

How ions bond: transfer and lattices

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

Name: _____ Date: _____ Class: _____

Which substances carry an electric current, and what does this tell you about their ions? You will test solids and solutions with graphite electrodes, plot current against the mass of sodium chloride dissolved, and explain the pattern.

Level: Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS1-3, GCSE C2

Aim

To test which substances conduct electricity as solids and as solutions, and to find how the current depends on the amount of sodium chloride dissolved.

Equipment

- 4.5 V supply (batteries or power pack), leads and a milliammeter
- Two graphite electrodes
- 100 cm³ beakers, distilled water, balance
- Sodium chloride, sugar (sucrose) and a piece of candle wax
- Stirring rod and a dry watch glass

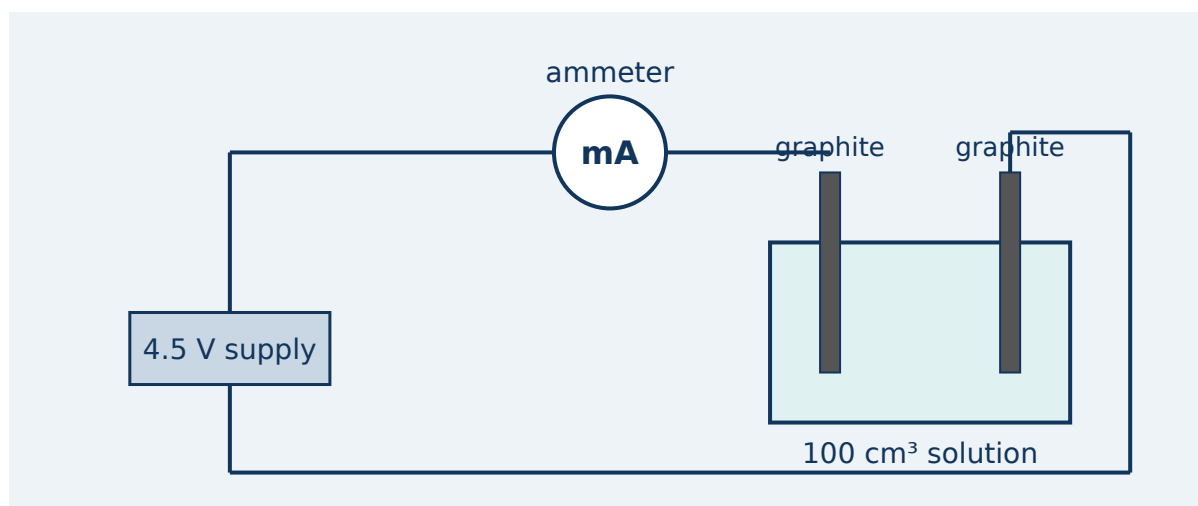
Safety

Safety

Keep leads and electrodes dry apart from the tips, and switch off before moving anything. Do not taste any substance. Wipe up spills at once so the floor is not slippery, and wash your hands after the lab.

Method

1. Press the electrodes 1 cm apart onto each dry solid (salt crystals, sugar, wax) in turn and note the current.
2. Measure 100 cm³ of distilled water into a beaker. Place the electrodes 2 cm apart and 3 cm deep, and record the current.
3. Dissolve 1.0 g of sodium chloride in the water, stir, and record the current. Add further 1.0 g portions up to 5.0 g in total, recording the current each time.
4. Repeat step 2 with 5.0 g of sugar in 100 cm³ of fresh distilled water.



A simple conductivity circuit with graphite electrodes.

Results

Test	Current / mA
Solid sodium chloride	0
Solid sugar	0
Candle wax	0
Distilled water	0.3
Sugar solution (5.0 g)	0.3

Mass of NaCl dissolved / g	0	1.0	2.0	3.0	4.0	5.0
Current / mA	0.3	38	72	105	138	168

Analysis questions

Question 1 Plot the graph

Plot the current (y-axis) against the mass of sodium chloride dissolved (x-axis). Describe the shape of the graph.

Question 2 Explain the trend

Explain why the current increases as more salt dissolves.

Question 3 Gradient

Calculate the average increase in current per gram of sodium chloride between 0 and 5.0 g.

Question 4 Solids and sugar

Explain why solid sodium chloride does not conduct but its solution does, and why sugar solution does not conduct.

Question 5 Interpolate

Use your graph to estimate the current for 3.5 g of sodium chloride.

Question 6 Control variables

Name three variables that must be kept constant and explain why.

Question 7 Evaluate

The ammeter reads to 1 mA. Calculate the percentage uncertainty in the 38 mA reading and suggest one improvement.