

Investigating the properties of ionic and covalent compounds

Aims

You will investigate how well different compounds conduct electricity when they are in aqueous solution (dissolved in water). Some of these compounds consist of ions and some consist of simple molecules.



Apparatus

Eye protection	2 × carbon electrodes
100 cm ³ beaker	Battery, lamp and wires
Stirring rod	Test substances (see the Results table)

Method

1. Connect the battery, lamp and wires to the two carbon electrodes.
Check that everything works before carrying on.
2. Add about 20 cm³ of potassium iodide solution to the beaker.
3. Lower the carbon electrodes into the solution. Observe and record in a suitable table:
 - whether the lamp lights
 - if bubbles of gas are given off (make a note of which electrode)
 - any colour changes.
4. Carefully rinse the beaker and electrodes.
Repeat steps 2 and 3 with each of the other substances.

Results

A suggested table for the results is shown below.

Substance in solution	Ionic or covalent?	Observations	Conducts electricity?
potassium iodide			
copper(II) sulfate			
ethanol			
magnesium sulfate			
sodium chloride			
sucrose			
water			

Analysis

1. Determine whether each substance conducts electricity when in solution.
2. Describe what your results show about ionic compounds and covalent compounds.

Evaluation

Explain why changes may be seen at or near the electrodes in the investigation (showing that the solution conducts electricity), but the lamp does not light.

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Teacher and technician notes

Apparatus

Per group:

- Eye protection
- 100 cm³ beaker
- Stirring rod
- 2 × carbon electrodes
- Battery, lamp and wires
- Test substances (allow 25 cm³ per group):
 - 0.1 mol/dm³ potassium iodide ⚠ (iodine is produced in the experiment)
 - 0.1 mol/dm³ copper(II) sulfate ⚠
 - 0.1 mol/dm³ magnesium sulfate
 - 0.1 mol/dm³ sodium chloride
 - 5% v/v ethanol ⚠
 - 2% w/v sucrose (table sugar)
 - deionised or distilled water



Sample results

Your results may differ. Vary the concentration of a solution if expected changes are not seen during your pre-class trial (but note: copper(II) sulfate solutions in the range 0.2 – 1 mol/dm³ are corrosive).

Substance in solution	Ionic or covalent?	Observations	Conducts electricity?
potassium iodide	Ionic	Lamp lights. Bubbles at the positive electrode, orange-brown colour forms at the negative electrode.	✓
copper(II) sulfate	Ionic	Lamp lights. Bubbles at positive electrode, pink coating on negative electrode.	✓
ethanol	Covalent	Lamp does not light, no bubbles seen.	✗
magnesium sulfate	Ionic	Lamp lights, bubbles at both electrodes.	✓
sodium chloride	Ionic	Lamp lights, bubbles at both electrodes.	✓
sucrose	Covalent	Lamp does not light, no bubbles seen.	✗
water	Covalent	Lamp does not light, no bubbles seen.	✗

Analysis

1. the table should be completed
2. Ionic compounds conduct electricity in solution, covalent compounds do not.

Evaluation

The current through the solution may not be high enough for the lamp to light.