

Move an Oxo cube at great speed

Time

It is suggested that either:

an entire morning be devoted to the problem (eg on the last day of term), which would allow 2 h for practical activities and 30 minutes for judging

or

the problem be given to the class as a homework exercise 2 weeks or so before the judging. Judging could then take place in a normal double science lesson, allowing 45 minutes for repair and final adjustments, and 30 minutes for judging.

Curriculum links

Production of carbon dioxide.

Group size

3– 4.

Materials and equipment

- items from the junk list to encourage creativity
- the judges will require a stop watch or an arrangement with a computer and photocells if the Oxo cubes move too fast.

Materials per group

- sodium hydrogencarbonate (maximum amount = 3 level teaspoons)
- citric acid (maximum amount = 9 level teaspoons)
- access to water
- butter/margarine to reduce friction.

Equipment per group

- identical teaspoons (can be plastic)
- safety glasses.

Safety

Citric acid is an eye irritant. Eye protection must be worn.

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

Some guidance may be needed for younger age groups – eg water is needed for the reaction. The reaction might be used to do the moving, or it could be used to start the movement – eg to trigger movement of a counterbalance.

Evaluation of solution

These are suggestions only.

1. The final device should be loaded with chemicals, and be ready to start when the judge says so.
2. The judge will provide each group with the levelled teaspoons of chemicals for the test. (Judges may prefer to weigh out the relevant amounts.)
3. The winner is the team whose device moves the Oxo cube over the course in the shortest time.
4. In the event of a tie, the judge should take into account the elegance of the solution, given the requirement that the devices are constructed mainly from junk materials.

Extension work

To increase the chemical content the task could be extended by prior (or subsequent) experimentation, to select best choice of gases/chemicals.

Acknowledgement

This activity is based on an idea by Peter Borrows.

Credits

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Health & safety checked May 2018

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