 of $FeCl_3$ standard solutions labelled **1** (0.0025 M), **2** (0.5 M), **3** (1.0 M), **4** (1.5 M), **5** (2.0 M). DANGER: 0.5 M $FeCl_3$ solution – corrosive (eyes) $FeCl_3$ solution with concentrations above 0.5 M are classified as corrosive (eyes) and irritant (skin). ≥ 1.5 M $FeCl_3$ solutions are also harmful (ingestion). Label all except beaker 1 with the harmful and corrosive warning labels:  Please refer to CLEAPSS recipe book RB052 and Hazcard HC055C for more information on preparation. Disposal: add solution to excess 1 M sodium carbonate solution. Use approximately 100 cm^3 of 1 M sodium carbonate solution per 100 cm^3 of a 0.1 M solution. Separate off the brown precipitate of hydrated iron(III) hydroxide. Place solid in the normal waste. Rinse remaining liquid down a foul-water drain.
1.5 M KSCN solution	50 cm^3 for each group ≥ 2.5 M WARNING: harmful (ingestion) – label the beakers and avoid inhalation and contact with skin. For more information on preparation please refer to CLEAPSS HC095A and RB122. Disposal: pour down a foul-water drain.