

GIANT COVALENT STRUCTURES

Diamond

Silica

Graphite

Answer all the questions below then check your answers.

1. Name the element that diamond and graphite are made of.
2. What type of bonding is found in all three substances (diamond, graphite, silica)?
3. Which substance, diamond, graphite, or silica, conducts electricity?
4. True or False: Silica (SiO_2) is a simple covalent molecule.
5. Describe the structure of diamond (include the number of bonds each carbon forms).
6. Explain why graphite is soft and slippery.
7. Name two uses of diamond (due to its properties).
8. Describe the structure of silica (silicon dioxide).
9. Explain why graphite can conduct electricity but diamond cannot.
10. Diamond, graphite, and silica all have high melting points. Explain why they have high melting points, referring to their structure and bonding.
11. Diamond and graphite are both allotropes of carbon. Explain what is meant by the term 'allotrope' and describe how the structures of diamond and graphite account for their different physical properties.

Answers

1. Name the element that diamond and graphite are made of.

Carbon

2. What type of bonding is found in all three substances (diamond, graphite, silica)?

Covalent bonding

3. Which substance, diamond, graphite, or silica, conducts electricity?

Graphite

4. True or False: Silica (SiO_2) is a simple covalent molecule.

False (Silica has a giant covalent structure).

5. Describe the structure of diamond (include the number of bonds each carbon forms).

In diamond, each carbon atom forms four covalent bonds with other carbon atoms in a giant, rigid, tetrahedral structure.

6. Explain why graphite is soft and slippery.

Graphite has a layered structure. There are weak forces between the layers, allowing them to slide over each other easily.

7. Name two uses of diamond (due to its properties).

Cutting tools (due to its hardness)

Jewellery (due to its brilliance and ability to refract light)

8. Describe the structure of silica (silicon dioxide).

Silica has a giant covalent structure. Each silicon atom bonds covalently to four oxygen atoms, and each oxygen atom bonds to two silicon atoms, forming a tetrahedral arrangement.

9. Explain why graphite can conduct electricity but diamond cannot.

Graphite has one delocalized electron per carbon atom. These electrons can move freely, carrying an electrical charge. Diamond has all its electrons tightly held in covalent bonds, so they cannot move to conduct electricity.

10. Diamond, graphite, and silica all have high melting points. Explain why they have high melting points, referring to their structure and bonding.

All three substances have giant covalent structures. This means they have a vast network of strong covalent bonds. To melt them, a large amount of energy is required to break these bonds, resulting in high melting points.

11. Diamond and graphite are both allotropes of carbon. Explain what is meant by the term 'allotrope' and describe how the structures of diamond and graphite account for their different physical properties.

Allotropes: Different structural forms of the same element in the same physical state.

Diamond: Each carbon atom bonded to four others in a tetrahedral structure, creating a very rigid, hard substance. Cannot conduct electricity.

Graphite: Each carbon atom bonded to three others in flat sheets (layers). Layers held together weakly, making graphite soft and slippery. One delocalized electron per carbon allows it to conduct electricity.