

Exercise walk-through

Giant covalent structures ■ 2.6

eXercise

You must be able to

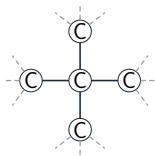
- describe the bonding in diamond and graphite
- link structure to properties (hardness, conductivity, lubrication)
- describe silicon(IV) oxide as a giant covalent structure

Method — Diamond vs graphite

- **diamond:** rigid 3-D network → very hard → cutting tools.
- **graphite:** layers slide (lubricant); one free electron per C → conducts (electrodes).
- **SiO** : giant covalent like diamond → very hard, very high melting point.

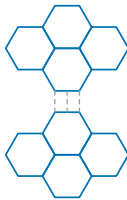
Method — Diamond vs graphite

diamond



each carbon
bonded to **4**
others: a hard
3-D network

graphite



flat layers of
hexagonal rings
(each C bonded
to **3**); weak forces
let the layers slide

Diamond's 4-bond network beside graphite's flat layers

Practice 2.1 ■ 1 mark

State how many carbon atoms each carbon is bonded to in diamond.

Solution 2.1

Method: Diamond vs graphite

Worked steps

four **B1**.

Practice 2.2 ■ 1 mark

State one use of graphite.

Solution 2.2

Worked steps

as a lubricant (or as an electrode) **B1**.

Exam-style 3.1 ■ 1 mark

Graphite conducts electricity because:

- A** it contains ions
- B** each carbon has a free (delocalised) electron
- C** the layers are strongly bonded
- D** it is a metal

Solution 3.1

Method: Diamond vs graphite

- A it contains ions
- B each carbon has a free (delocalised) electron** 
- C the layers are strongly bonded
- D it is a metal

Worked steps

B. Each carbon has one free (delocalised) electron that can move.

Exam-style 3.2 ■ 2 marks

Diamond and graphite are both forms of carbon.

- (a) Explain why diamond is very hard.
- (b) Explain why graphite is a good lubricant.

Solution 3.2

Method: Diamond vs graphite

Worked steps

- (a) each carbon is bonded to four others by strong covalent bonds (M1); forming a rigid 3-D network, so it is very hard (A1).
- (b) graphite has layers held by weak forces (M1); the layers can slide over each other (A1).

Exam-style 3.3 ■ 2 marks

Explain why both diamond and graphite have very high melting points.

Solution 3.3

Method: Diamond vs graphite

Worked steps

they are giant covalent structures with many strong covalent bonds (M1); a lot of energy is needed to break them, so the melting point is very high (A1).