

How atoms share electrons in covalent bonds

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

These answers use the sample data. If your own class results differ, check the pattern: wax and sugar behave as simple molecular solids, while sand and graphite behave as giant covalent solids. Show your working for the mean current and the resistance, and give units with every result.

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

Question 1 Classify the samples

Wax melts quickly and does not conduct, so it is simple molecular. Sugar melts at a fairly low temperature and does not conduct, so it is simple molecular. Sand does not change at the flame temperature, so it is giant covalent. Graphite does not melt in the flame and conducts, so it is giant covalent.

Simple: wax, sugar. Giant: sand, graphite.

Question 2 Mean current and resistance

Mean = $(118 + 122 + 120) \div 3 = 360 \div 3 = 120 \text{ mA} = 0.120 \text{ A}$. Resistance $R = V \div I = 3.0 \div 0.120 = 25 \Omega$.

120 mA; 25 Ω .

Question 3 Why graphite conducts

Each carbon atom in graphite uses three outer electrons for bonds, so the fourth is free to move along the layers. The other samples have all electrons held in bonds or on atoms, so they have no free charge carriers.

Graphite has delocalised electrons.

Question 4 Wax and sand

Wax is made of molecules held by weak forces, which are easily overcome by heat. Sand is a giant network, so the strong bonds between all atoms would need breaking, which needs a much higher temperature than the flame.

Weak forces versus strong network.

Question 5 The browning sugar

The brown colour shows a new substance is forming. The sugar is decomposing, which means covalent bonds inside the molecules are breaking, so this is a chemical change as well as melting.

Decomposition, a chemical change.**Question 6 Solubility**

Solubility depends on how well the molecules attract water molecules, not just on the type of bonding. Sugar molecules attract water, but wax molecules do not.

Solubility does not identify the structure.

Question 7 Fair test and improvement

Control the mass of sample (0.5 g) and the position of the lid in the flame. An improvement is to use a thermometer or temperature probe so that melting points can be compared as numbers instead of times.

Same mass and flame position; measure the temperature.