Your notes

GCSE Chemistry: revision notes

Giant covalent structures

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Giant covalent structures

- In **giant covalent structures**, all the atoms are linked to other atoms by strong covalent bonds.
- These bonds must be overcome to melt or boil the substance, so giant covalent substances are solids with very high melting points.
- Examples: **diamond** and **graphite** (forms of carbon) and **silicon dioxide** (silica, found in sand).

Diamond

- In **diamond**, each carbon atom forms four covalent bonds with other carbon atoms in a rigid giant structure.
- **Diamond** is very hard and has a very high melting point.
- It does not conduct electricity, because it has no delocalised electrons.

Graphite

- In **graphite**, each carbon atom forms three covalent bonds, making layers of hexagonal rings.
- There are no covalent bonds between the layers, only weak forces, so the layers slide over each other. This makes **graphite** soft and slippery.
- Each carbon atom has one delocalised electron, so **graphite** conducts electricity and thermal energy, like metals.

Graphene and fullerenes

- **Graphene** is a single layer of **graphite**. It is very strong, light and conducts electricity, so it is useful in electronics and composites.
- **Fullerenes** are molecules of carbon atoms with hollow shapes, based on hexagonal rings (sometimes with rings of five or seven atoms).

- The first **fullerene** discovered was **buckminsterfullerene**, C_{60}, which is spherical.
- **Carbon nanotubes** are cylindrical **fullerenes** with a very high length-to-diameter ratio. They are used in nanotechnology, electronics and strong materials, such as tennis rackets.

Your notes

Key terms

Giant covalent structure	A structure in which all the atoms are joined by strong covalent bonds.
Diamond	A form of carbon in which each atom forms four covalent bonds; very hard.
Graphite	A form of carbon in layers, in which each atom forms three covalent bonds; conducts electricity.
Graphene	A single layer of graphite, one atom thick.
Fullerene	A hollow molecule of carbon atoms, such as C_{60}.
Buckminsterfullerene	A spherical fullerene with the formula C_{60}.
Carbon nanotube	A cylindrical fullerene with a very high length-to-diameter ratio.
Silicon dioxide	A giant covalent compound (silica), found in sand.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. How many covalent bonds does each carbon atom form in diamond?
2. Why is diamond very hard?
3. Why does graphite conduct electricity?
4. Why is graphite soft and slippery?
5. Why do giant covalent substances have very high melting points?
6. What is graphene?
7. What is the formula of buckminsterfullerene?
8. What is a carbon nanotube?

Answers

1. Four
2. Each atom is joined to four others by strong covalent bonds
3. Each carbon atom has one delocalised electron
4. Layers slide over each other because there are no covalent bonds between them
5. Many strong covalent bonds must be broken
6. A single layer of graphite
7. C_{60}
8. A cylindrical fullerene

What to do next

Practise 10 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

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