

GCSE Combined Science: Trilogy

Worksheet: Graphite

TIME 30 min	TOTAL 26 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Graphite

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

Graphite is a form of carbon arranged in layers.

0 1 . 1

Why does graphite feel slippery?

Tick (✓) **one** box.

Its layers can slide over each other easily.

☐

It has delocalised electrons.

☐

It has a very high melting point.

☐

It dissolves in water.

☐

[1 mark]

0 2

Graphite is a form of carbon.

0 2 . 1

How many covalent bonds does each carbon atom form in graphite?

.....

.....

.....

[1 mark]

0 2 . 2

Graphite is used in pencils.

Which property makes graphite suitable for this use?

Tick (✓) **one** box.

It is soft and slippery.

☐

It is very hard.

☐

It has a low melting point.

☐

It is transparent.

☐

[1 mark]

0 2 . 3

The layers in graphite are made of rings of carbon atoms.

How many carbon atoms are in each ring?

Tick (✓) **one** box.

4

☐

5

☐

6

☐

8

☐

[1 mark]

0 2 . 4

Graphite conducts electricity.

Which particles carry the charge through graphite?

.....

.....

.....

.....

[1 mark]

0 3

Diamond and graphite are both giant covalent forms of carbon, but they are used for very different purposes.

0 3 . 1

Describe how the number of covalent bonds formed by each carbon atom leads to the different properties of diamond and graphite.

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[4 marks]

0 4

Table 1 compares diamond and graphite.

Table 1

Property	Diamond	Graphite
Covalent bonds formed by each carbon atom	4	3
Conducts electricity?	no	yes
Hardness	extremely hard	soft, slippery

0 4 . 1

Use the number of bonds formed by each carbon atom in Table 1 to explain why graphite conducts electricity but diamond does not.

.....

.....

.....

.....

[2 marks]

0 5

Graphite is used as the 'lead' in pencils. When a pencil is moved across paper, it leaves a grey mark.

0 5 . 1

Explain, in terms of structure, why writing with a graphite pencil leaves a mark on paper.

[2 marks]

0 6

Graphite is used to make electrodes.

0 6 . 1

Explain why graphite has a very high melting point.

[2 marks]

0 6 . 2

In what way is graphite similar to metals?

[1 mark]

0 6 . 3

Explain why graphite conducts electricity but diamond does not.

[2 marks]

0 6 . 4

Graphite electrodes are used to extract aluminium by the electrolysis of a molten mixture of aluminium oxide and cryolite. The positive electrodes must be replaced regularly.
Suggest why.

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[2 marks]

0 7

Graphite is a form of carbon.

0 7 . 1

Explain why graphite is soft and slippery.

.....

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.....

[3 marks]

0 7 . 2

Explain why graphite conducts electricity.

.....

.....

.....

.....

.....

.....

[3 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: Graphite · 26 marks

Question 1 (1 mark)

01.1 [1 mark]

Correct: Its layers can slide over each other easily.

Question 2 (4 marks)

02.1 [1 mark]

Answer: 3

- 3 (1)
-

02.2 [1 mark]

Correct: It is soft and slippery.

02.3 [1 mark]

Correct: 6

02.4 [1 mark]

Answer: delocalised electrons

- (delocalised) electrons (1)
-

Question 3 (4 marks)

03.1 [4 marks]

Answer: In diamond each carbon atom forms 4 bonds in a rigid 3D structure, so it is very hard and has no delocalised electrons. In graphite each atom forms 3 bonds in layers with weak forces between them, so it is soft and slippery, and it has one delocalised electron per atom, so it conducts.

Levels of response

- **Level 2 (3–4)** A clear, logically linked answer covering the key points accurately.
- **Level 1 (1–2)** One or two relevant points with little linking.
- **No marks (0)** Nothing relevant or worthy of credit.

Indicative content

- in diamond, each carbon atom forms 4 covalent bonds in a rigid 3D structure, so diamond is very hard
 - diamond has no delocalised electrons (all outer electrons are used in bonds), so it does not conduct electricity
 - in graphite, each carbon atom forms 3 covalent bonds, making layers with only weak forces between them, so graphite is soft and slippery
 - each carbon atom in graphite has one delocalised electron, so graphite conducts electricity
-

Question 4 (2 marks)

04.1 [2 marks]

Answer: Each carbon atom in graphite uses only 3 of its 4 outer electrons in bonds, leaving 1 delocalised electron per atom; in diamond all 4 outer electrons are used in bonds.

- graphite: each carbon atom forms only 3 bonds, so one outer electron per atom is delocalised (free to move) (1)
 - diamond: each carbon atom forms 4 bonds, using all its outer electrons, so there are no delocalised electrons (1)
-

Question 5 (2 marks)

05.1 [2 marks]

Answer: There are only weak forces between the layers of graphite, so layers break off easily and stick to the paper.

- there are only weak forces between the layers of graphite (no covalent bonds between the layers) (1)
 - so layers slide off / break away easily and are left on the paper (1)
-

Question 6 (7 marks)

06.1 [2 marks]

Answer: It has many strong covalent bonds (in the layers) that need a lot of energy to break.

- many strong covalent bonds (within the layers) (1)
- a lot of energy is needed to break them (1)

Notes: Do not accept 'strong forces between the layers'.

06.2 [1 mark]

Answer: It has delocalised electrons.

- it has delocalised electrons (1)

Notes: Allow 'it conducts electricity' only if linked to delocalised electrons.

06.3 [2 marks]

Answer: In graphite each carbon atom forms only three bonds, so one electron per atom is delocalised; in diamond all four outer electrons are used in bonds.

- graphite: each carbon atom forms three bonds so one electron per atom is delocalised (1)
 - diamond: all four outer electrons are used in bonds, so there are no delocalised electrons (1)
-

06.4 [2 marks]

Answer: Oxygen is produced at the positive electrode. At the high temperature, the oxygen reacts with the carbon (graphite) to form carbon dioxide, so the electrode burns away.

- oxygen is produced at the positive electrode (1)
- the oxygen reacts with the carbon / graphite (to form carbon dioxide), so the electrode wears / burns away (1)

Notes: Allow 'the electrode burns in the oxygen' for the second mark.

Question 7 (6 marks)

07.1 [3 marks]

Answer: Graphite is made of layers with no covalent bonds between them (only weak forces), so the layers can slide over each other.

- graphite has layers (of carbon atoms) (1)
- there are no covalent bonds between the layers / only weak forces between the layers (1)
- so the layers can slide over each other (1)

07.2 [3 marks]

Answer: Each carbon atom forms only three bonds, so one electron from each atom is delocalised; these electrons move through the structure carrying charge.

- each carbon atom forms three covalent bonds (1)
 - (so) one electron from each carbon atom is delocalised (1)
 - the delocalised electrons move through the structure / along the layers, carrying charge (1)
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