

Lifting an egg by a thread

Time

1–1.5 h.

Curriculum links

The more problem solving the students have done the better.

Group size

2–3.

Materials and equipment

Items from the junk list – this must include items that allow the gel to be extruded *ie* syringes, cake icer, washing-up bottles.

Materials per group

- 300 cm³ of 880 ammonia solution (This is concentrated ammonia. Corrosive to skin and eyes. Causes severe internal damage if swallowed. Gas pressure increases on hot days. Respiratory irritant)
- 30 g powdered copper carbonate (Harmful if swallowed, toxic to aquatic life)
- 6 g cellulose (filter paper, cotton wool)
- 1 mol dm⁻³ sulphuric acid (Skin/eye irritant)
- small fresh egg
- deionised water.

Equipment per group

- two 250 cm³ beakers
- glass rod
- shallow plastic tray (to extrude the cellulose into)
- safety glasses.

Safety

Eye protection (to BS EN166 3) must be worn. 880 ammonia is a respiratory irritant – work in a well-ventilated laboratory or use a fume cupboard.

Disposal: Blue copper ammonium solution should be kept for disposal.

Risk assessment

A risk assessment must be carried out for this activity.

This is an open-ended problem solving activity, so the guidance given here is necessarily incomplete. Teachers need to be particularly vigilant, and a higher degree of supervision is needed than in activities which have more closed outcomes. Students must be encouraged to take a responsible attitude towards safety, both their own and that of others. In planning an activity students should always include safety as a factor to be considered. Plans should be checked by the teacher before implementing them.

You must always comply with your employer's procedures and in some cases may decide that a particular activity is inappropriate in your situation. Further information on Health and Safety should be obtained from reputable sources such as CLEAPSS [<http://science.cleapss.org.uk/>] in England, Wales and Northern Ireland and, in Scotland, SSERC [<https://www.sserc.org.uk/>].

Commentary

This problem caused much consternation during trialling because it is more difficult than it seems. The trick is to get the recipe right and to make fairly thick fibres. These will lift an egg if used carefully although the fibres degrade after a while. Using cotton wool as the source of cellulose was found to give the best results. In the trials one group cheated first by using a blown egg, and then a small pigeon egg: both were spotted and banned!

Procedure

The following procedure was found to give good results.

10 g of copper carbonate was added to 100 cm³ of 880 ammonia solution in a beaker, until no more dissolved. After two minutes the blue solution was decanted off. 1 g of finely shredded cotton wool was stirred in gently, taking extreme care not to fold in air, until the blue solution has the consistency of a shower gel. Between 1 and 1.5 g of cellulose was needed. Cellulose fibres were reformed by extruding the solution using a 20 cm³ syringe into a 1 cm depth of 1 mol dm⁻³ sulphuric acid solution in a tray. The fibres can be washed with water after 20–40 minutes. The ideal fibres are *ca* 2–3 mm thick and the egg can be lifted gently by using the fibres to form a cradle.

Acknowledgement

This activity was based on an idea by John Crellin. The procedure outlined was developed by Valerie Tordoff at Eton College.

Credits

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Health & safety checked May 2018

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