

RS•C

59. A Cartesian diver

Topic

Particulate nature of matter, liquids and gases.

Timing

Variable.

Description

Students make a Cartesian diver from a fizzy drink bottle and a plastic pipette. This experiment illustrates how gases are more compressible than liquids.

Apparatus and equipment (per group)

- ▼ 5 cm³ Plastic disposable pipette (available from Hogg)
- ▼ Hex nut (from most DIY superstores 11mm across face to face)
- ▼ One 2 dm³ or 1.5 dm³ or 1 dm³ soft drink bottle with lid (clear plastic)
- ▼ 250 cm³ Plastic beaker
- ▼ Access to scissors.

Teaching tips

It is important to adjust the diver so that it barely floats in the beaker. If the diver requires a strong squeeze to make it sink there is not enough water in the diver. If the diver sinks then it has too much water inside. The diver should be about half full with water.

Background theory

The diver sinks if it is more dense than the surrounding water and rises if it is less dense.

Safety

Mop up any water spillage from the floor.

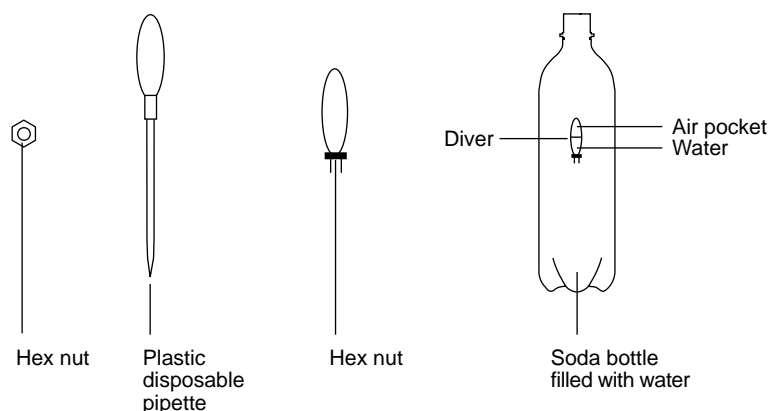
Answers

1. Air is compressed and the volume of air is reduced.
2. When compared with those in liquids, the gas particles which make up air are a large distance apart. It is therefore easier to squash them closer together thus reducing the volume.
3. When the bottle is squeezed pressure in the water pushes on the pocket of air inside the diver. The volume of air is reduced and this allows more water into the diver. This makes the diver more dense and it therefore sinks. When the pressure is released, the air expands taking up a larger volume. Water is pushed out of the diver which becomes less dense and therefore floats in the water.

A Cartesian diver

Introduction

This is an experiment named after René Descartes (1596–1650). Descartes was a French scientist and philosopher. The Cartesian diver can be used to illustrate the behaviour of gases and liquids when compressed. In this experiment a Cartesian diver is constructed and some of the properties observed.



What to do

1. Screw the hex nut onto the base of the pipette until it is held tightly in place.
2. Cut off all but 1 cm of the pipette stem. (This is the diver.)
3. Place the diver in a beaker of water. Squeeze the bulb of the pipette to force air out and release to allow water up into the diver. Repeat this until the diver is about half full of water.
4. Does the diver still float? If adjusted properly the diver should barely float in the water. If it sinks squeeze a little water out.
5. Carefully transfer the diver to the soda bottle that is full to the brim with water. Take care not to lose water from the diver. Place the cap on the bottle.
6. Use both hands and squeeze the bottle. Watch the diver sink when the bottle is squeezed, or float when pressure is released.

Safety

Wipe up any water spillage.

Questions

1. What happens to the air in the diver when the bottle is squeezed?
2. Why does the air behave in this way?
3. Write a sentence that explains how the Cartesian diver works.