

Convection in a test-tube of liquid

Class practical

Watching convection currents in water.

Apparatus and materials

For each student or group of students

Bunsen burner

Test-tube (hard glass)

Potassium manganate VII crystals

Glass tube, approximately 150 mm long x 3 mm internal diameter

Health & Safety

This experiment is quite safe so long as the Bunsen flame is small.

[Read our standard health & safety guidance](#)

Procedure

a Fill the hard glass test-tube with cold water. When the water is still, put the glass tube into the test-tube so that it rests on the base of the test-tube. Drop a single, very small, crystal of potassium manganate VII through the tube so that it falls to the bottom, leaving little colour.

b Hold the test-tube near the top but not above water level. Heat it gently with a Bunsen flame at the bottom of the tube to see the streamers of dye begin to circulate. As soon as the tube is felt to be warmed by the hot water, stop heating.

c Empty the test-tube, allow it to cool, wash it and fill again with cold water. When the water is at rest, add another very small crystal without stirring.

This time hold the tube at the bottom and heat with the Bunsen flame near the top of the tube, just below the water surface.

Continue until the water at the top of the tube just begins to boil, but the bottom remains cool. No coloured streamers are observed.

Teaching notes

1 If the test-tube is held at the top of the water and heated from the bottom, convection trails can be seen in the water. If the test-tube is held at the bottom and the water heated at the top, there are no convection trails. The water at the bottom stays cool. A piece of ice fixed (with gauze) at the bottom of the test-tube will not melt even when the water is boiling at the top. Melting has to await conduction of energy through the water.

2 The hot water carries its own thermal energy with it when it moves. That is the process of convection. It happens in a fluid whether it is a liquid or a gas. On a large scale it happens in the oceans and in the atmosphere, in hot water heating systems and in ventilation. Winds are just convection currents.

This experiment was safety-checked in March 2006

Related guidance

[Conduction, convection and radiation](#) [2]

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Links:

[1] <http://www.nuffieldfoundation.org/node/1634/>

[2] <http://www.nuffieldfoundation.org/node/1856>