

How ions bond: transfer and lattices

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

These model answers use the sample readings. They connect the size of the current to the number of mobile ions and explain why solids and sugar solution do not conduct.

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

Question 1 Plot the graph

The points rise steadily, almost in a straight line through the origin: 0.3, 38, 72, 105, 138, 168 mA. The slope is nearly constant, with a very slight levelling off at higher masses.

The current increases almost in proportion to the mass dissolved.

Question 2 Explain the trend

Dissolving more salt releases more Na^+ and Cl^- ions. More mobile charged particles carry more charge each second, so the current increases.

More ions free to move means a larger current.

Question 3 Gradient

Increase = $168 - 0.3 = 167.7$ mA over 5.0 g. Gradient = $167.7 \div 5.0 = 33.5$ mA/g.

About 34 mA per gram.

Question 4 Solids and sugar

In the solid the ions are fixed in the lattice. In solution they are free to move. Sugar dissolves as separate molecules and does not form ions, so no charge carriers exist.

Ionic solid: ions fixed. Sugar: no ions.

Question 5 Interpolate

Halfway between 105 mA (3.0 g) and 138 mA (4.0 g) gives $(105 + 138) \div 2 = 121.5$ mA.

About 122 mA.

Question 6 Control variables

Electrode separation, electrode depth and volume of water (or temperature). Each changes the resistance of the solution, so a change would alter the current even if the amount of salt were the same.

Separation, depth and volume (or temperature) are kept fixed.

Question 7 Evaluate

If the resolution is ± 1 mA, the percentage uncertainty = $1 \div 38 \times 100 = 2.6 \%$.

Improvement: use a more sensitive ammeter, repeat the measurement and take a mean.

2.6 %; use repeats and a more sensitive meter.