AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.2.3.2

Graphite

Past-paper questions

Tier	**Higher**
Question groups	**11**
Available paper years	**2008–2025**

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.

4.2.3.2 Graphite

Question 01

January 2008 | CHY2H | Original Q4 | Legacy

4 The *electrolysis* of sodium chloride solution produces useful substances.

(a) Explain the meaning of *electrolysis*.

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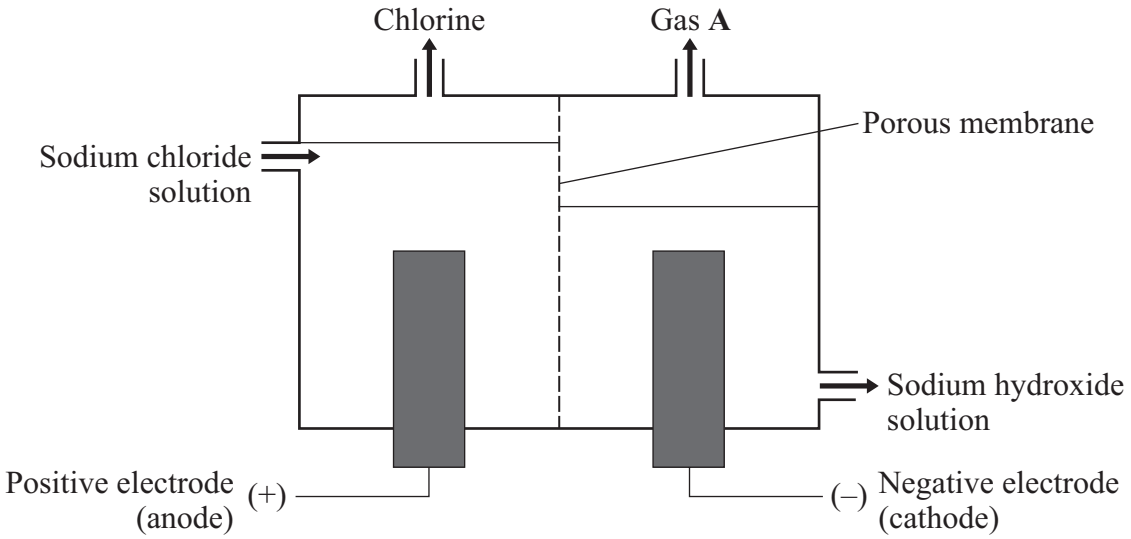
(2 marks)

(b) The diagram shows an apparatus used for the electrolysis of sodium chloride solution.



The electrolysis produces two gases, chlorine and Gas **A**.

Name Gas **A** .....

(1 mark)

(c) The electrodes used in this process can be made of graphite. Explain why graphite conducts electricity.

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(2 marks)

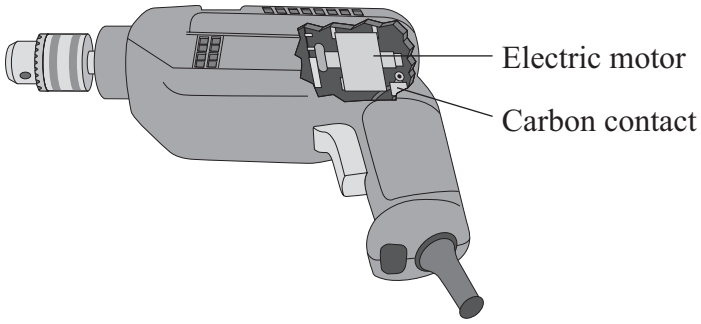
5

4.2.3.2 Graphite

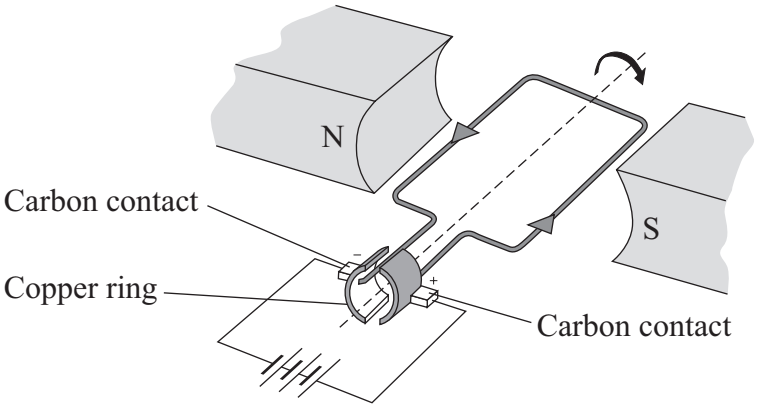
Question 02

June 2009 | CHY2H | Original Q4 | Legacy

4 This drill contains an electric motor.



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



4.2.3.2 Graphite

Question 02 · continued

for mark

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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(5 marks)

5

4.2.3.2 Graphite

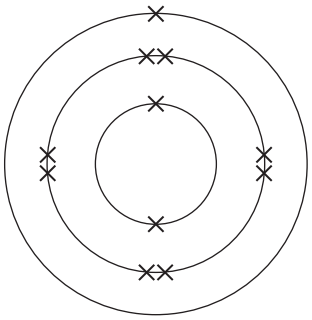
Question 03

1 Sodium chloride is a raw material.

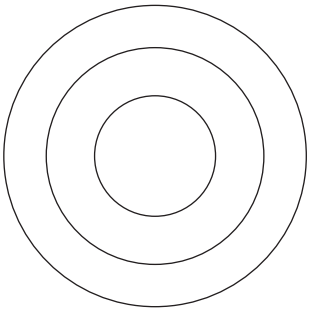
1 (a) The electronic structure of a sodium atom is shown below.

Complete the diagram for the electronic structure of a chlorine atom. A chlorine atom has 17 electrons.

Sodium atom



Chlorine atom



(1 mark)

1 (b) When sodium and chlorine react to form sodium chloride they form sodium ions (Na^+) and chloride ions (Cl^-).

How does a sodium atom change into a sodium ion?

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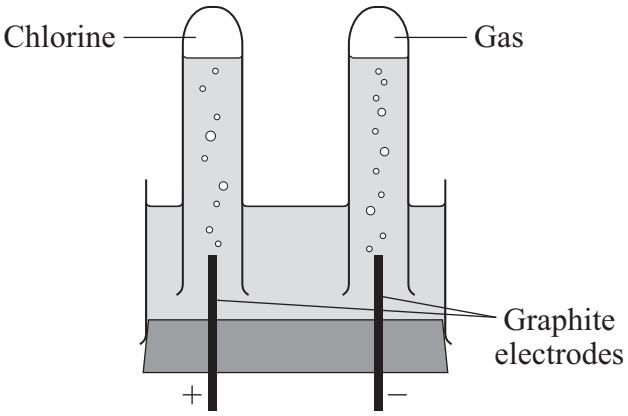
(2 marks)

4.2.3.2 Graphite

Question 03 · continued

for mark

1 (c) The diagram shows apparatus used in a school laboratory for the electrolysis of sodium chloride solution.



The solution contains sodium ions (Na^+), chloride ions (Cl^-), hydrogen ions (H^+) and hydroxide ions (OH^-).

1 (c) (i) Why do chloride ions move to the positive electrode?

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(1 mark)

1 (c) (ii) Name the gas formed at the negative electrode.

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(1 mark)

Question 1 continues on the next page

4.2.3.2 Graphite

for mark

1 (d) Chlorine and chlorine compounds are used to bleach wood pulp that is used to make paper.

The article below is from a newspaper.

> Local people have been protesting outside a paper factory. They say:
> 'We want the company to stop using chlorine compounds. Chlorine compounds release poisons into the environment. The company should use safer compounds.'
>
> The company replied:
> 'Chlorine has been used safely for many years to treat drinking water. Only tiny amounts of chlorine are released, which cause no harm. Using other compounds will be more expensive and may put us out of business.'

1 (d) (i) Why are some local people worried about the use of chlorine compounds?

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(1 mark)

1 (d) (ii) Why might other local people want the company to continue to use chlorine compounds?

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(1 mark)

1 (d) (iii) It is decided to have an enquiry.
Why should this be done by independent scientists?

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(1 mark)

8

4.2.3.2 Graphite

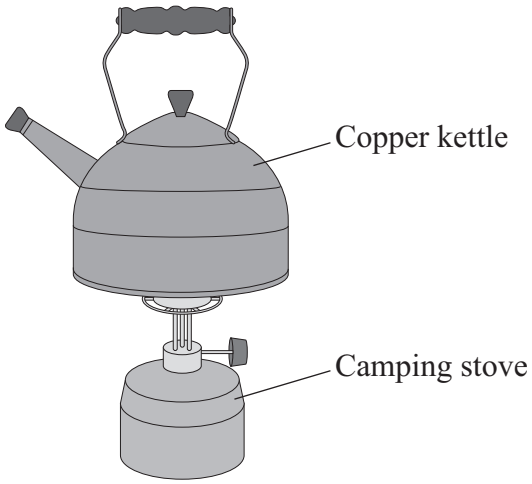
Question 04

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)

4.2.3.2 Graphite

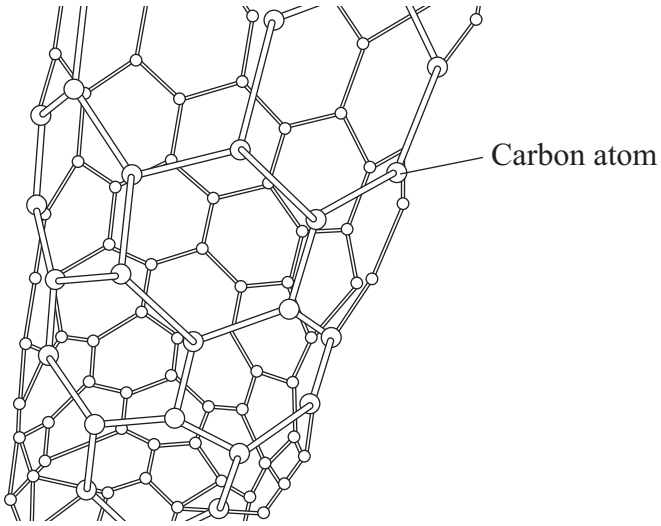
Question 04 · continued

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)

7

4.2.3.2 Graphite

Question 05

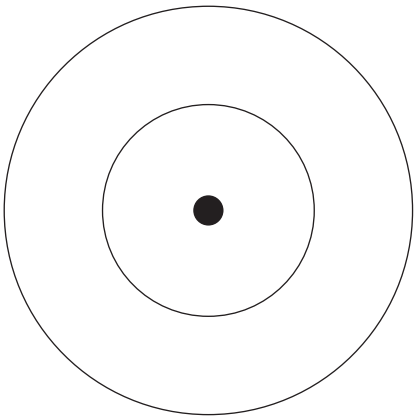
June 2010 | CHY2H | Original Q3 | Legacy

3 Pure carbon can exist in two forms, diamond and graphite.

3 (a) Complete the diagram to show the electronic structure of a carbon atom.

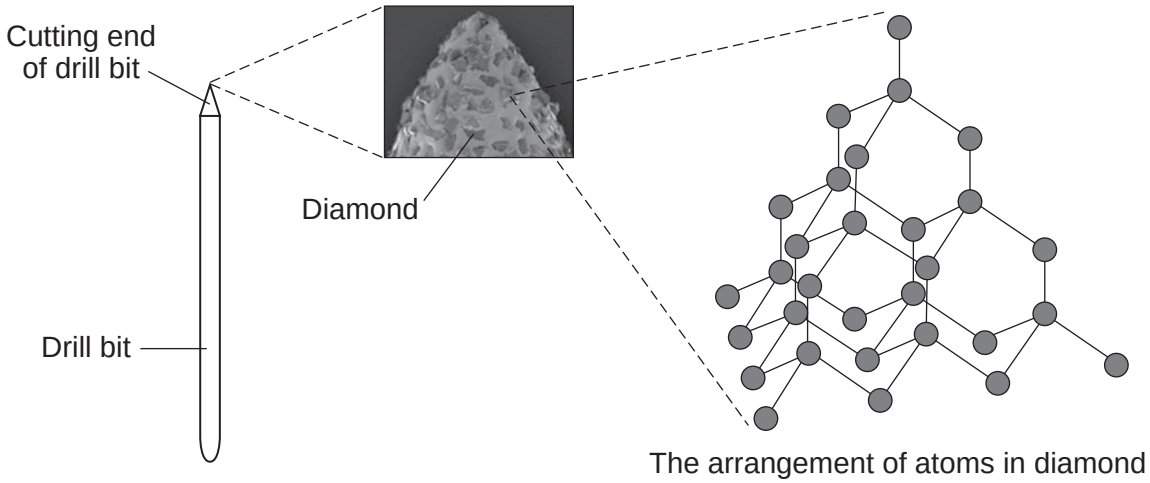
A carbon atom has 6 electrons.

Show the electrons as crosses (x).



(1 mark)

3 (b) A drill bit is used to cut holes through materials. The cutting end of this drill bit is covered with very small diamonds.



4.2.3.2 Graphite

Question 05 · continued

3 (b) (i) What property of diamond makes it suitable for use on the cutting end of a drill bit?

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(1 mark)

3 (b) (ii) Explain, as fully as you can, why diamond has this property. Use your knowledge of the structure and bonding of diamond and the information shown opposite to help you to answer this question.

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(3 marks)

3 (c) Explain why graphite is a good conductor of electricity and why diamond does **not** conduct electricity.

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(3 marks)

8

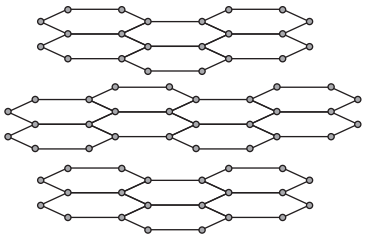
4.2.3.2 Graphite

Question 06

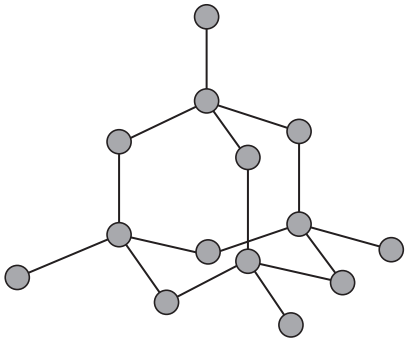
June 2012 | CH2HP | Original Q7 | Legacy

7 Graphite and diamond are different forms of the element carbon.
Graphite and diamond have different properties.

The structures of graphite and diamond are shown below.



Graphite



Diamond

7 (a) Graphite is softer than diamond.

Explain why.

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(4 marks)

4.2.3.2 Graphite

Question 06 · continued

7 (b) Graphite conducts electricity, but diamond does not.

Explain why.

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(3 marks)

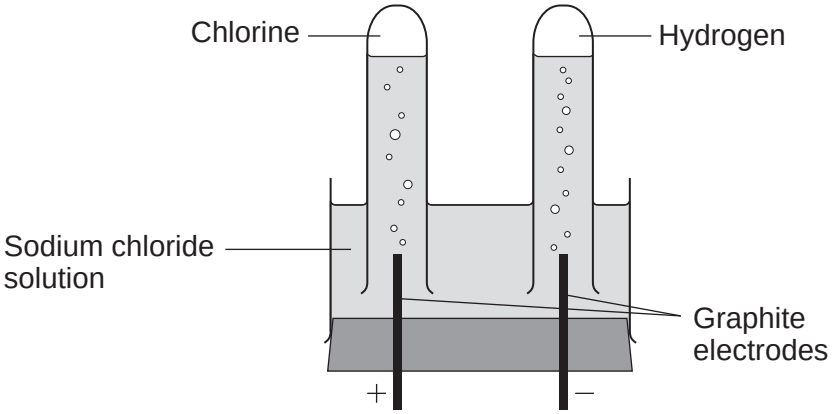
7

4.2.3.2 Graphite

Question 07

2 The electrolysis of sodium chloride solution is an industrial process.

The diagram shows the apparatus used in a school experiment.



2 (a) One of the products of the electrolysis of sodium chloride solution is hydrogen.

2 (a) (i) Why do hydrogen ions move to the negative electrode?

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(1 mark)

2 (a) (ii) How does a hydrogen ion change into a hydrogen atom?

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(1 mark)

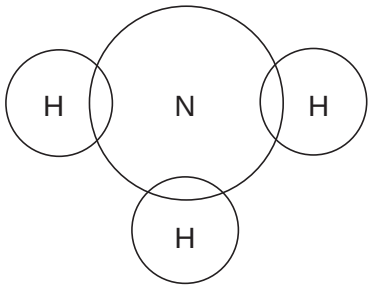
4.2.3.2 Graphite

2 (b) Hydrogen is used to make ammonia (NH_3).

Complete the diagram to show the bonding in ammonia.

Use dots (●) and crosses (x) to show electrons.

Show only outer shell electrons.



(2 marks)

2 (c) The table shows the ions in sodium chloride solution.

Positive ions	Negative ions
hydrogen	chloride
sodium	hydroxide

In industry, some of the waste from the electrolysis of sodium chloride solution is alkaline and has to be neutralised.

2 (c) (i) Which ion makes the waste alkaline?

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(1 mark)

2 (c) (ii) This waste must be neutralised.

Write the ionic equation for the neutralisation reaction.

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(1 mark)

Question 2 continues on the next page

4.2.3.2 Graphite

2 (d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The electrolysis of sodium chloride solution also produces chlorine and sodium hydroxide.

In industry, the electrolysis of sodium chloride solution can be done in several types of electrolysis cell.

Some information about two different types of electrolysis cell is given below.

	Mercury cell	**Membrane cell**
Cost of construction	Expensive	Relatively cheap
Additional substances used	Mercury, which is recycled. Mercury is toxic so any traces of mercury must be removed from the waste.	Membrane, which is made of a polymer. The membrane must be replaced every 3 years.
Amount of electricity used for each tonne of chlorine produced in kWh	3400	2950
Quality of chlorine produced	Pure	Needs to be liquefied and distilled to make it pure.
Quality of sodium hydroxide solution produced	50% concentration. Steam is used to concentrate the sodium hydroxide solution produced.	30% concentration. Steam is used to concentrate the sodium hydroxide solution produced.

Use the information and your knowledge and understanding to compare the environmental and economic advantages and disadvantages of these **two** types of electrolysis cell.

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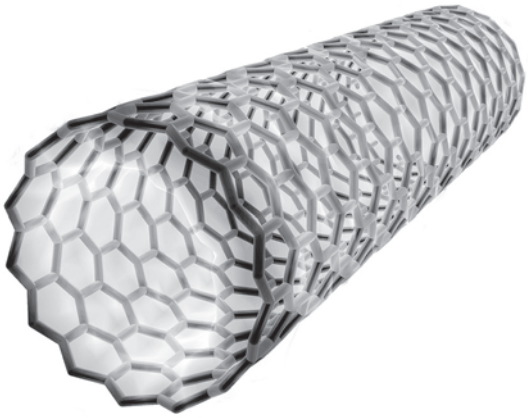
4.2.3.2 Graphite

Question 08

June 2014 | CH2HP | Original Q5 | Legacy

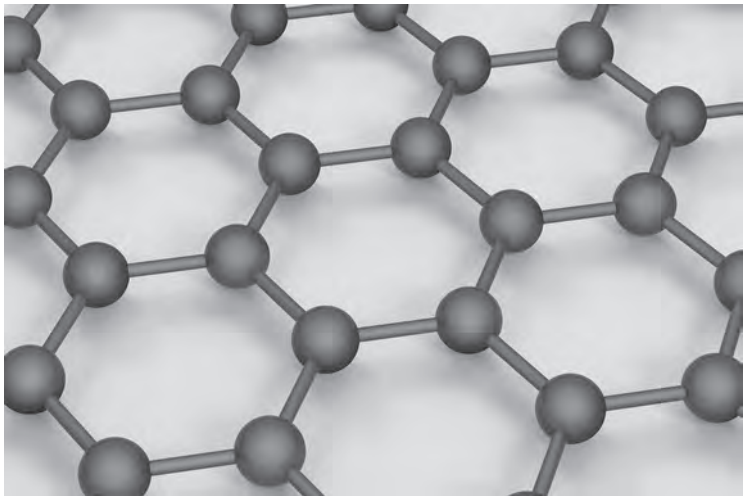
5 Carbon atoms are used to make nanotubes.



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



4.2.3.2 Graphite

Question 08 · 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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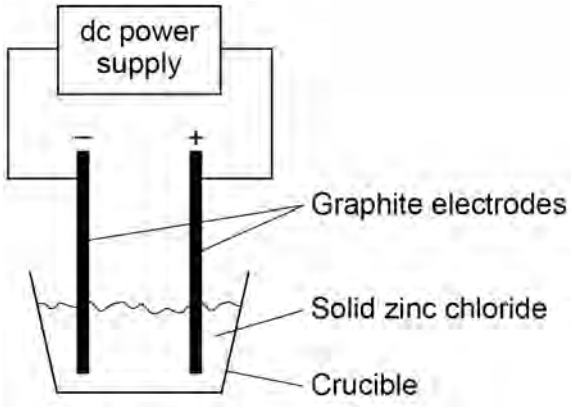
4.2.3.2 Graphite

Question 09

0 6 A student investigated the electrolysis of different substances.

Figure 6 shows the apparatus.

Figure 6



0 6 . 1 Explain why electrolysis would **not** take place in the apparatus shown in **Figure 6**.

[2 marks]

0 6 . 2 Explain why graphite conducts electricity.

Answer in terms of the structure and bonding in graphite.

[3 marks]

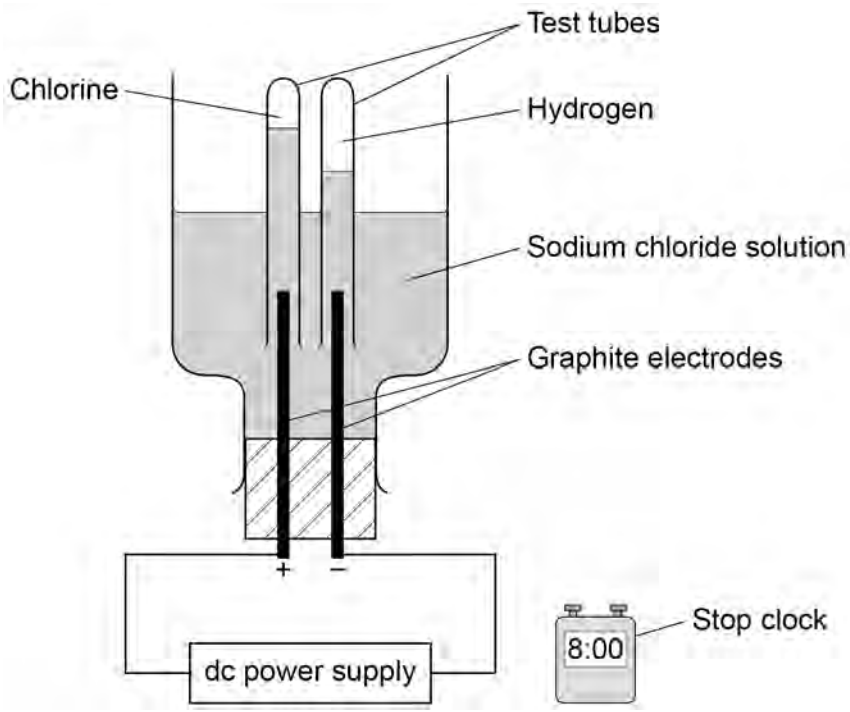
4.2.3.2 Graphite

Question 09 · continued

The student investigated how the volume of gases produced changes with time in the electrolysis of sodium chloride solution.

Figure 7 shows the apparatus.

Figure 7



0 6 . 3 The student made an error in selecting the apparatus for this investigation.

How should the apparatus be changed?

Give **one** reason for your answer.

[2 marks]

4.2.3.2 Graphite

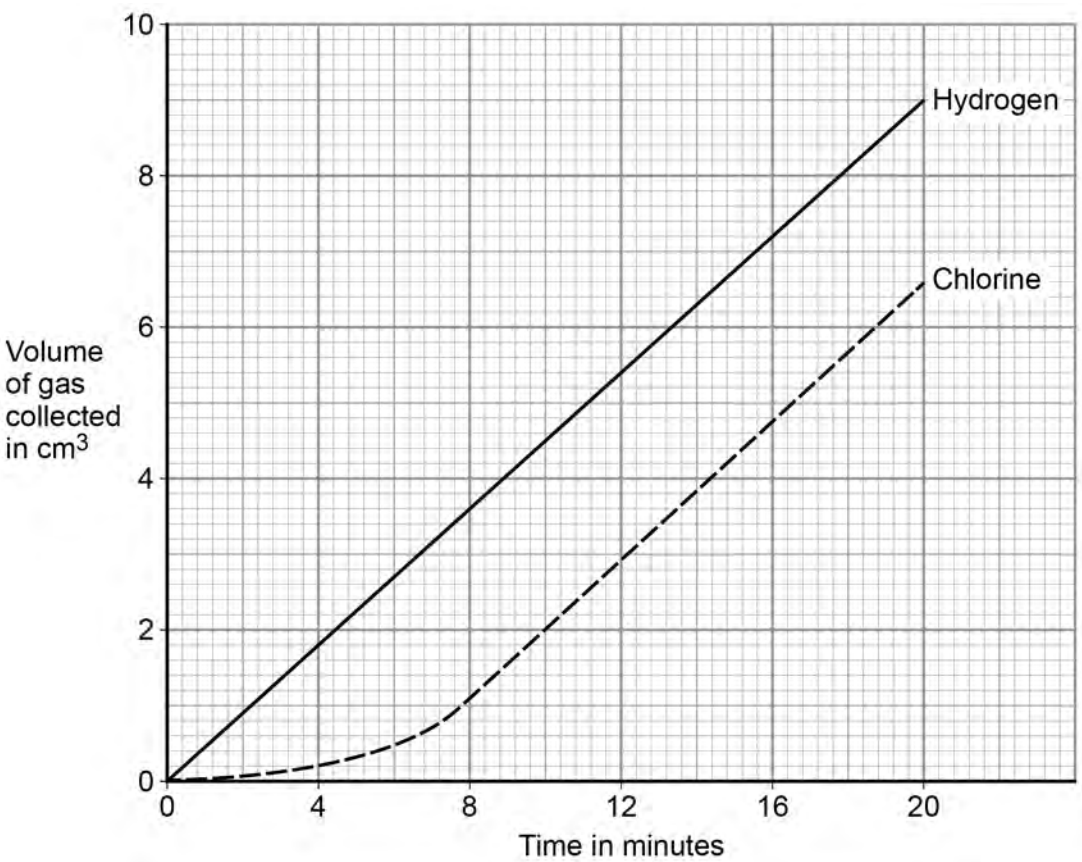
Question 09 · continued

Another student used the correct apparatus.

This student measured the volumes of gases collected every minute for 20 minutes.

Figure 8 shows the student's results.

Figure 8



0 6 . 4 Describe the trends shown in the results.

Use values from **Figure 8**.

[3 marks]

4.2.3.2 Graphite

Question 09 · continued

0 6 . 5 The number of moles of each gas produced at the electrodes is the same.

No gas escapes from the apparatus.

Suggest **one** reason for the difference in volume of each gas collected.

[1 mark]

0 6 . 6 Calculate the amount in moles of chlorine collected after 20 minutes.

Use **Figure 8**.

The volume of one mole of any gas at room temperature and pressure is 24.0 dm^3

Give your answer in standard form.

[3 marks]

Moles of chlorine = _____ mol

14

4.2.3.2 Graphite

Question 10

November 2021 | 8462/1H | Original Q1

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]

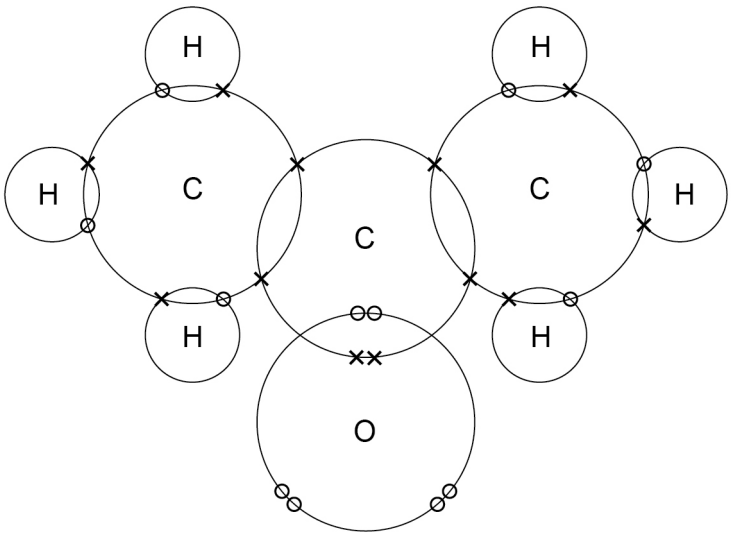
0 1 . 2 Give **one** use of a fullerene.

[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



4.2.3.2 Graphite

Question 10 · continued

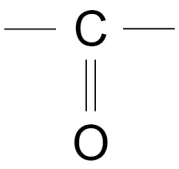
0 1 . 3 Complete **Figure 2** to show a propanone molecule.

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. ☐

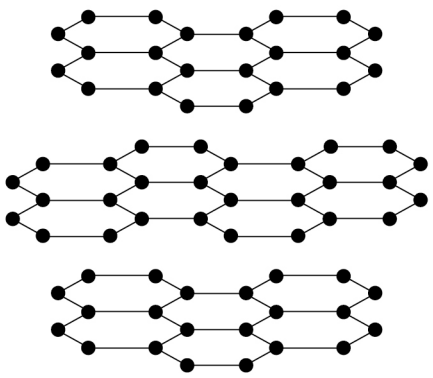
The intermolecular forces are weak. ☐

4.2.3.2 Graphite

Question 10 · 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]

11

4.2.3.2 Graphite

Question 11

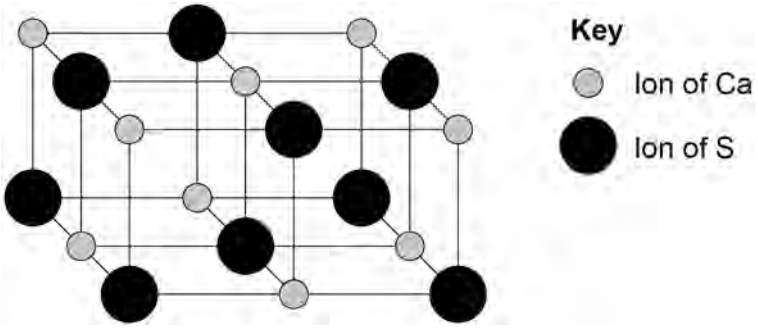
June 2025 | 8462/1H | Original Q2

0 2 This question is about structure and bonding.

Calcium sulfide is an ionic compound.

Figure 2 represents the structure of calcium sulfide.

Figure 2



0 2 . 1 Determine the empirical formula of calcium sulfide.

[1 mark]

Empirical formula _____

Question 2 continues on the next page

4.2.3.2 Graphite

Question 11 · continued

0 2 . 2 Calcium is in Group 2 of the periodic table.

Sulfur is in Group 6 of the periodic table.

Describe what happens when a calcium atom reacts with a sulfur atom.

Answer in terms of electrons and ions.

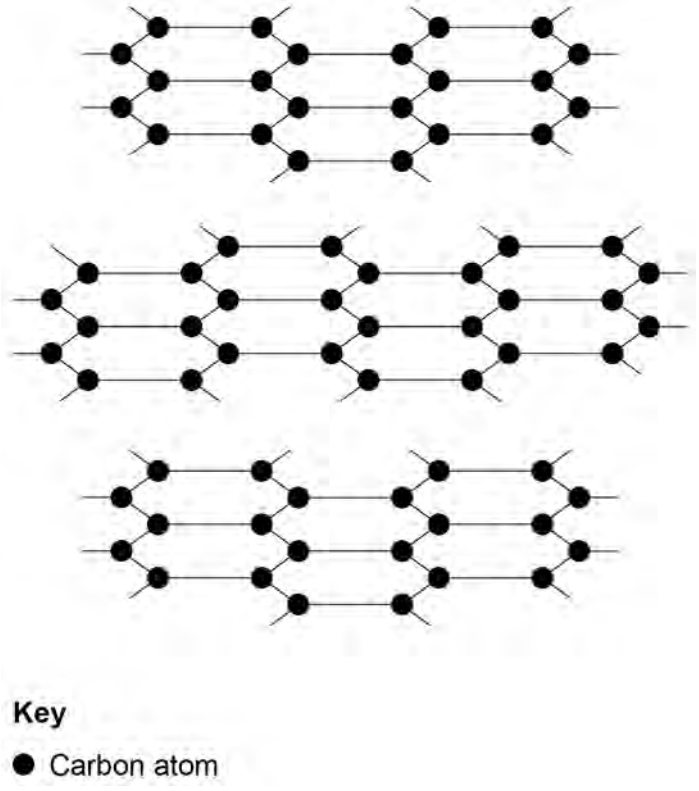
[4 marks]

4.2.3.2 Graphite

Question 11 · continued

Figure 3 shows the structure of graphite.

Figure 3



0 2 . 3 Describe the structure and bonding of graphite.

[4 marks]

Extra space

4.2.3.2 Graphite

Question 11 · continued

0 2 . 4 Substances that consist of small molecules do **not** conduct electricity.

Give **one** reason why.

[1 mark]

0 2 . 5 Methane consists of small molecules.

Poly(ethene) is a polymer.

Why does poly(ethene) have a higher melting point than methane?

[1 mark]

Tick (✓) **one** box.

- Poly(ethene) has more covalent bonds to break than methane. ☐
- Poly(ethene) has no intermolecular forces to overcome. ☐
- Poly(ethene) has stronger covalent bonds to break than methane. ☐
- Poly(ethene) has stronger intermolecular forces to overcome than methane. ☐

11