The ten gram boat race

- Your task

Build a boat powered by soap to carry a ten gram mass and to see how many times it will go round a clampstand.

- HINT: You will need to change the water each time you try.

Based on a suggestion by S. Lindley.

Time

Anything up to an hour depending on how many "attempts" students have at the circuit.

Group size

2–3

Equipment & materials

Per group
A plastic washing up bowl, a clampstand (no fittings), cotton, aluminium foil, a small piece of soap, a 10 g mass, polystyrene, pins.

Safety notes

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/*].

As described, there are no significant hazards associated with the experiment. If alterations are made, they should be risk-assessed.

It is the responsibility of the teacher to carry out a suitable risk assessment.

Curriculum links

Surface tension.

Possible approaches

The students make a boat from aluminium foil and polystyrene containing a 10 g mass. A small piece of soap is pinned to the stern (back) of the boat. The boat is attached to a clampstand in the middle of a plastic washing up bowl of water by a length of cotton. Students have to see how many circuits of the bowl the boat can make before it needs refuelling.

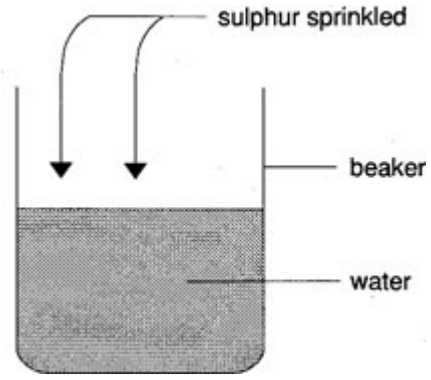
At least 30 laps of the bowl will be completed on one filling by an experienced "captain". Some students will do some major re-designing when they realise that in a washing up bowl the biggest boat is not the best! The students will need prompting to replace the water – rather than the soap – for

another try. Count the 10 g masses before you start, they tend to get thrown away with the boats at the end of the lesson.

The boat is able to work because of surface tension. The soap pinned to the stern of the boat slowly dissolves. The surface tension of soap solution is less than that of water, therefore the 'pull' of the water in front of the boat is greater than the 'pull' of the soap solution. The boat moves forward.

Extension work

Investigate whether the type of soap makes any difference. Would the boat work in a swimming pool – where chlorine is in the water?



Excellent demo or "magic trick". Sprinkle flowers of sulfur onto water.

When you touch the surface with a soapy finger the sulfur immediately falls like snow to the bottom of the beaker. VERY DRAMATIC. Set homework for students to try out herbs, flowers *etc.*

Credits

Health & safety checked May 2018

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