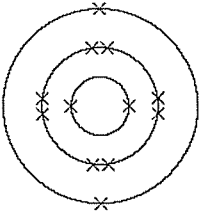


Structure and bonding

1. (a) Write a balanced symbol equation for the reaction between magnesium (Mg) and oxygen (O₂) to form magnesium oxide (MgO).

(1)

- (b) The diagram shows the electronic structure of a magnesium atom. The atomic (proton) number of magnesium is 12.

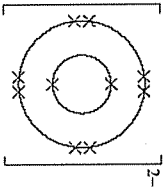


Magnesium atom

Draw a similar diagram to show the electronic structure of an oxygen atom. The atomic (proton) number of oxygen is 8.

(1)

- (c) Magnesium ions and oxide ions are formed when magnesium reacts with oxygen. The diagram shows the electronic structure of an oxide ion.



Oxide ion

Draw a similar diagram to show the electronic structure of a magnesium ion.

(1)

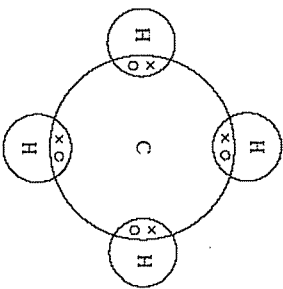
- (d) Magnesium oxide is a white solid with a high melting point. Explain how the ions are held together in solid magnesium oxide.

(2)

- (e) Indigestion tablets can be made from magnesium oxide. The magnesium oxide neutralises some of the hydrochloric acid in the stomach. Complete the word equation for the reaction between magnesium oxide and hydrochloric acid.
- hydrochloric acid + magnesium oxide → + water.

(Total 6 marks)
(1)

2. The diagram represents a particle of methane.



- (a) What is the formula of methane?

(1)

- (b) Choose a word from the box to answer the question.

atom	ion	molecule
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Which of the words best describes the methane particle shown in the diagram?
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(1)

- (c) Choose a word from the box to answer the question.

covalent	ionic	metallic
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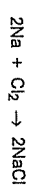
What is the type of bonding shown in the diagram?
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(Total 3 marks)
(1)

7 Progress check

Unit C2, C2.1.1

3. Sodium reacts with chlorine to form the compound sodium chloride.



Describe, in terms of electron arrangement, the type of bonding in:

(i) a molecule of chlorine:

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(3)

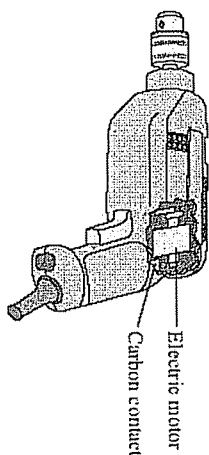
(ii) the compound sodium chloride.

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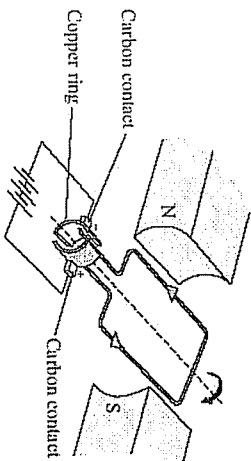
(4)
(Total 7 marks)

Covalent structures

1. This drill contains an electric motor.



The diagram below shows the main parts of an electric motor.



The carbon contacts are made of graphite. Springs push the contacts against the copper ring. The contacts conduct electricity to the copper ring. The copper ring rotates rapidly but does not stick or become worn because the graphite is soft and slippery.

Graphite has properties which are ideal for making the contacts in an electric motor.

Explain, in terms of structure and bonding, why graphite has these properties.

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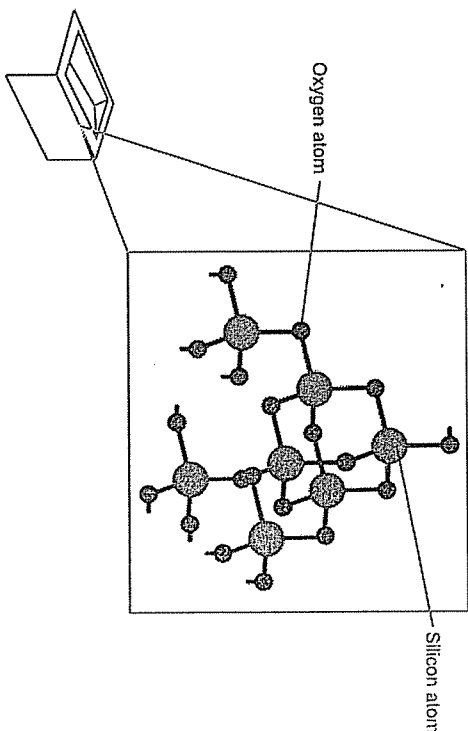
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(Total 5 marks)

2. Bricks made from silica (silicon dioxide) are used to line furnaces that operate at high temperatures.

Part of the structure of silica is shown in the diagram.



Suggest and explain why silica is used to make bricks for high-temperature furnaces. In your answer, you should refer to the structure of, and bonding in, silica.

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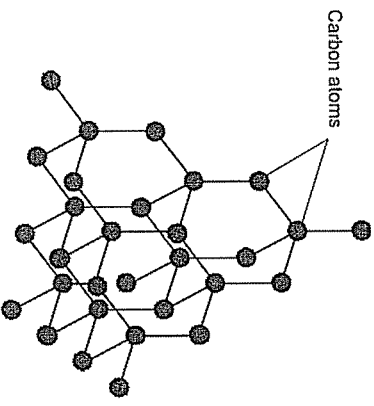
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(Total 4 marks)

3. The diagram shows the structure of diamond.



(a) To gain full marks for this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words. Explain, as fully as you can, why diamond has a high melting point.

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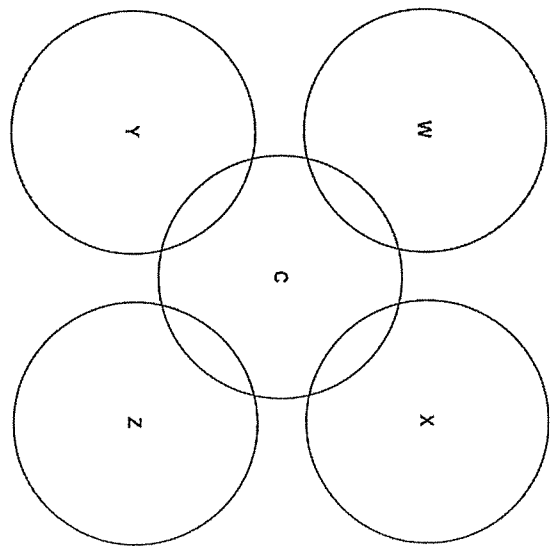
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(3)

(b) The diagram below shows the outer electron shells of five carbon atoms in the giant lattice of diamond.
Carbon atom C forms bonds with each of the carbon atoms W, X, Y and Z.
Draw the positions of all the electrons in the outer shells of each of carbon atoms C, W, X, Y and Z.



(Total 6 marks)
(3)