2. Float and sort

2 hours

Children investigate the force of up thrust in different liquids and link it to a recycling process where materials are sorted in flotation tanks containing liquids of various densities.

OBJECTIVES

- Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when necessary
- Identify the effects of air resistance, water resistance and friction that act between moving surfaces.
- To understand that submerged objects experience up thrust.
- To use a force meter to measure up thrust in different liquids.
- To investigate the use of different density liquids to sort plastic waste.

RESOURCES

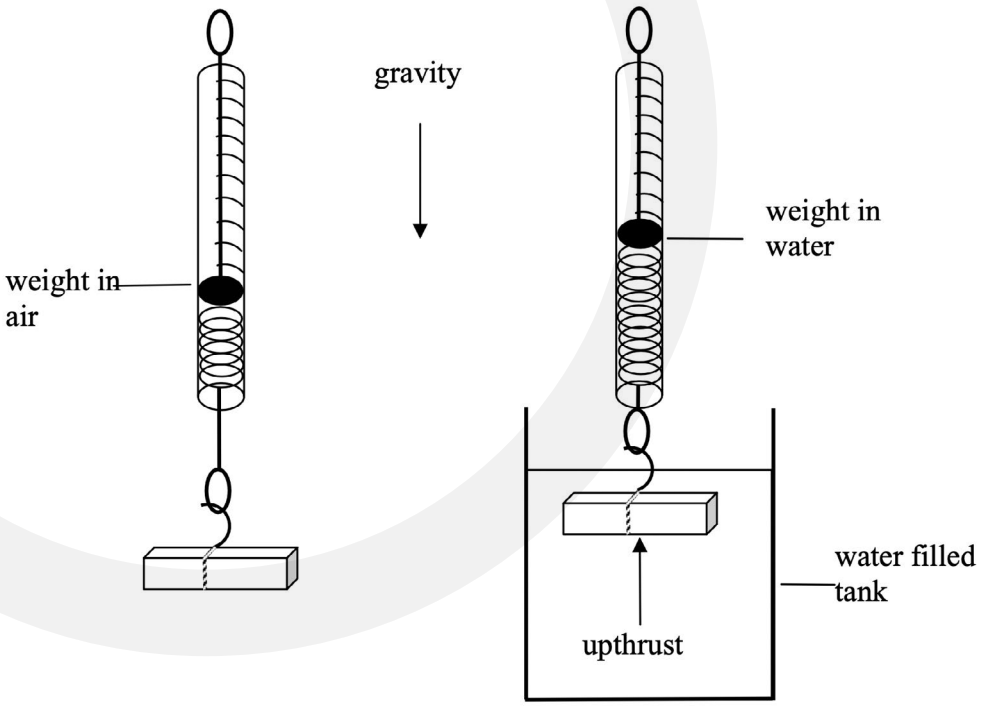
(Per group of 4 children unless otherwise stated)

- Activity sheets 8 - 9
- A tank (transparent container) of water
- Three beakers (or other containers) containing equal quantities of liquid; choose from water, salt water, oil, bubble bath, washing up liquid or golden syrup.
- Newton meter (with a scale of 0.5 N or less)
- Modelling material (plasticine)
- A selection of small objects with thread tied to attach to Newton meter (test the objects to ensure a range of floating and sinking outcomes in different liquids)

INTRODUCING THE ACTIVITY

Ask the children to predict which of the objects will float and which will sink in water. Test their ideas for some of the objects in the water tank. Use the phrase up thrust to describe the force pushing up in water.

Explain and demonstrate how to measure the up thrust for different materials by measuring the weight in air and then in water using a Newton metre, and finding the difference. If the object floats on the surface, the up thrust equals the weight in air.



Weighing an object to find the effect of up thrust in water.

First suspend the object from the Newton meter and record the weight in air. Then re-suspend lowering the object into the water tank. The object should be pushed below the surface and allowed to float back to the top. This prevents the surface tension of the water from affecting the result. The resulting weight in water will be affected by the up thrust of the water on the object, see diagram above.

MAIN ACTIVITY

Set the children the investigation question:

- Can we use floating and sinking to separate materials?

A supplementary question could be,

- Do things float in the same way in different liquids e.g. salty water, cooking oil, golden syrup?

The objects chosen for this should have been selected to ensure that some will sink in all liquids, some float in all liquids and others float only in the thicker (more dense) liquids.

When planning, children need to consider which factors would affect fair testing. The volume of liquid does not change the up thrust of that liquid on an object. This can be demonstrated by weighing the same object in a large and a small volume of water.

Provided that each object is pushed below the surface of the water, the shape and size of the object will not affect the up thrust. The difference in up thrust is a result of the density of the material from which the objects are made. Materials which would not normally float in water can be made to do so by adding air e.g. the air inside an inflatable or the air inside a boat.

The children can now investigate the up thrust of the liquids by measuring the weight of each of the objects in air and in the liquids.

Provide the children with the three containers of different liquids and a selection of objects. The results can be recorded on Activity sheet 8. Once a pattern for the liquids has been established with one object, they should test the theory using other objects. Activity sheet 9 is designed to help children to construct an identification chart. Ask the children how useful this would be to a recycling company.

PLENARY

Discuss the differences between the forces of up thrust in the different liquids. As the density of the liquid increases, the object will appear to be lighter. Discuss the relationship between the forces when objects float. (When the forces of up thrust and gravity are equal or balanced, the object will float and weigh nothing).

Visit the European Metal Recycling website (https://uk.emrgroup.com/) to show a flotation tank animation. Click on 'Quick links' menu, scroll for 'Dense Media Separation', and click on 'view presentation'. This can be used to stimulate discussion of the use of liquids in recycling.