AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.2.3.3

Graphene and fullerenes

Past-paper questions

Tier	**Higher**
Question groups	**4**
Available paper years	**2010–2021**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.2.3.3 Graphene and fullerenes

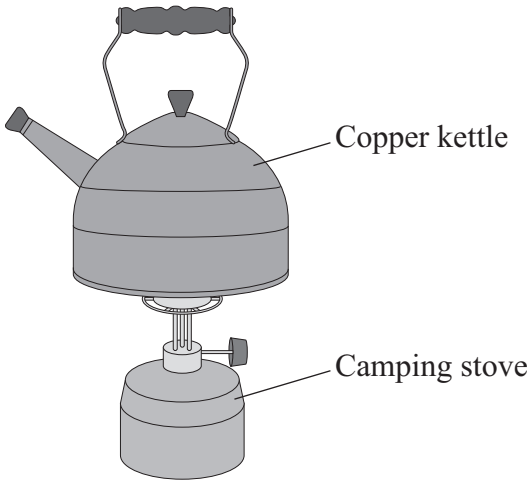
Question 01

January 2010 | CHY2H | Original Q4 | Legacy

4 The picture shows a copper kettle being heated on a camping stove.

Copper is a good material for making a kettle because:

- it has a high melting point
- it is a very good conductor of heat.



4 (a) Explain why copper, like many other metals, has a high melting point.
You should describe the structure and bonding of a metal in your answer.

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(4 marks)

4.2.3.3 Graphene and fullerenes

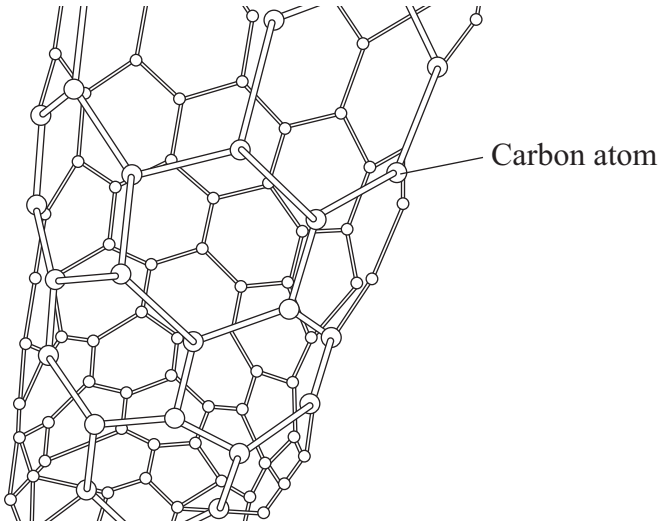
Question 01 · continued

for mark

4 (b) An aeroplane contains many miles of electrical wiring made from copper. This adds to the mass of the aeroplane.

It has been suggested that the electrical wiring made from copper could be replaced by lighter carbon nanotubes.

The diagram shows the structure of a carbon nanotube.



4 (b) (i) What does the term 'nano' tell you about the carbon nanotubes?

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(1 mark)

4 (b) (ii) Like graphite, each carbon atom is joined to three other carbon atoms.

Explain why the carbon nanotube can conduct electricity.

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(2 marks)

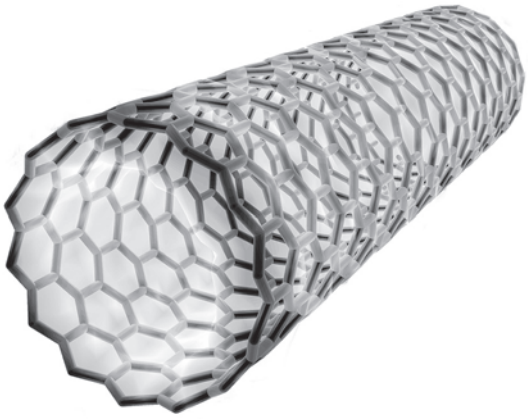
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4.2.3.3 Graphene and fullerenes

Question 02

June 2014 | CH2HP | Original Q5 | Legacy

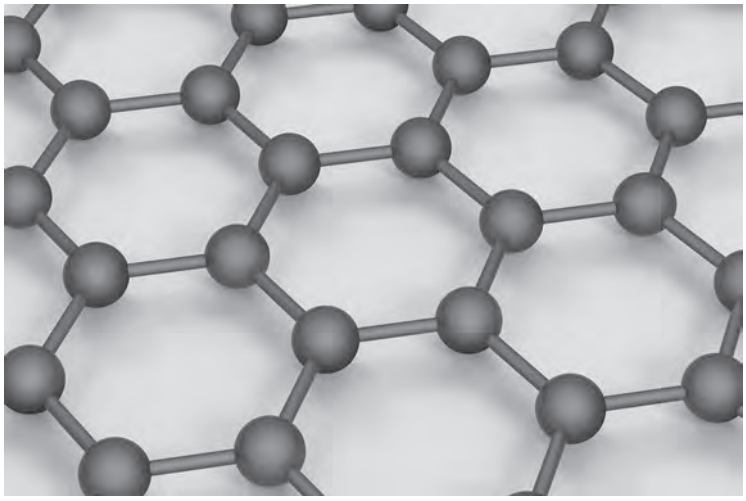
5 Carbon atoms are used to make nanotubes.



Carbon atoms in a nanotube are bonded like a single layer of graphite.

Figure 5 shows the structure of a single layer of graphite.

Figure 5



4.2.3.3 Graphene and fullerenes

Question 02 · continued

5 (a) Suggest why carbon nanotubes are used as lubricants.

[2 marks]

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5 (b) Explain why graphite can conduct electricity.

[2 marks]

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4

4.2.3.3 Graphene and fullerenes

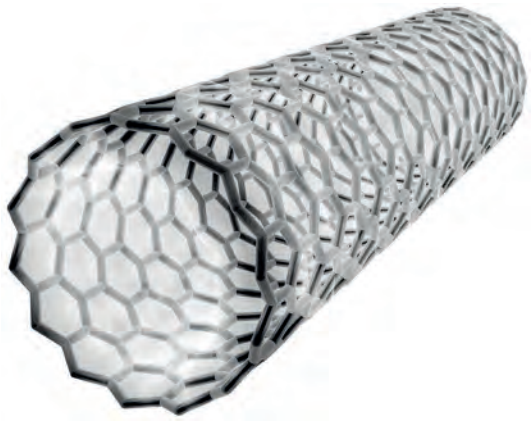
Question 03

June 2019 | 8462/1H | Original Q3

0 3 This question is about materials and their properties.

0 3 . 1 **Figure 3** shows a carbon nanotube.

Figure 3



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

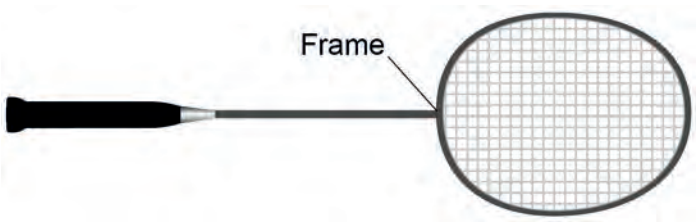
Carbon nanotubes are used in electronics because they conduct electricity.

Explain why carbon nanotubes conduct electricity.

[2 marks]

0 3 . 2 **Figure 4** shows a badminton racket.

Figure 4



4.2.3.3 Graphene and fullerenes

Question 03 · continued

Table 1 shows some properties of materials.

The materials could be used to make badminton racket frames.

Table 1

Material	Density in g/cm^3	Relative strength	Relative stiffness
Aluminium	2.7	0.3	69
Carbon nanotube	1.5	60	1000
Wood	0.71	0.1	10

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

Use **Table 1**.

[4 marks]

4.2.3.3 Graphene and fullerenes

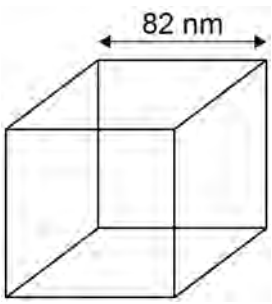
Question 03 · continued

Zinc oxide can be produced as nanoparticles and as fine particles.

0 3 . 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 = _____ nm^2

0 3 . 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]

10

4.2.3.3 Graphene and fullerenes

Question 04

0 1 This question is about carbon and its compounds.

Fullerenes are molecules of carbon atoms.

The first fullerene to be discovered was Buckminsterfullerene (C_{60}).

0 1 . 1 What shape is a Buckminsterfullerene molecule?

[1 mark]

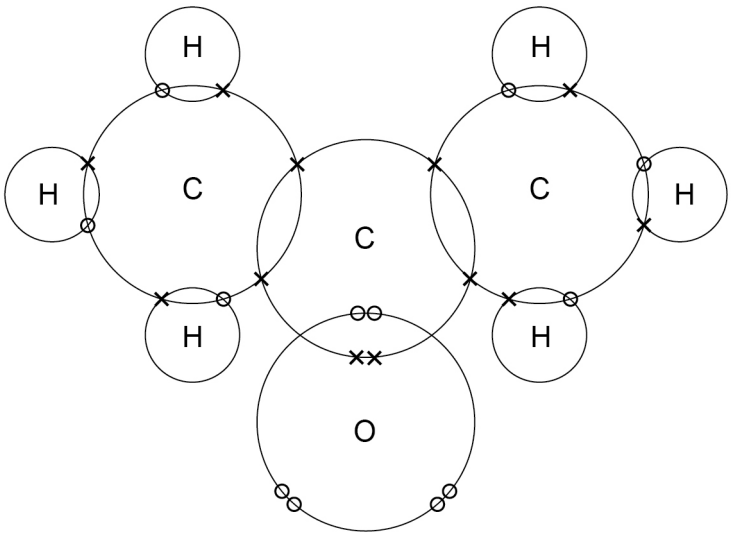
0 1 . 2 Give **one** use of a fullerene.

[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



4.2.3.3 Graphene and fullerenes

Question 04 · continued

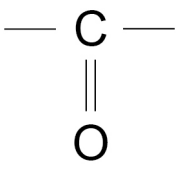
0 1 . 3 Complete **Figure 2** to show a propanone molecule.

Use a line to represent each single bond.

Use **Figure 1**.

[1 mark]

Figure 2



0 1 . 4 Determine the molecular formula of propanone.

Use **Figure 1**.

[1 mark]

Molecular formula = _____

0 1 . 5 Propanone is a liquid with a low boiling point.

Why does propanone have a low boiling point?

[1 mark]

Tick (✓) **one** box.

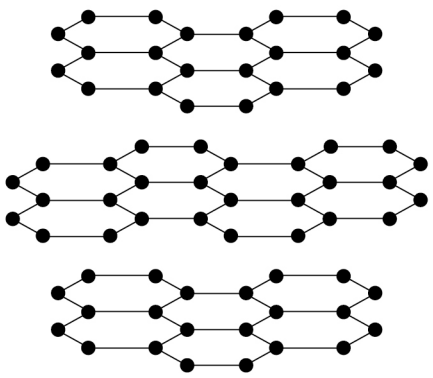
- The covalent bonds are strong. ☐
- The covalent bonds are weak. ☐
- The intermolecular forces are strong. ☐
- The intermolecular forces are weak. ☐

4.2.3.3 Graphene and fullerenes

Question 04 · continued

0 1 . 6 **Figure 3** represents the structure of graphite.

Figure 3



Explain why graphite is:

- a good electrical conductor
- soft and slippery.

You should answer in terms of structure and bonding.

[6 marks]

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