

How atoms share electrons in covalent bonds

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab

Name: _____ Date: _____ Class: _____

Covalent substances look very different: wax melts in seconds, while sand and graphite hardly change in a flame. This lab tests four solids with simple apparatus to link melting, conduction and solubility to structure, so you can predict whether a substance is made of small molecules or a giant network.

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Aim

To compare the melting behaviour, electrical conductivity and solubility of four covalent solids and decide which have simple molecular structures and which are giant.

Equipment

- Samples of candle wax, sugar, dry sand and a graphite rod (pencil lead)
- Metal bottle lid or deflagrating spoon, tripod, gauze and small burner (or hot plate)
- Tongs, stopwatch, 3.0 V battery, ammeter, two crocodile clips, leads
- Four beakers with 50 cm³ of water, glass rod, goggles

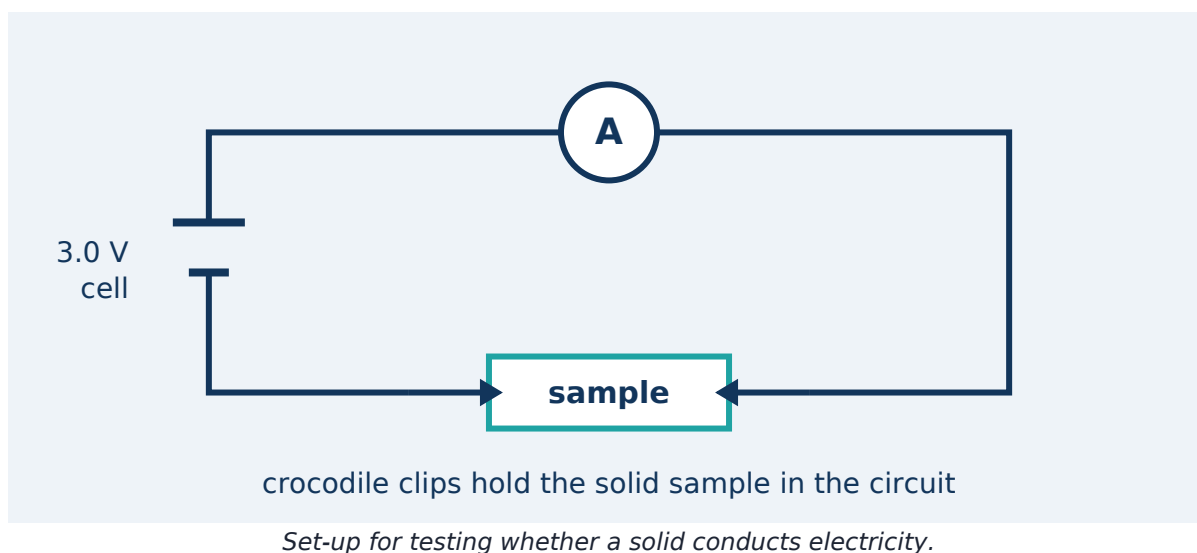
Safety

Safety

Wear goggles. Hot metal looks cool, so lift lids only with tongs. Keep hair tied back. Do not smell the burning sugar closely and keep the room ventilated.

Method

1. Place 0.5 g of the first sample on a metal lid over the flame and start the stopwatch. Record the time to melt, or what happens in 180 s. Repeat for each sample.
2. Connect the circuit shown, with each solid sample between the clips. Record the current for each, repeating the graphite reading three times.
3. Stir 1 g of each sample in 50 cm³ of water for one minute and record whether it dissolves.



Results

Sample data from Aarav's group:

Sample	Time to melt / s	Current / mA	Dissolves in water?
Candle wax	25	0	no
Sugar	95 (turns brown)	0	yes
Dry sand	no change in 180 s	0	no
Graphite rod	no change in 180 s	118, 122, 120	no

Analysis questions

Question 1 Classify the samples

Use the results to classify each sample as simple molecular or giant covalent.

Question 2 Mean current and resistance

Calculate the mean current for graphite in mA, then use the 3.0 V supply to calculate its resistance in ohms.

Question 3 Why graphite conducts

Explain why graphite conducts when the other three samples do not.

Question 4 Wax and sand

Explain why wax melts in seconds but sand does not change.

Question 5 The browning sugar

The sugar turned brown as well as melting. Suggest what this shows.

Question 6 Solubility

Sugar dissolved but wax did not, although both are simple molecular. State what this shows.

Question 7 Fair test and improvement

State two variables you would control, and suggest one improvement to the melting test.