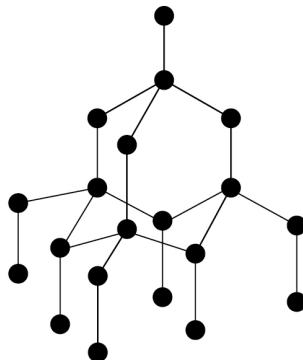


This question is about structure and bonding.

1.1 **Figure 5** shows part of the structure and bonding in diamond.

Figure 5

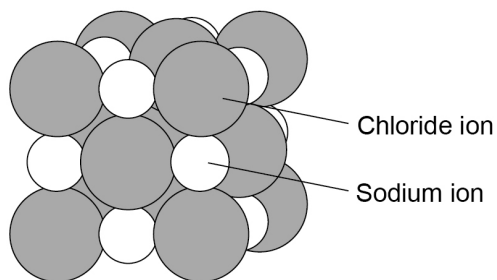


Explain why diamond has a high melting point.

[3 marks]

1.2 **Figure 6** shows part of the structure and bonding in sodium chloride (NaCl).

Figure 6



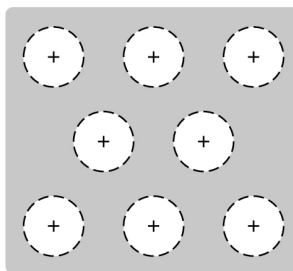
Explain the conditions needed for sodium chloride to conduct electricity.

[3 marks]

Question 5 continues on the next page

Turn over ►

Figure 7



[3 marks]

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2.1 The fertiliser also contains potassium chloride.

Explain why potassium chloride has a high melting point.

[4 marks]

[

3.1 Explain why graphite conducts electricity.

Answer in terms of the structure and bonding in graphite.

[3 marks]

4.1 Chlorine reacts with hydrogen to form hydrogen chloride.

Explain why hydrogen chloride is a gas at room temperature.

Answer in terms of structure and bonding.

[3 marks]

5.1 Titanium chloride is a liquid at room temperature.

Explain why you would **not** expect titanium chloride to be a liquid at room temperature.

[3 marks]

In **Stage 2**, sodium displaces titanium from titanium chloride.

Table 2 shows the boiling points of fluorine, chlorine and bromine.

Table 2

Element	Boiling point in °C
Fluorine	−186
Chlorine	−34
Bromine	+59

6.1 Explain why the boiling points in **Table 2** are low.

[2 marks]

Table 2 shows the boiling points of fluorine, chlorine and bromine.

Table 2

Element	Boiling point in °C
Fluorine	–186
Chlorine	–34
Bromine	+59

Explain why the boiling points in **Table 2** are low.

[2 marks]

6.2 Explain the trend in the boiling points in **Table 2**.

[3 marks]

7.1

[6 marks]

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END OF QUESTIONS

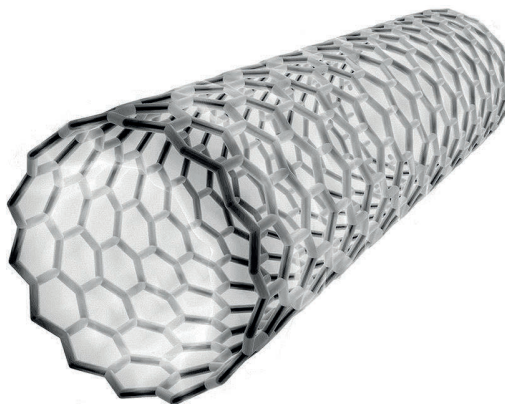
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This question is about materials and their properties.

8.1 **Figure 3** shows a carbon nanotube.

Figure 3



The structure and bonding in a carbon nanotube are similar to graphene.

Carbon nanotubes are used in electronics because they conduct electricity.

Explain why carbon nanotubes conduct electricity.

[2 marks]

Figure 4 shows a badminton racket.

Figure 4

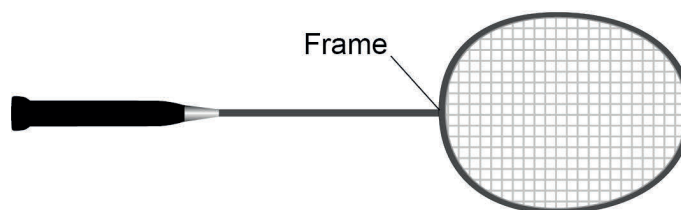


Table 1 shows some properties of materials.

Table 1

Evaluate the use of the materials to make badminton racket frames.

[4 marks]

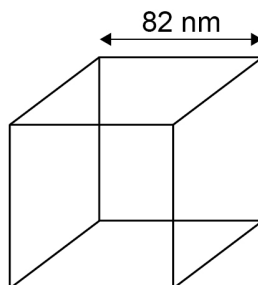
This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Source: AQA 2019 Chemistry Paper 1, original question 3.2

8.3 A nanoparticle of zinc oxide is a cube of side 82 nm

Figure 5 represents a nanoparticle of zinc oxide.

Figure 5



Calculate the surface area of a nanoparticle of zinc oxide.

Give your answer in standard form.

[3 marks]

Surface area = _____ nm²

8.4 Some suncreams contain zinc oxide as nanoparticles or as fine particles.

Suggest **one** reason why it costs less to use nanoparticles rather than fine particles in suncreams.

[1 mark]

[

9.1 Explain why ammonia has a low boiling point.

You should refer to structure and bonding in your answer.

[3 marks]

Turn over ►

10.1 A substance conducts electricity because of free moving, charged particles.

What are the free moving, charged particles in a:

- carbon electrode (made from graphite)
- molten mixture of aluminium oxide and cryolite
- metal wire?

[3 marks]

Carbon electrode (made from graphite) _____

Molten mixture of aluminium oxide and cryolite _____

Metal wire _____

Turn over for the next question

Turn over ►

11.1 Ice has a low melting point.

Water molecules in ice are held together by intermolecular forces.

Complete the sentence.

[1 mark]

Ice has a low melting point because the

intermolecular forces are _____.

11.2 What is the number of bonds formed by each carbon atom in diamond?

[1 mark]

Tick (✓) **one** box.

2

☐

3

☐

4

☐

8

☐

11.3 Give **two** physical properties of diamond.

[2 marks]

1 _____

2 _____

11.4 Name **two** other substances with giant covalent structures.

[2 marks]

1 _____

2 _____

[

12.1

Table 2 shows the boiling points of three alkanes.

Table 2

Alkanes	Boiling point in °C
C ₅ H ₁₂	36
C ₁₀ H ₂₂	174
C ₁₅ H ₃₂	271

] Explain the trend in the boiling points of the alkanes.

[3 marks]

Question 5 continues on the next page

13.1 Which **two** substances have intermolecular forces between particles?

[2 marks]

Tick (✓) **two** boxes.

Diamond

☐

Magnesium

☐

Poly(ethene)

☐

Sodium chloride

☐

Water

☐

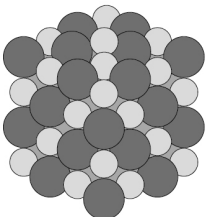
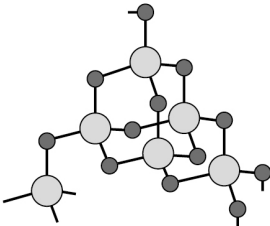
Water



2 Table 1 shows the structures of three compounds.

Table 1

Diagrams not to scale

Compound	Structure
Carbon dioxide	 Key ● O ● C
Magnesium oxide	 Key ● O^{2-} ● Mg^{2+}
Silicon dioxide	 Key ● O ● Si

1

[6 marks]

- carbon dioxide
- magnesium oxide
- silicon dioxide.

Source: AQA 2020 Chemistry Paper 1, original question 1.2

This question is about the halogens.

Table 5 shows the melting points and boiling points of some halogens.

Table 5

Element	Melting point in °C	Boiling point in °C
Fluorine	–220	–188
Chlorine	–101	–35
Bromine	–7	59

14.1

] Explain the trend in boiling points of the halogens shown in **Table 5**.

[4 marks]

L
C

15.1 The first fullerene to be discovered was Buckminsterfullerene.

What is the formula of Buckminsterfullerene?

[1 mark]

Tick (✓) **one** box.

C₄₀

☐

C₅₀

☐

C₆₀

☐

C₇₀

☐

15.2 Graphite is a form of carbon.

Explain why graphite conducts electricity.

[2 marks]

15.3 Explain why steel is harder than iron.

[3 marks]

16.1

Figure 3



Table 2 shows the melting points and boiling points of methane and hexane.

Table 2

	Melting point in °C	Boiling point in °C
Methane	−183	−162
Hexane	−95	69

Compare the structure and properties of methane and hexane.

[6 marks]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

17.1 What shape is a Buckminsterfullerene molecule?

[1 mark]

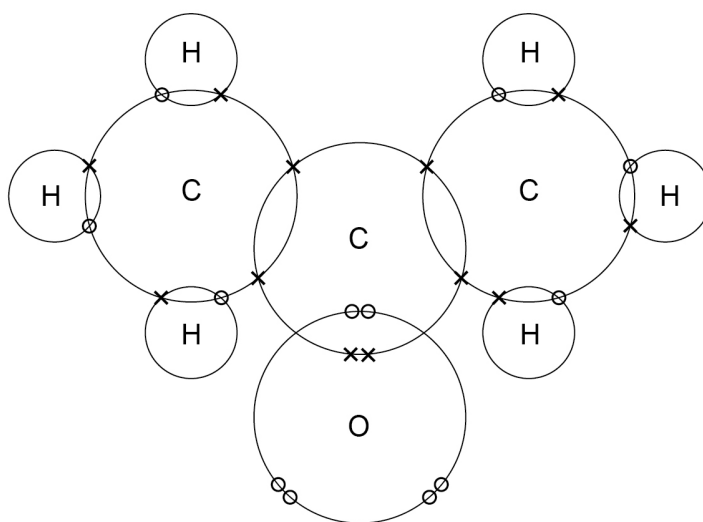
17.2 Give **one** use of a fullerene.

[1 mark]

Propanone is a compound of carbon, hydrogen and oxygen.

Figure 1 shows the dot and cross diagram for a propanone molecule.

Figure 1



17.3 Propanone is a liquid with a low boiling point.

Why does propanone have a low boiling point?

[1 mark]

Tick (✓) **one** box.

The covalent bonds are strong.

☐

The covalent bonds are weak.

☐

The intermolecular forces are strong.

☐

The intermolecular forces are weak.

☐

Turn over ►

1

18.1 Explain why sodium oxide has a high melting point.

[3 marks]

Turn over for the next question

Turn over ►

19.1 **Table 3** shows information about four substances.

Table 3

Substance	Melting point in °C	Boiling point in °C	Does it conduct electricity in the solid state?	Does it conduct electricity in the liquid state?
A	–117	79	No	No
B	801	1413	No	Yes
C	1535	2750	Yes	Yes
D	1610	2230	No	No

Which substance could be a metal?

[1 mark]

Tick (✓) **one** box.

A

☐

B

☐

C

☐

D

☐

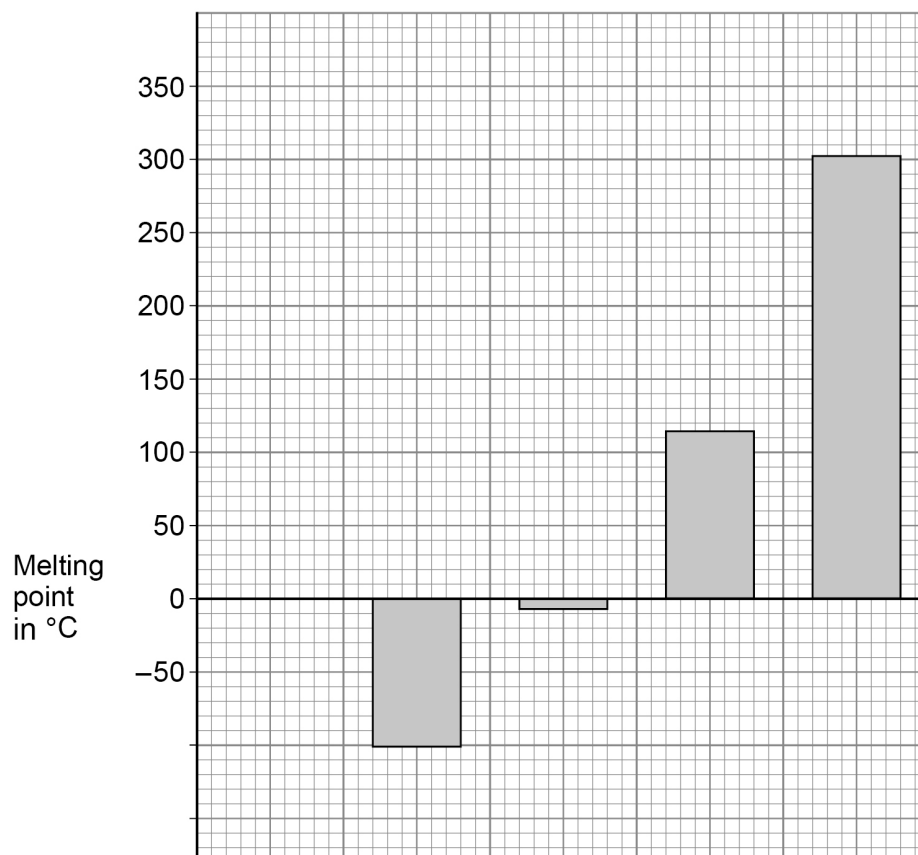
19.2 Explain why alloys are harder than pure metals.

[3 marks]

Turn over ►

Figure 4 shows the melting points of some Group 7 elements.

Figure 4



20.1

] Explain the trend in the melting points of the Group 7 elements.

Use **Figure 4**.

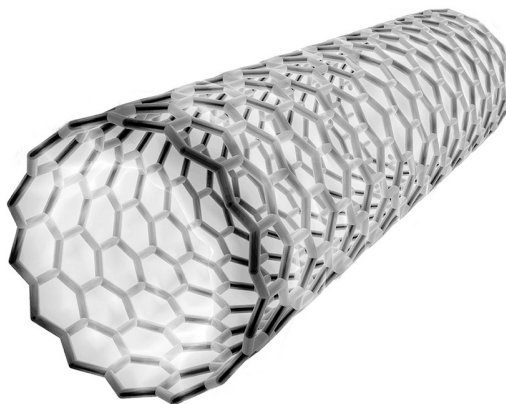
[3 marks]

7 What is the state symbol for bromine at -50°C ?

This question is about structure and bonding.

21.1 **Figure 5** represents part of a carbon molecule.

Figure 5

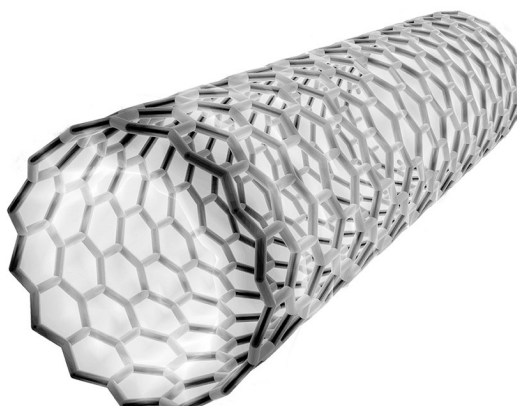


Name the type of carbon molecule in **Figure 5**.

[1 mark]

21.2] **Figure 5** represents part of a carbon molecule.

Figure 5



] Suggest **one** property that makes the carbon molecule in **Figure 5** useful in nanotechnology.

[1 mark]

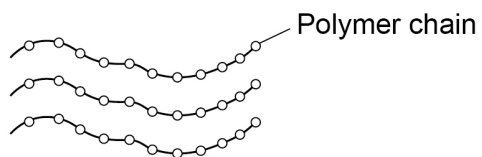
21.3 An alloy of aluminium contains small amounts of other metals.

Explain why other metals are added to aluminium.

[4 marks]

21.4 **Figure 6** represents part of the structure of a polymer.

Figure 6



Compare the bonding within the chains with the forces between the chains in this polymer.

[3 marks]

Turn over ►

Sodium metal and sodium chloride are both able to conduct electricity.

22.1 Describe how sodium metal conducts electricity.

[2 marks]

22.2 Explain how sodium chloride can conduct electricity.

[3 marks]

END OF QUESTIONS

23.1 Aluminium is a metal.

Describe how metals conduct electricity.

Answer in terms of electrons.

[3 marks]

23.2 Name the type of bonding in compounds formed between metals and non-metals.

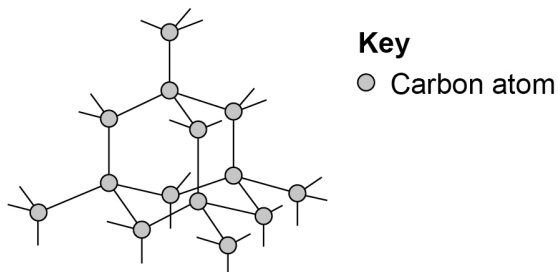
[1 mark]

Turn over ►

This question is about different forms of carbon.

Figure 5 represents the structure of diamond.

Figure 5



24.1 Describe the structure and bonding of diamond.

[3 marks]

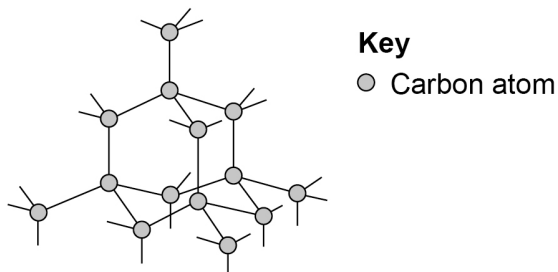
24.2

D
o

This question is about different forms of carbon.

Figure 5 represents the structure of diamond.

Figure 5

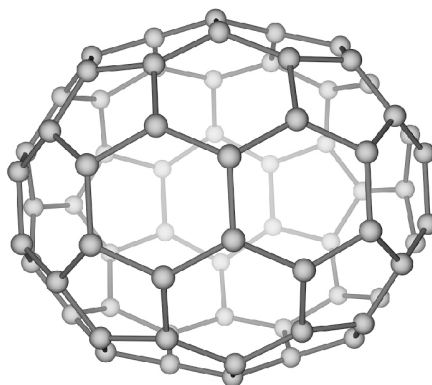


] Explain why diamond has a very high melting point.

[3 marks]

Figure 6 represents the molecule C_{70}

Figure 6



24.3 What is the name of this type of molecule?

[1 mark]

Tick (✓) **one** box.

Fullerene

☐

Graphene

☐

Nanotube

☐

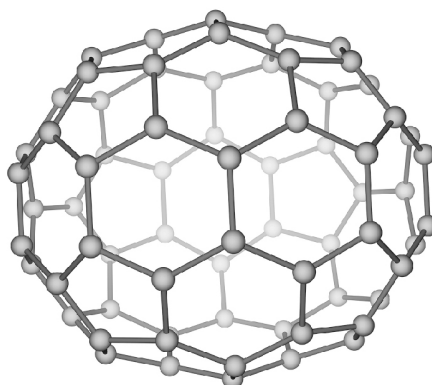
Polymer

☐

24.4

Figure 6 represents the molecule C_{70}

Figure 6



] Molecules such as C_{70} can be used in medicine to move drugs around the body.

Suggest **one** reason why the C_{70} molecule is suitable for this use.

[1 mark]

During electrolysis ions are discharged at the electrodes to produce elements.

A student investigates the electrolysis of sodium chloride.

25.1 Why does solid sodium chloride **not** conduct electricity?

[1 mark]

This question is about structure and properties.

- 26.1 Which pair of substances **both** contain atoms in hexagonal rings?

[1 mark]

Tick (✓) **one** box.

Diamond and graphite

☐

Fullerenes and graphene

☐

Nanotubes and silica

☐

26.2 Explain why the structure of copper allows the conduction of thermal energy.

[3 marks]

26.3 Explain why copper oxide (CuO) has a high melting point.

[3 marks]

26.4 Explain why water (H_2O) has a low melting point.

[3 marks]

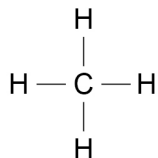
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END OF QUESTIONS

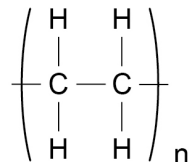
27.1 **Figure 5** represents molecules of methane and of poly(ethene).

Figure 5

Methane



Poly(ethene)



Methane is a gas at room temperature but poly(ethene) is a solid at room temperature.

Explain why methane and poly(ethene) exist in different states at room temperature.

[4 marks]

Turn over for the next question

Turn over ►

This question is about uses of metals in electrical wires.

Electrical wires can be made from:

- aluminium
- copper
- silver.

Figure 6 shows three uses of electrical wires.

Figure 6

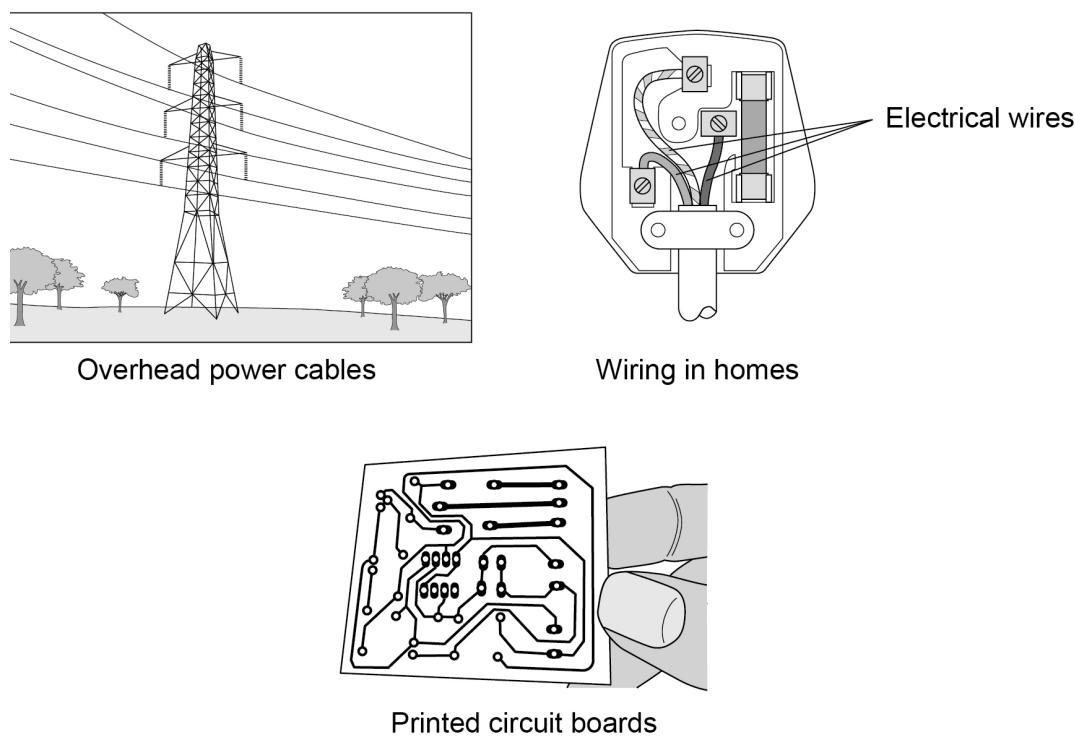


Table 5 shows information about the metals.

The higher the value for electrical conductivity, the better the metal is at conducting electricity.

Table 5

	Aluminium	Copper	Silver
Electrical conductivity in arbitrary units	37.7	59.6	63.0
Density in g/cm ³	2.7	9.0	10.5
Cost of metal per kg in £	1.50	7.00	640.00

28.1

] Evaluate the use of aluminium, copper and silver for the types of electrical wires shown in **Figure 6**.

Use **Table 5**.

[4 marks]

D
c

28.2 Describe how metals conduct electricity.

[3 marks]

Question 6 continues on the next page

Turn over ►

- 28.3 Electrical wires are usually made of pure metals and **not** alloys. This is because pure metals are better electrical conductors.

Suggest why alloys do **not** conduct electricity as well as pure metals.

Answer in terms of structure and bonding.

[2 marks]

D
C

[

29.1 Self-cleaning windows are coated with a layer of nanoparticles of titanium dioxide.

Titanium dioxide:

- helps sunlight break down dirt particles
- attracts water, so dirt is washed away by rain.

Nanoparticles of titanium dioxide are used instead of fine particles of titanium dioxide for coating self-cleaning windows.

Suggest **two** reasons why.

[2 marks]

1 _____

2 _____

Question 10 continues on the next page

Turn over ►