

GCSE Combined Science: Trilogy

Worksheet: Giant covalent structures

TIME 25 min	TOTAL 23 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Giant covalent structures

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Some substances have giant covalent structures.

0 1 . 1

Which substance has a giant covalent structure?

Tick (✓) **one** box.

Silicon dioxide

☐

Water

☐

Sodium chloride

☐

Oxygen

☐

[1 mark]

0 1 . 2

Explain why substances with giant covalent structures have very high melting points.

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.....

.....

.....

[2 marks]

0 1 . 3

Substance **X** has a giant covalent structure.
Predict the state of **X** at room temperature.

.....

.....

.....

.....

[1 mark]

0 2

Diamond, graphite and silicon dioxide are examples of giant covalent structures.

0 2 . 1

Which property is typical of giant covalent structures?

Tick (✓) **one** box.

Low melting point

☐

Very high melting point

☐

Always conducts electricity

☐

Soluble in water

☐

[1 mark]

0 3

A student says:

‘Silicon dioxide must conduct electricity, because it is a giant structure, just like metals are giant structures that conduct.’

0 3 . 1

Evaluate the student’s statement.

.....

.....

.....

.....

[2 marks]

0 4

Cubic boron nitride is a giant covalent structure. As in diamond, each atom forms four strong covalent bonds to neighbouring atoms in a rigid three-dimensional structure, but boron nitride contains boron and nitrogen atoms instead of carbon atoms.

0 4 . 1

Predict **two** physical properties of cubic boron nitride. Give a reason for each prediction.

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[4 marks]

0 5

In silicon dioxide, each silicon atom is covalently bonded to four oxygen atoms. Each oxygen atom is covalently bonded to two silicon atoms.

0 5 . 1

Explain why the formula of silicon dioxide is SiO_2 .

.....

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.....

[2 marks]

0 5 . 2

Explain why silicon dioxide has a high melting point.

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[3 marks]

0 5 . 3

Silicon dioxide does not conduct electricity.
Suggest why.

.....

.....

[1 mark]

0 6

Table 1 gives some properties of four substances, **W**, **X**, **Y** and **Z**.

Table 1

Substance	Melting point in °C	Conducts electricity when solid?	Conducts electricity when liquid?
W	1710	no	no
X	-95	no	no
Y	801	no	yes
Z	1085	yes	yes

0 6 . 1

Which substance has a giant covalent structure?
Give **two** reasons for your answer.

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[3 marks]

0 6 . 2

Which substance is a metal?

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[1 mark]

0 6 . 3

Explain why substance **Y** conducts electricity when liquid but substance **W** does not.

.....

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.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Giant covalent structures · 23 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: Silicon dioxide

01.2 [2 marks]

Answer: All the atoms are linked by many strong covalent bonds, and a lot of energy is needed to break them.

- (many) strong covalent bonds (1)
- a lot of energy is needed to break / overcome the bonds (1)

Notes: Do not accept references to intermolecular forces.

01.3 [1 mark]

Answer: solid

- solid (1)
-

Question 2 (1 mark)

02.1 [1 mark]

Correct: Very high melting point

Question 3 (2 marks)

03.1 [2 marks]

Answer: The student is wrong: being a giant structure does not make a substance conduct. Metals conduct because they have delocalised electrons; silicon dioxide has no delocalised electrons or ions that are free to move.

- the student is wrong: being a giant structure does not by itself mean a substance conducts (1)
 - metals conduct because of delocalised electrons; silicon dioxide has no delocalised electrons (or ions) free to move, so it does not conduct (1)
-

Question 4 (4 marks)

04.1 [4 marks]

Answer: Very high melting point, because many strong covalent bonds must be broken; very hard, because each atom is held firmly by four strong covalent bonds in a rigid structure.

- very high melting point (1)
- because many strong covalent bonds must be broken to melt it, which needs a lot of energy (1)
- very hard (1)
- because each atom is held firmly in place by four strong covalent bonds in a rigid 3D structure (1)

Notes: Allow 'does not conduct electricity' with the reason 'no delocalised electrons or ions' as one of the two properties.

Question 5 (6 marks)

05.1 [2 marks]

Answer: Each oxygen atom is shared between two silicon atoms, so each silicon atom has $4 \times \frac{1}{2} = 2$ oxygen atoms.

- each oxygen atom is shared between two silicon atoms (1)
- so there are $4 \times \frac{1}{2} = 2$ oxygen atoms for every silicon atom (1)

05.2 [3 marks]

Answer: It is a giant covalent structure with many strong covalent bonds, which need a lot of energy to break.

- giant covalent structure (1)
- many strong covalent bonds (1)
- a lot of energy is needed to break the bonds (1)

05.3 [1 mark]

Answer: It has no delocalised electrons or ions that are free to move.

- no delocalised electrons / no ions / no charged particles free to move (1)
-

Question 6 (6 marks)

06.1 [3 marks]

Answer: W: very high melting point, and it does not conduct electricity as a solid or a liquid.

- W (1)
 - very high melting point (1)
 - does not conduct electricity (when solid or when liquid) (1)
-

06.2 [1 mark]

Answer: Z

- Z (1)
-

06.3 [2 marks]

Answer: Liquid Y contains ions that are free to move; W contains only covalently bonded atoms, with no ions or delocalised electrons.

- Y contains ions that are free to move when liquid (1)
 - W has no ions / delocalised electrons (its atoms are joined by covalent bonds) (1)
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