AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.2.3.2

# Graphite

## Past-paper questions

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **17** |
| 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

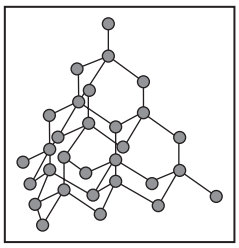
**Question 01**

January 2008 | CHY2F | Original Q2 | Legacy

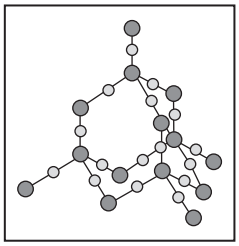
**2** This question is about giant structures. Diamond, graphite and silicon dioxide all have giant structures.

(a) The diagrams show the structures of these three substances.

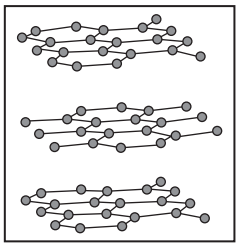
Draw a line from each structure to its name.



Silicon dioxide



Graphite



Diamond

*(2 marks)*

**4.2.3.2 Graphite**

**Question 01 · continued**



*BLANK*

(b) Complete the sentences using words from the box.

| | | | |
|---|---|---|---|
| **covalent** | **four** | **hard** | **ionic** |
| **shiny** | **soft** | **three** | **two** |

(i) Diamond, graphite and silicon dioxide have high melting points because all the atoms in their structures are joined by strong ..... bonds.
*(1 mark)*

(ii) In diamond each atom is joined to ..... other atoms.
*(1 mark)*

(iii) Diamond can be used to make cutting tools because it has a rigid structure which makes it very ..... .
*(1 mark)*

(iv) In graphite each atom is joined to ..... other atoms.
*(1 mark)*

(v) Graphite can be used to make pencils because it has a structure which makes it ..... .
*(1 mark)*

(c) When a diamond is heated to a high temperature and then placed in pure oxygen it burns. Carbon dioxide is the only product.

Name the element in diamond. .....
*(1 mark)*

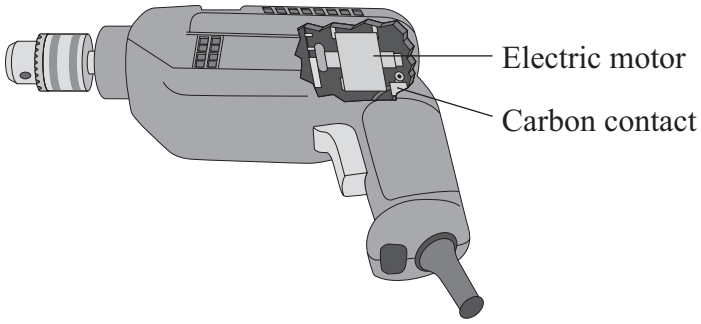
**8**

**4.2.3.2 Graphite**

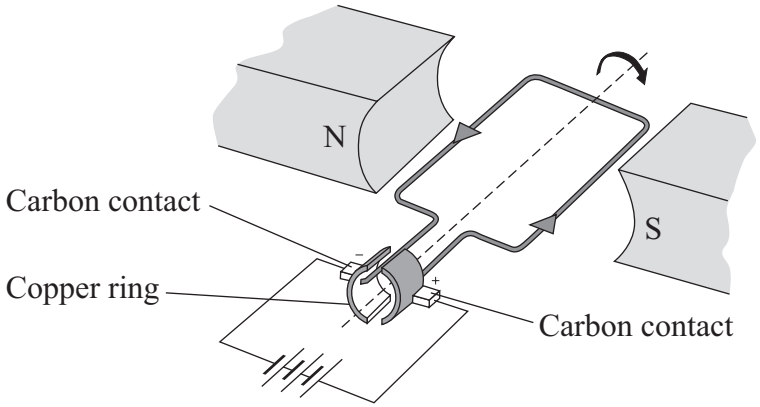
**Question 02**

June 2009 | CHY2F | Original Q5 | Legacy

**5** 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 carbon 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.

**5** (a) Using this information give **two** properties that make graphite suitable for making the carbon contacts.

1 .....

.....

2 .....

.....

*(2 marks)*

4.2.3.2 Graphite

Question 02 · continued



*for mark*

**5** (b) (i) Draw a ring around the correct word in each box to complete the sentence.

Each carbon atom in graphite is joined to

| two / three / four | other carbon atoms by | covalent / ionic / metallic | bonds. |
|---|---|---|---|

*(2 marks)*

**5** (b) (ii) Tick (✓) the statement which explains why graphite is soft and slippery.

| Statement | Tick (✓) |
|---|---|
| It is made of layers of atoms. | |
| It is made of small molecules. | |
| It is an ionic compound. | |

*(1 mark)*

5

### 4.2.3.2 Graphite

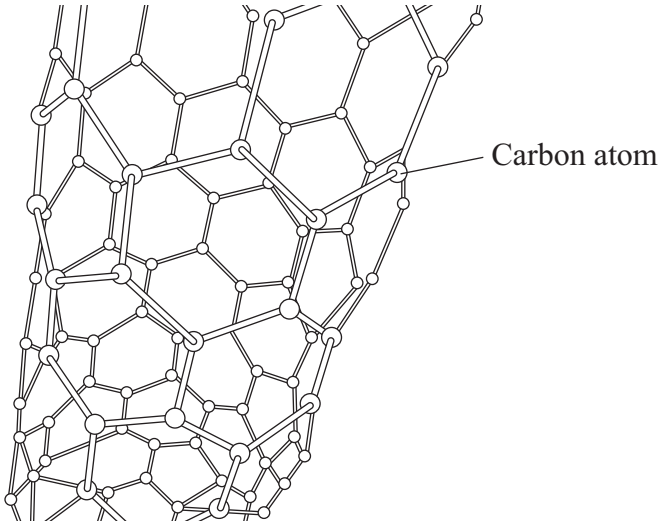
**Question 03**



**4** Lightweight handlebars for bicycles are made from materials containing carbon nanotubes.

Carbon nanotubes are lightweight but very strong.

The diagram shows the structure of a carbon nanotube.




**4** (a) What does the term 'nano' tell you about the diameter of carbon nanotubes?

Tick (✓) the correct answer in the table.

| Answer | Tick (✓) |
|---|---|
| The diameter of the tube is very small. | |
| The diameter of the tube is large. | |
| The diameter of the tube is very large | |

*(1 mark)*

**4.2.3.2 Graphite**

**Question 03 · continued**



*for mark*

**4** (b) Look at the diagram and then draw a ring around the correct word to complete each sentence.

**4** (b) (i) Carbon nanotubes are similar to graphite because each carbon atom is joined to

two
three
four

other carbon atoms.

*(1 mark)*

**4** (b) (ii) The carbon atoms are joined by

covalent
ionic
metallic

bonds.

*(1 mark)*

**4** (b) (iii) Carbon nanotubes are very strong because the

atoms
bonds
electrons

are hard to break.

*(1 mark)*

**4**

**4.2.3.2 Graphite**

**Question 04**

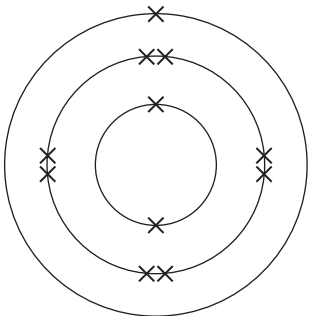


**7** Sodium chloride is a raw material.

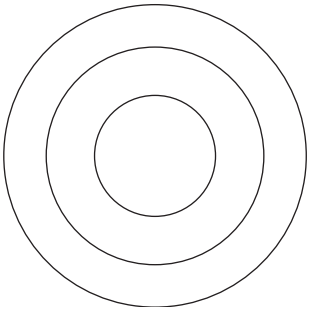
**7** (a) The electronic structure of a sodium atom is shown below.

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

**Sodium atom**



**Chlorine atom**



*(1 mark)*

**7** (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?

.....

.....

.....

.....

*(2 marks)*

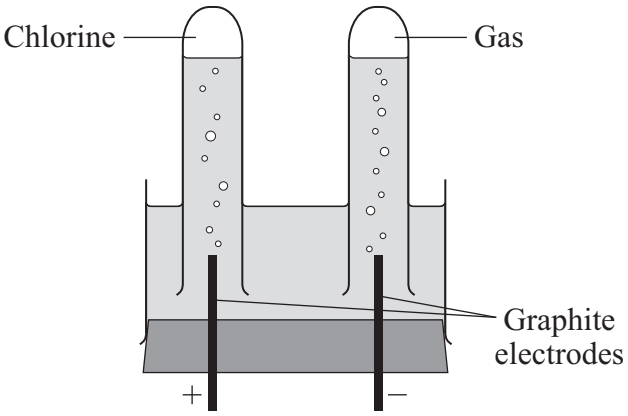
4.2.3.2 Graphite

Question 04 · continued



*for mark*

**7** (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 ($OH^-$).

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

.....

*(1 mark)*

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

.....

*(1 mark)*

**Question 7 continues on the next page**

**4.2.3.2 Graphite**

**Question 04 · continued**



*for mark*

**7** (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.'

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

.....

.....

*(1 mark)*

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

.....

.....

*(1 mark)*

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

.....

.....

*(1 mark)*

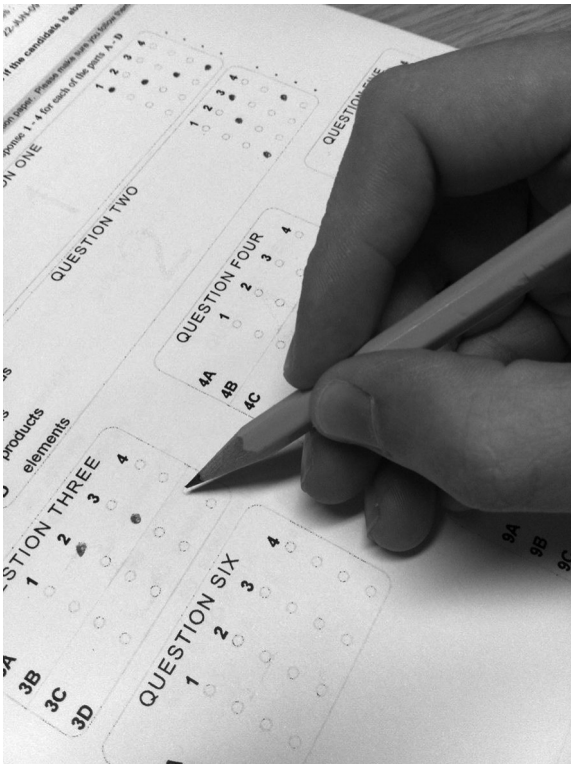
**8**

### 4.2.3.2 Graphite

**Question 05**

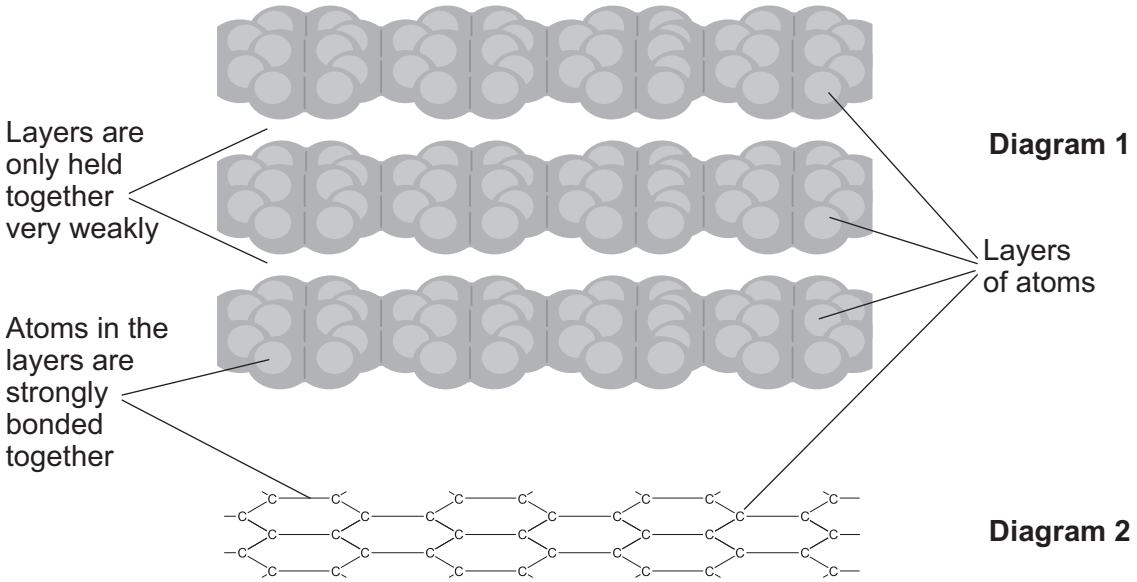
June 2011 | CHY2F | Original Q3 | Legacy

**3** The picture shows a student using a pencil to complete a multiple choice answer sheet.




The pencil contains graphite. Graphite rubs off the pencil onto the paper.

**Diagrams 1** and **2** show how the atoms are arranged in graphite.




**3 (a)** Use **Diagram 2** and your Data Sheet to help you to name the element from which graphite is made.

.....

*(1 mark)*

4.2.3.2 Graphite

Question 05 · continued



**3 (b)** Use **Diagram 1** to help you explain why graphite can rub off the pencil onto the paper.

.....

.....

.....

.....

*(2 marks)*

**3 (c)** Draw a ring around the type of bond which holds the atoms together in each layer.

**covalent** **ionic** **metallic**

*(1 mark)*

4

**Turn over for the next question**

### 4.2.3.2 Graphite

**Question 06**

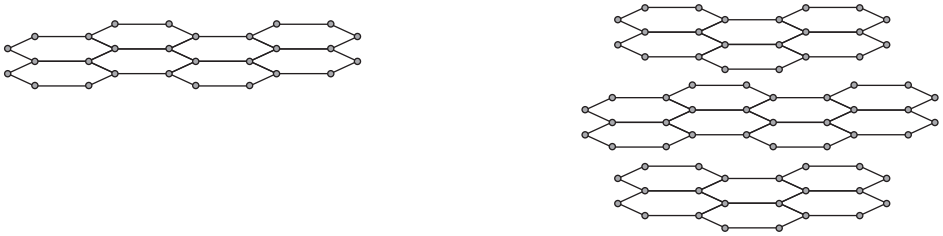
June 2012 | CH2FP | Original Q5 | Legacy

**5** Read the information.

**Graphene**

Scientists have made a new substance called graphene.
The bonding and structure of graphene are similar to graphite.

Graphene is made of a single layer of the same atoms as graphite.



**Graphene** **Graphite**

Use the information above and your knowledge of graphite to answer the questions.

**5 (a)** This part of the question is about graphene.

Choose the correct answer to complete each sentence.

**5 (a) (i)**

| | | |
|---|---|---|
| **ionic** | **covalent** | **metallic** |

The bonds between the atoms in graphene are ..... .

*(1 mark)*

**5 (a) (ii)**

| | | |
|---|---|---|
| **chromium** | **carbon** | **chlorine** |

Graphene is made of ..... atoms.

*(1 mark)*

**5 (a) (iii)**

| | | |
|---|---|---|
| **2** | **3** | **4** |

In graphene each atom bonds to ..... other atoms.

*(1 mark)*

4.2.3.2 Graphite

Question 06 · continued



**5 (b)** This part of the question is about graphite.

Graphite is used in pencils.

Explain why. Use the diagrams to help you.

.....

.....

.....

.....

*(2 marks)*

5

**Turn over for the next question**

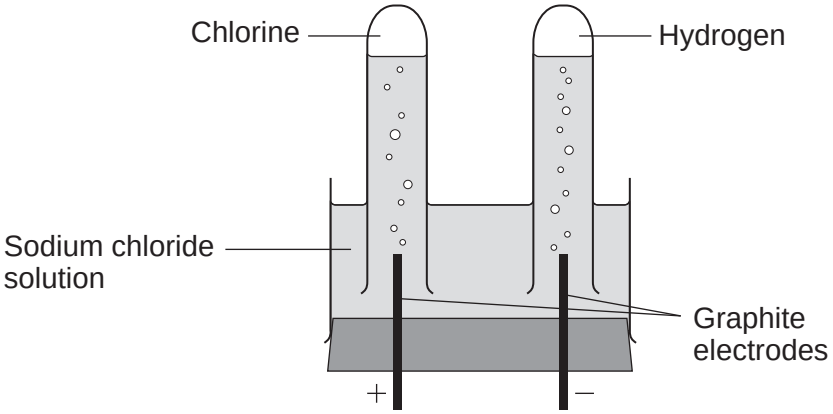
### 4.2.3.2 Graphite

**Question 07**

January 2013 | CH2FP | Original Q8 | Legacy

**8** The electrolysis of sodium chloride solution is an industrial process.

The diagram shows the apparatus used in a school experiment.




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

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

.....

.....

*(1 mark)*

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

.....

.....

*(1 mark)*

4.2.3.2 Graphite

Question 07 · continued

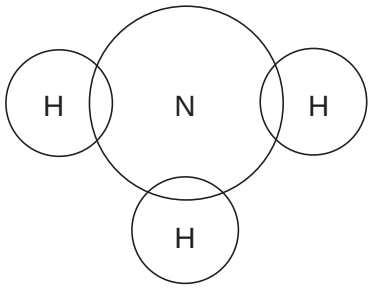


**8 (b)** Hydrogen is used to make ammonia ($NH_3$).

Complete the diagram to show the bonding in ammonia.

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

Show only outer shell electrons.




*(2 marks)*

**8 (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.

**8 (c) (i)** Which ion makes the waste alkaline?

.....

*(1 mark)*

**8 (c) (ii)** This waste must be neutralised.

Write the ionic equation for the neutralisation reaction.

.....

*(1 mark)*

**Question 8 continues on the next page**

4.2.3.2 Graphite

Question 07 · continued



**8 (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.

.....

.....

.....

.....

.....

.....

.....

.....

### 4.2.3.2 Graphite

**Question 08**

June 2015 | CH2FP | Original Q4 | Legacy

**4** This question is about electrolysis.

**4 (a)** Metal spoons can be coated with silver.
This is called electroplating.

Suggest **one** reason why spoons are electroplated.

**[1 mark]**

.....

.....

**4 (b)** When sodium chloride solution is electrolysed the products are hydrogen and chlorine.

**4 (b) (i)** What is made from chlorine?

**[1 mark]**

Tick (✓) **one** box.

Bleach ☐

Fertiliser ☐

Soap ☐

**4 (b) (ii)** Sodium chloride solution contains two types of positive ions, hydrogen ions ($H^+$) and sodium ions ($Na^+$).

Why is hydrogen produced at the negative electrode and **not** sodium?

**[1 mark]**

Tick (✓) **one** box.

Hydrogen is a gas. ☐

Hydrogen is less reactive than sodium. ☐

Hydrogen ions move faster than sodium ions. ☐

4.2.3.2 Graphite

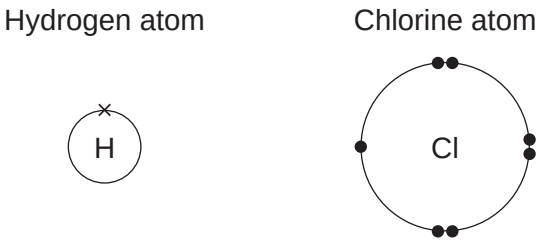
Question 08 · continued



**4 (b) (iii)** Hydrogen and chlorine can be used to produce hydrogen chloride.

The diagrams in **Figure 4** show how the outer electrons are arranged in an atom of hydrogen and an atom of chlorine.

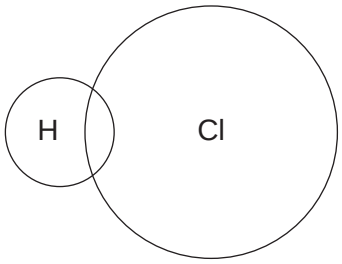
**Figure 4**




Complete **Figure 5** to show how the outer electrons are arranged in a molecule of hydrogen chloride (HCl).

**[1 mark]**

**Figure 5**




**4 (b) (iv)** What is the type of bond in a molecule of hydrogen chloride?

**[1 mark]**

Tick (✓) **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

**Question 4 continues on the next page**

4.2.3.2 Graphite

Question 08 · continued



**4 (b) (v)** Why is hydrogen chloride a gas at room temperature (20 °C)?

**[2 marks]**

Tick (✓) **two** boxes.

Hydrogen chloride has a low boiling point. ☐

Hydrogen chloride has a high melting point. ☐

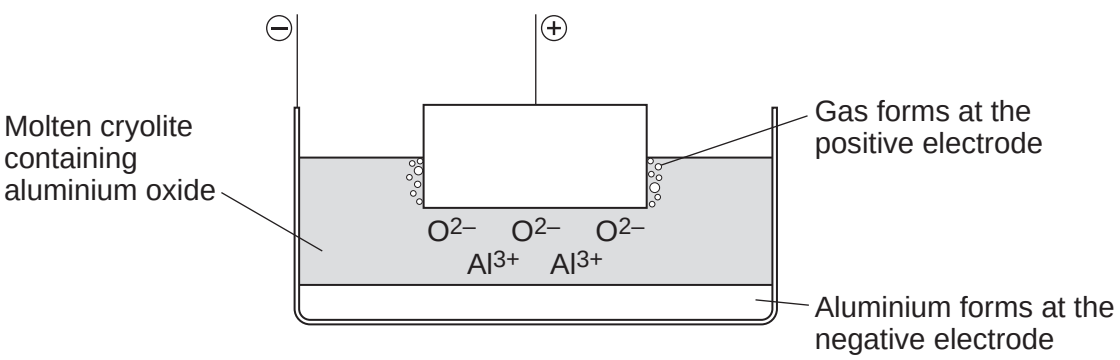
Hydrogen chloride is made of simple molecules. ☐

Hydrogen chloride does not conduct electricity. ☐

Hydrogen chloride has a giant structure. ☐

**4 (c)** Aluminium is produced by electrolysis of a molten mixture of aluminium oxide and cryolite.
This is shown in **Figure 6**.

**Figure 6**




**4 (c) (i)** Name a gas produced at the positive electrode.

**[1 mark]**

.....

4.2.3.2 Graphite

Question 08 · continued



**4 (c) (ii)** Aluminium ions move to the negative electrode.

Explain why.

**[2 marks]**

.....

.....

.....

.....

**4 (c) (iii)** At the negative electrode, the aluminium ions gain electrons to produce aluminium.

What is this type of reaction called?

**[1 mark]**

Tick (✓) **one** box.

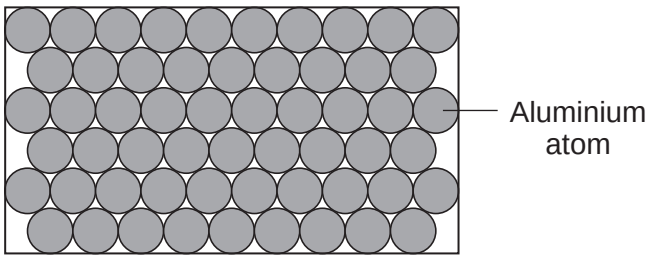
Combustion ☐

Oxidation ☐

Reduction ☐

**4 (c) (iv)** Aluminium has layers of atoms, as shown in **Figure 7**.

**Figure 7**




Complete the sentence.

**[1 mark]**

Metals can be bent and shaped because the layers of atoms can ..... .

**Question 4 continues on the next page**

4.2.3.2 Graphite

Question 08 · continued

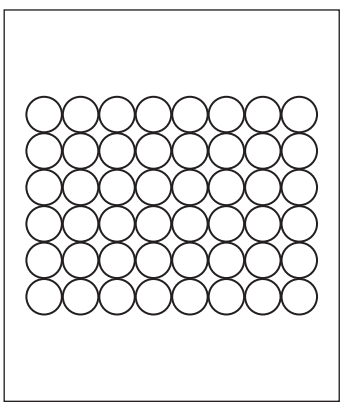


**4 (d)** Electrodes used in the production of aluminium are made from graphite.

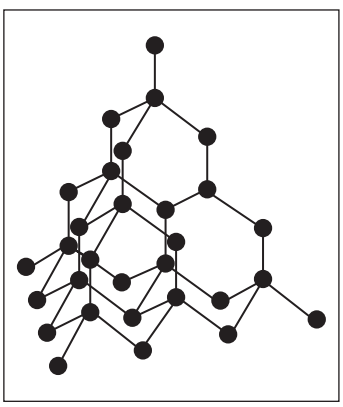
**4 (d) (i)** Which diagram, **A**, **B** or **C**, shows the structure of graphite?

**[1 mark]**

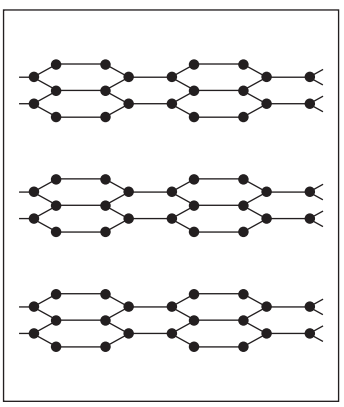
**A**



**B**



**C**



The structure of graphite is shown in diagram ☐.

**4 (d) (ii)** The temperature for the electrolysis is 950 °C.

Use the correct answer from the box to complete the sentence.

**[1 mark]**

| | | |
|---|---|---|
| **cross links** | **a giant ionic lattice** | **strong covalent bonds** |

The graphite does not melt at 950 °C because

graphite has ..... .

14

### 4.2.3.2 Graphite

**Question 09**

June 2016 | CH2FP | Original Q2 | Legacy

**2** This question is about substances containing carbon atoms.

**2 (a)** Diamond is made of carbon atoms.

**2 (a) (i)** Diamond is used for tips of drills.

**Figure 3** shows a drill.

**Figure 3**



Give **one** reason why diamond is used for tips of drills.

**[1 mark]**

_____

_____

**2 (a) (ii)** Diamond nanoparticles can be made.

Use the correct answer from the box to complete the sentence.

**[1 mark]**

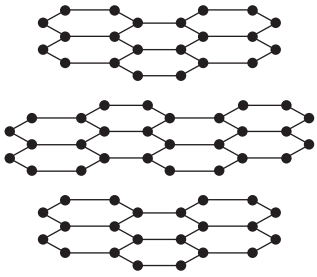
| | | |
|---|---|---|
| **hundred** | **million** | **thousand** |

Nanoparticles contain a few _____ atoms.

**2 (b)** Graphite is made of carbon atoms.

**Figure 4** shows the structure of graphite.

**Figure 4**



### 4.2.3.2 Graphite

**Question 09 · continued**



**2 (b) (i)** What type of bonding does graphite have?

**[1 mark]**

Tick (✓) **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

**2 (b) (ii)** How many carbon atoms does each carbon atom bond to in graphite?

**[1 mark]**

Tick (✓) **one** box.

1 ☐

2 ☐

3 ☐

4 ☐

**2 (b) (iii)** What is a property of graphite?

**[1 mark]**

Tick (✓) **one** box.

Dissolves in water ☐

Has a low melting point ☐

Soft and slippery ☐

**Question 2 continues on the next page**

4.2.3.2 Graphite

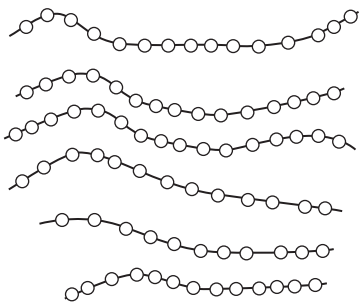


**2 (c)** Poly(ethene) is made of carbon and hydrogen atoms.

Poly(ethene) is a thermosoftening polymer.

**Figure 5** shows the structure of a thermosoftening polymer.

**Figure 5**



**2 (c) (i)** Complete the sentence.

**[1 mark]**

Between the polymer chains in a thermosoftening polymer there

are no _____ .

**2 (c) (ii)** Use the correct answer from the box to complete the sentence.

**[1 mark]**

| | | |
|---|---|---|
| **condense** | **dissolve** | **melt** |

Heating would cause a thermosoftening polymer to _____ .

**2 (c) (iii)** Many ethene molecules react together to make poly(ethene).

Different types of poly(ethene) can be made by changing the conditions for the reaction. Suggest **two** conditions that could be changed.

**[2 marks]**

1 _____

2 _____

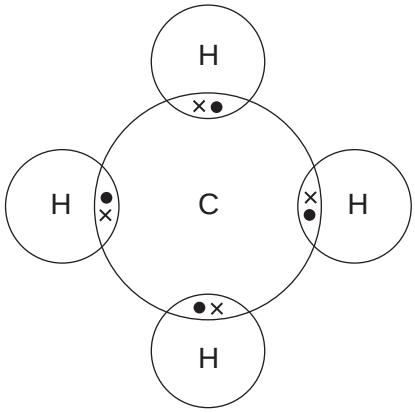
4.2.3.2 Graphite

Question 09 · continued



**2 (d)** **Figure 6** shows how the atoms are bonded in methane.

**Figure 6**




**2 (d) (i)** What is the formula for methane?

**[1 mark]**

Tick (✓) **one** box.

$C_4H$ ☐

$CH_4$ ☐

$C_4H_4$ ☐

**2 (d) (ii)** Methane has a low boiling point.

What does methane consist of?

**[1 mark]**

Tick (✓) **one** box.

Charged ions ☐

A giant lattice ☐

Small molecules ☐

11

4.2.3.2 Graphite

Question 10

June 2017 | CH2FP | Original Q2 | Legacy

**2** This question is about sulfuric acid, copper sulfate and ethene.

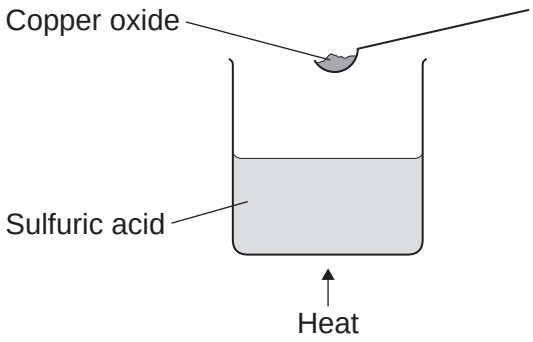
**2 (a)** A student added copper oxide to sulfuric acid to make copper sulfate.

The word equation for the reaction is:

sulfuric acid + copper oxide ⟶ copper sulfate + water

**Figure 4** shows the first stage of the student's method.

**Figure 4**




**2 (a) (i)** The state symbol for CuO is missing from the equation below.

Use the correct answer from the box to complete the equation.

**[1 mark]**

| aq | g | l | s |
|---|---|---|---|

$H_2SO_4$ (aq) + CuO ( ___ ) ⟶ $CuSO_4$ (aq) + $H_2O$ (l)

**2 (a) (ii)** Why is the sulfuric acid heated?

**[1 mark]**

_____

_____

**Question 2 continues on the next page**

4.2.3.2 Graphite

Question 10 · continued



**2 (a) (iii)** Which of these values could be the pH of sulfuric acid?

**[1 mark]**

Tick (✓) **one** box.

1 ☐

7 ☐

11 ☐

14 ☐

**2 (a) (iv)** Why does the student continue to add copper oxide until some is left at the end of the reaction?

**[1 mark]**

Tick (✓) **one** box.

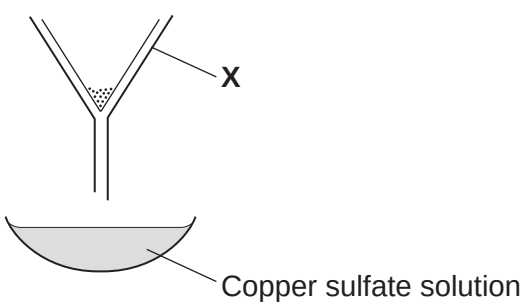
To make bigger copper sulfate crystals. ☐

To make sure all the copper oxide has reacted. ☐

To make sure all the sulfuric acid has reacted. ☐

**2 (b)** **Figure 5** shows the second stage of the student's method.

**Figure 5**



4.2.3.2 Graphite

Question 10 · continued



**2 (b) (i)** Name the apparatus labelled **X** on **Figure 5**.

**[1 mark]**

_____

**2 (b) (ii)** What could the student do to the copper sulfate solution to get copper sulfate crystals?

**[1 mark]**

_____

_____

**2 (c)** The student weighed the copper sulfate crystals.

Why was the mass of the copper sulfate crystals less than the student expected?

**[1 mark]**

Tick (✓) **one** box.

The student added too much copper oxide. ☐

The student left some copper sulfate crystals in the apparatus. ☐

The student weighed the copper sulfate crystals when they were wet. ☐

**2 (d)** The equation shows the reaction when blue hydrated copper sulfate crystals are heated.

hydrated copper sulfate $\rightleftharpoons$ anhydrous copper sulfate + water

**2 (d) (i)** What colour is anhydrous copper sulfate?

**[1 mark]**

_____

**2 (d) (ii)** What would you see if water is added to anhydrous copper sulfate?

**[1 mark]**

_____

4.2.3.2 Graphite

Question 10 · continued



**2 (e)** Ethene and sulfuric acid are used to make many substances.

**Table 1** shows data about wealth of countries, ethene production and sulfuric acid production.

**Table 1**

| Country | Wealth of country in billions of dollars | Ethene production in kilotonnes | Sulfuric acid production in kilotonnes |
|---|---|---|---|
| **A** | 4000 | 13 900 | 36 000 |
| **B** | 1300 | 4 400 | 6 600 |
| **C** | 1290 | 2 700 | 26 000 |
| **D** | 460 | 1 500 | 2 500 |

**2 (e) (i)** Use the correct answer from the box to complete the sentence.

**[1 mark]**

| alloys | chlorine | graphite | polymers |
|---|---|---|---|

Ethene is used to make _____ .

**2 (e) (ii)** Describe the relationship, if any, between the wealth of a country and the production of ethene.

**[1 mark]**

_____

_____

**2 (e) (iii)** Describe the relationship, if any, between the wealth of a country and the production of sulfuric acid.

**[1 mark]**

_____

_____

12

### 4.2.3.2 Graphite

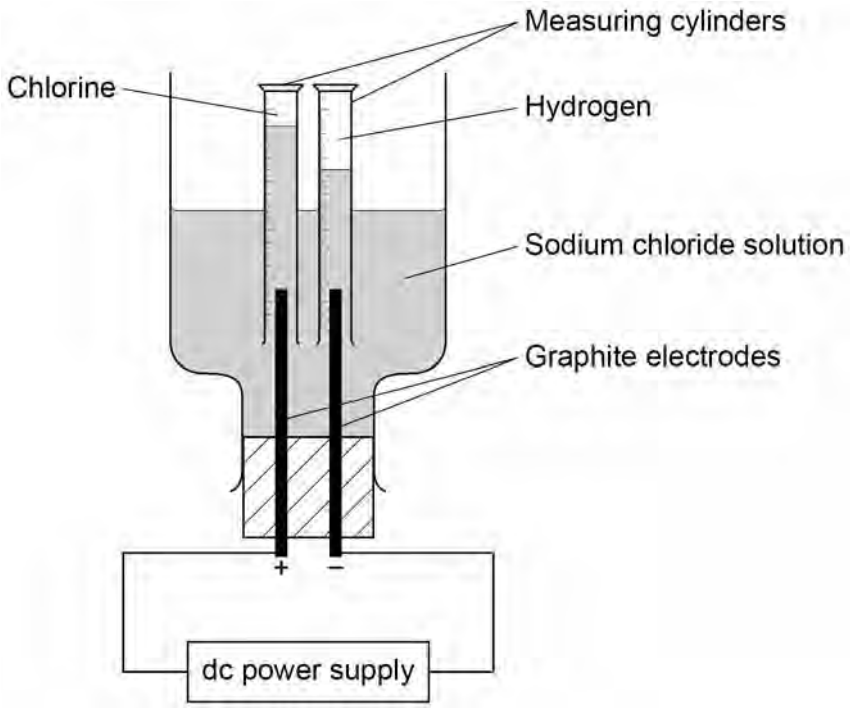
**Question 11**

June 2018 | 8462/1F | Original Q4

**0 4** A student investigated the electrolysis of sodium chloride solution.

**Figure 4** shows the apparatus.

**Figure 4**




The student measured the volume of gas collected in each measuring cylinder every minute for 20 minutes.

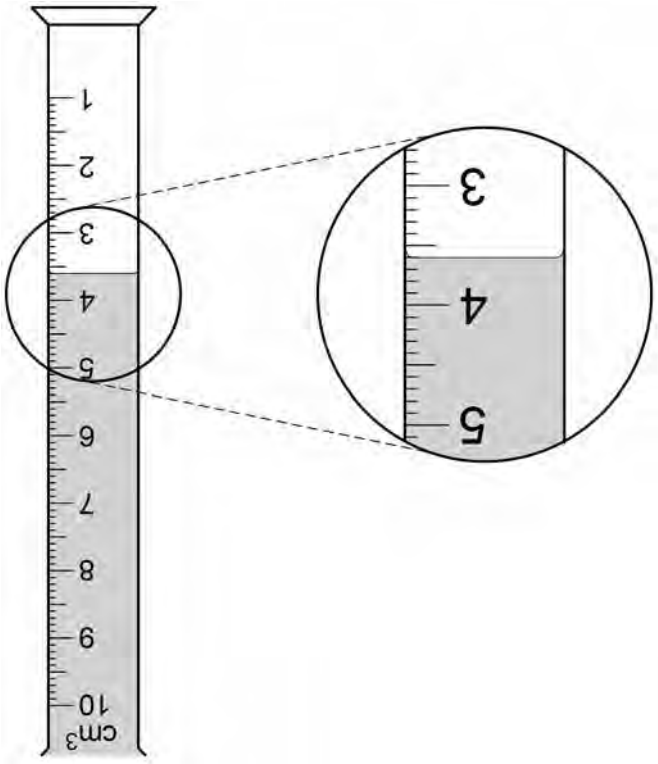
4.2.3.2 Graphite

Question 11 · continued



**0 4 . 1** **Figure 5** shows the volume of hydrogen gas collected in the measuring cylinder after 8 minutes.

**Figure 5**




What is the volume of hydrogen gas collected?

**[1 mark]**

Volume = _____ $cm^3$

**Question 4 continues on the next page**

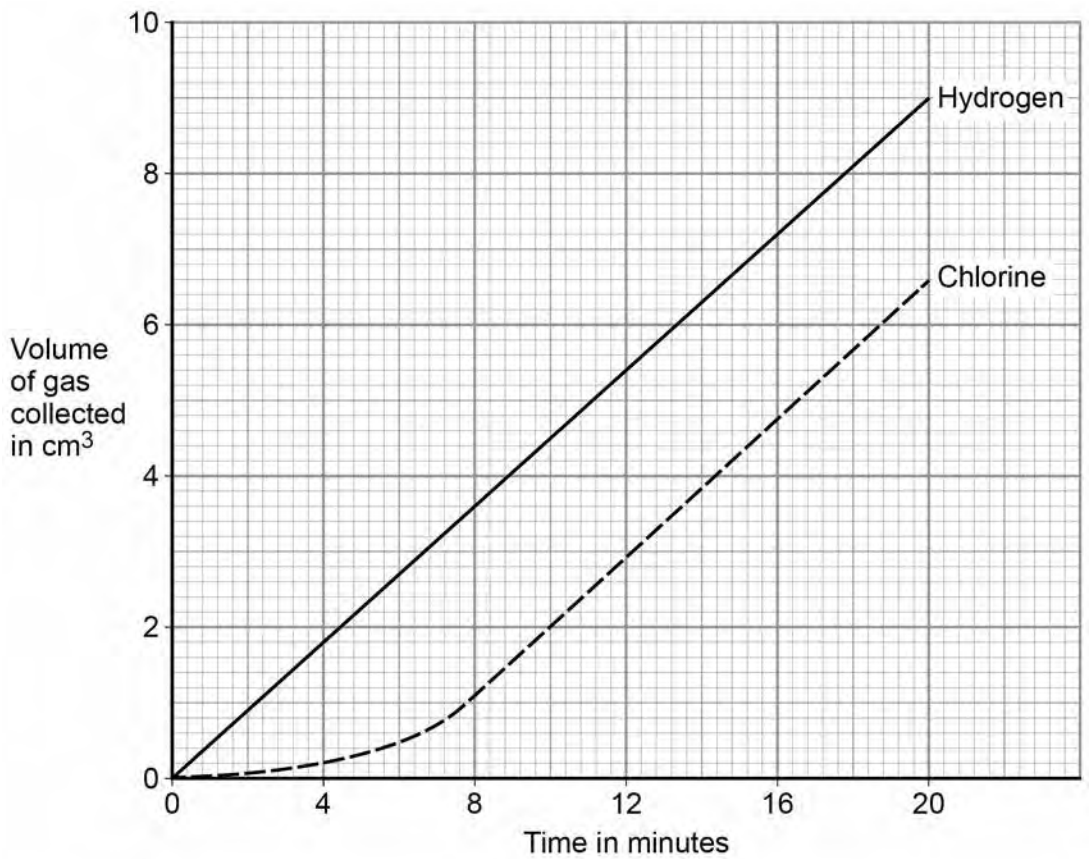
4.2.3.2 Graphite

Question 11 · continued



**Figure 6** shows the results of the investigation.

**Figure 6**




**0 4 . 2** Which of the lines on **Figure 6** show that the volume of gas collected is directly proportional to the time?

**[1 mark]**

Tick **one** box.

- Both lines ☐
- Chlorine line only ☐
- Hydrogen line only ☐
- Neither line ☐

4.2.3.2 Graphite

Question 11 · continued



**0 4 . 3** Which of the lines on **Figure 6** show a positive correlation between the volume of gas collected and time?

**[1 mark]**

Tick **one** box.

- Both lines ☐
- Chlorine line only ☐
- Hydrogen line only ☐
- Neither line ☐

**Question 4 continues on the next page**

4.2.3.2 Graphite

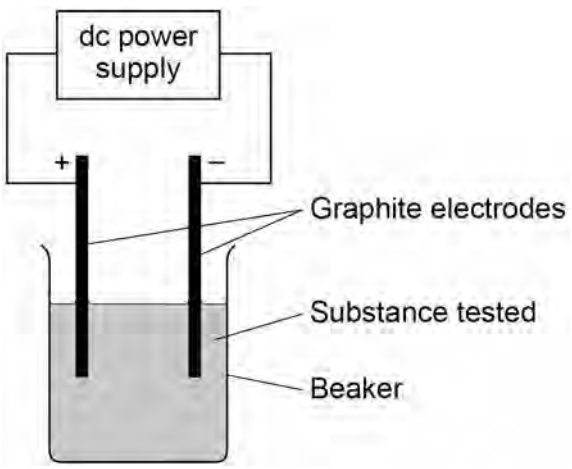
Question 11 · continued



A teacher demonstrates the electrolysis of different substances using graphite electrodes.

**Figure 7** shows the apparatus used.

**Figure 7**




**0 4 . 4** Why can graphite conduct electricity?

**[1 mark]**

Tick **one** box.

Graphite exists in layers of atoms. ☐

Graphite has a giant structure. ☐

Graphite has a high melting point. ☐

Graphite has delocalised electrons. ☐

4.2.3.2 Graphite

Question 11 · continued



**0 4 . 5** The teacher demonstrates the electrolysis of:

- molten zinc chloride
- potassium bromide solution.

Complete **Table 3** to predict the products.

Choose answers from the box.

**[4 marks]**

| | | | | | |
|---|---|---|---|---|---|
| **chlorine** | **bromine** | **hydrogen** | **oxygen** | **potassium** | **zinc** |

**Table 3**

| Substance electrolysed | Product at cathode (negative electrode) | Product at anode (positive electrode) |
|---|---|---|
| Molten zinc chloride | | |
| Potassium bromide solution | | |

4.2.3.2 Graphite

Question 12

November 2020 | 8462/1F | Original Q4

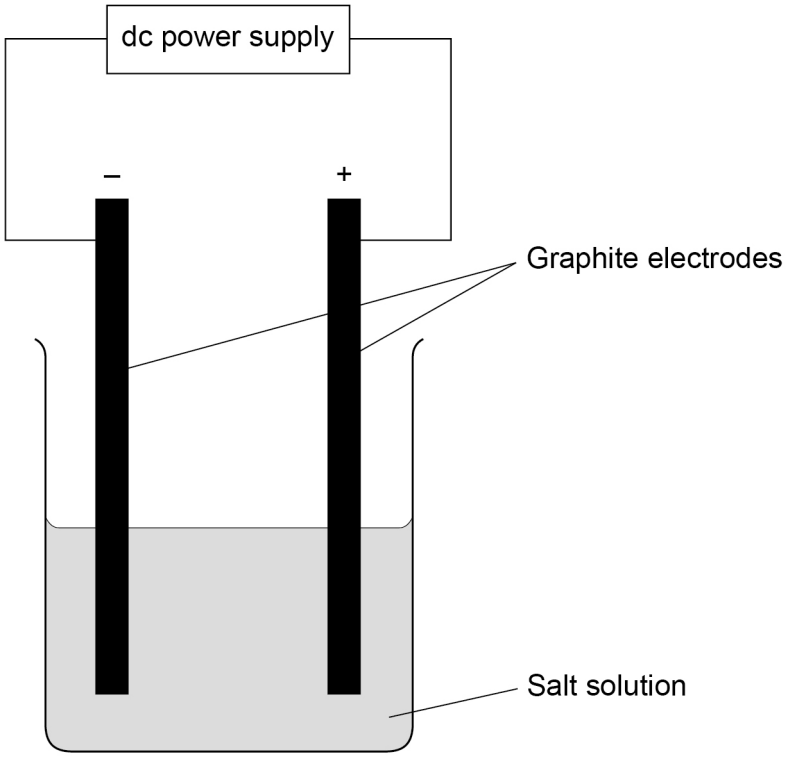
**0 4** This question is about electrolysis.

A student investigated the hypothesis:

'The electrolysis of a salt solution produces a metal at the negative electrode and a gas at the positive electrode.'

**Figure 4** shows the apparatus used.

**Figure 4**




**0 4 . 1** What observation would be made at each electrode if the hypothesis is correct?

**[2 marks]**

Observation if metal produced at the negative electrode _____

_____

Observation if gas produced at the positive electrode _____

_____

4.2.3.2 Graphite

Question 12 · continued



**Table 3** shows the student's results.

**Table 3**

| Salt solution | Product at the negative electrode | Product at the positive electrode |
|---|---|---|
| Copper chloride | Copper | Chlorine |
| Potassium nitrate | Hydrogen | Oxygen |
| Silver nitrate | Silver | Oxygen |

**0 4 . 2** Which salt solution in **Table 3** does **not** match the student's hypothesis?

Give **one** reason why.

**[2 marks]**

Salt solution _____

Reason _____

_____

**0 4 . 3** Give **two** reasons why graphite is used for the electrodes.

**[2 marks]**

1 _____

_____

2 _____

_____

4.2.3.2 Graphite

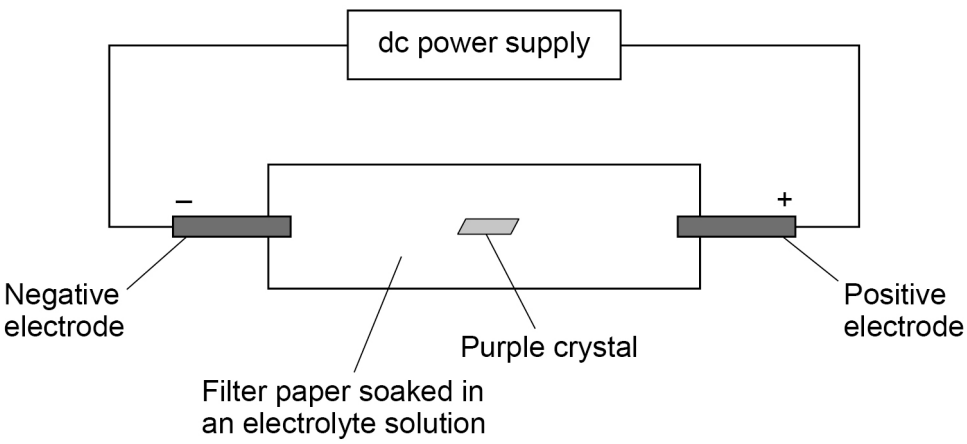
Question 12 · continued



A different student investigated what happens during electrolysis.

**Figure 5** shows the apparatus.

**Figure 5**




The purple crystal contained:

- colourless positive ions
- purple coloured negative ions.

The purple crystal dissolved in the electrolyte solution.

**0 4 . 4** What happens to the purple coloured ions?

Give **one** reason for your answer.

**[2 marks]**

Tick (✓) **one** box.

The ions do not move. ☐

The ions move towards the negative electrode. ☐

The ions move towards the positive electrode. ☐

Reason _____

_____

8

4.2.3.2 Graphite

Question 13

November 2021 | 8462/1F | Original Q8

**0 8** 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 8 . 1** What shape is a Buckminsterfullerene molecule?

**[1 mark]**

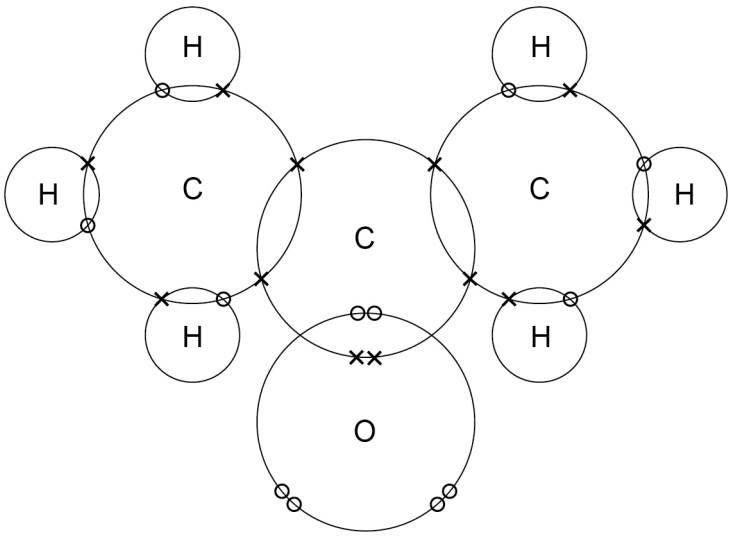
**0 8 . 2** Give **one** use of a fullerene.

**[1 mark]**

Propanone is a compound of carbon, hydrogen and oxygen.

**Figure 13** shows the dot and cross diagram for a propanone molecule.

**Figure 13**



4.2.3.2 Graphite

Question 13 · continued



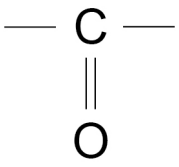
**0 8 . 3** Complete **Figure 14** to show a propanone molecule.

Use a line to represent each single bond.

Use **Figure 13**.

**[1 mark]**

**Figure 14**




**0 8 . 4** Determine the molecular formula of propanone.

Use **Figure 13**.

**[1 mark]**

Molecular formula = _____

**0 8 . 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. ☐

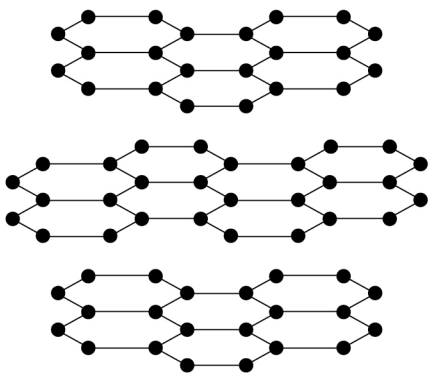
4.2.3.2 Graphite

Question 13 · continued



**0 8 . 6** **Figure 15** represents the structure of graphite.

**Figure 15**



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

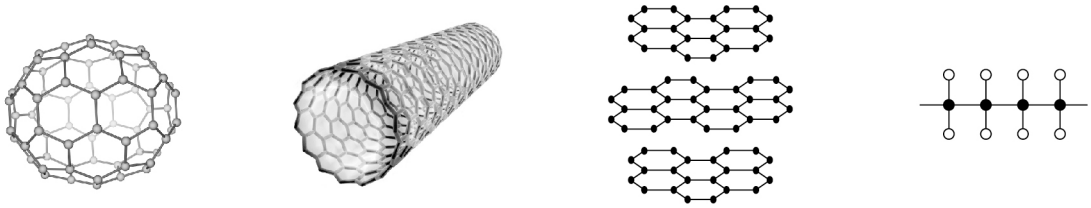
Question 14

June 2022 | 8462/1F | Original Q6

**0 6** This question is about carbon and compounds of carbon.

**Figure 9** shows diagrams that represent different structures.

**Figure 9**



**A** **B** **C** **D**

Use **Figure 9** to answer questions **06.1** and **06.2**.

**0 6 . 1** Which diagram represents graphite?

**[1 mark]**

Tick (✓) **one** box.

**A** ☐ **B** ☐ **C** ☐ **D** ☐

**0 6 . 2** Which diagram represents poly(ethene)?

**[1 mark]**

Tick (✓) **one** box.

**A** ☐ **B** ☐ **C** ☐ **D** ☐

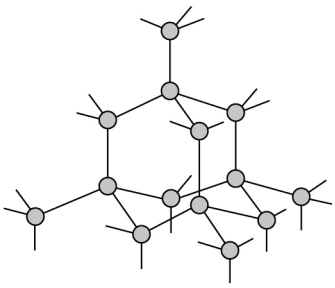
4.2.3.2 Graphite

Question 14 · continued

June 2022 | 8462/1F | Original Q6

**Figure 10** represents the structure of diamond.

**Figure 10**



**Key**
Carbon atom

**0 6 . 3** How many covalent bonds does each carbon atom form in diamond?

**[1 mark]**

**0 6 . 4** Which is a property of diamond?

**[1 mark]**

Tick (✓) **one** box.

- Conducts electricity ☐
- Low melting point ☐
- Very hard ☐

**Question 6 continues on the next page**

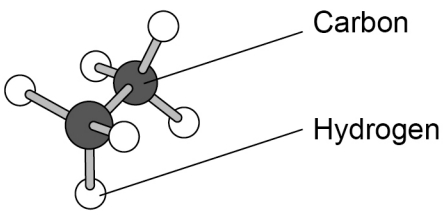
4.2.3.2 Graphite

Question 14 · continued



**0 6 . 5** **Figure 11** shows a model of a molecule.

**Figure 11**




Complete the molecular formula of the molecule.

**[1 mark]**

Molecular formula = C__ H__

Carbonic acid is a compound of carbon.

The formula of carbonic acid is $H_2CO_3$

**0 6 . 6** Which ion is produced by carbonic acid in aqueous solution?

**[1 mark]**

Tick (✓) **one** box.

$H^+$ ☐ $OH^-$ ☐ $O^{2-}$ ☐

**0 6 . 7** Calculate the relative formula mass ($M_r$) of carbonic acid ($H_2CO_3$).

Relative atomic masses ($A_r$): H = 1 C = 12 O = 16

**[2 marks]**

Relative formula mass ($M_r$) = _____

8

### 4.2.3.2 Graphite

**Question 15**

June 2023 | 8462/1F | Original Q3

**0 3** This question is about carbon.

**0 3 . 1** Which type of substance is carbon?

**[1 mark]**

Tick (✓) **one** box.

Compound ☐

Element ☐

Mixture ☐

**0 3 . 2** Carbon has isotopes with mass numbers 12, 13 and 14.

Complete the sentences.

Choose answers from the box.

**[2 marks]**

| | | | | |
|---|---|---|---|---|
| **electrons** | **ions** | **molecules** | **neutrons** | **protons** |

The isotopes of carbon have the same number of _____.

The isotopes of carbon have a different number of _____.

4.2.3.2 Graphite

Question 15 · continued



**0 3 . 3** 12 g of carbon contains $6.02 \times 10^{23}$ atoms.

Which expression is used to calculate the mass of one atom of carbon?

**[1 mark]**

Tick (✓) **one** box.

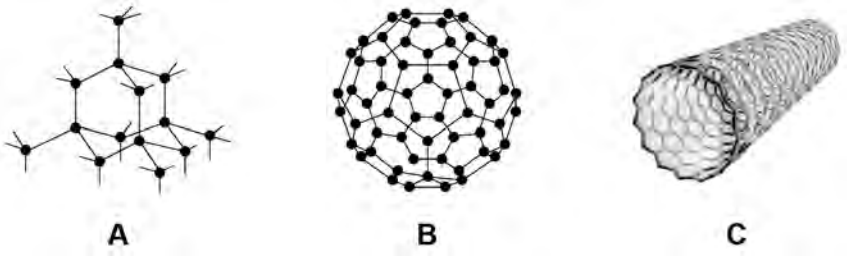
$\frac{12}{6.02 \times 10^{23}}$ ☐

$\frac{6.02 \times 10^{23}}{12}$ ☐

$12 \times 6.02 \times 10^{23}$ ☐

**0 3 . 4** **Figure 2** shows diagrams that represent different forms of carbon.

**Figure 2**




Which diagram in **Figure 2** represents Buckminsterfullerene?

**[1 mark]**

Tick (✓) **one** box.

**A** ☐ **B** ☐ **C** ☐

**Question 3 continues on the next page**

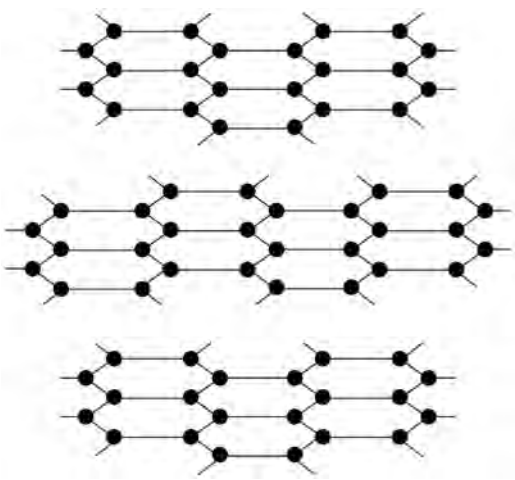
4.2.3.2 Graphite

Question 15 · continued



**0 3 . 5** **Figure 3** represents part of the structure of graphite.

**Figure 3**



Draw **one** line from each property of graphite to the structural feature that is the reason for that property.

**[2 marks]**

| Property | Structural feature |
|---|---|
| | Graphite has hexagonal rings of carbon atoms. |
| Graphite conducts electricity. | The bonds between carbon atoms in the layers are strong. |
| Graphite is soft. | There are no covalent bonds between layers of atoms. |
| | There are delocalised electrons in graphite. |

7

### 4.2.3.2 Graphite

**Question 16**

June 2024 | 8462/1F | Original Q5

**0 5** This question is about carbon and carbon compounds.

An atom of carbon is represented as:

(Mass number) 13
(Atomic number) 6 C

**0 5 . 1** What is the number of protons in this atom of carbon?

Tick (✓) **one** box.

**[1 mark]**

1 ☐ 6 ☐ 7 ☐ 13 ☐

**0 5 . 2** What is the number of neutrons in this atom of carbon?

Tick (✓) **one** box.

**[1 mark]**

1 ☐ 6 ☐ 7 ☐ 13 ☐

**0 5 . 3** What is the number of electrons in this atom of carbon?

Tick (✓) **one** box.

**[1 mark]**

1 ☐ 6 ☐ 7 ☐ 13 ☐

**Question 5 continues on the next page**

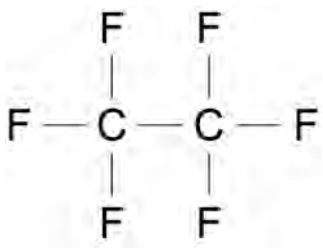
4.2.3.2 Graphite

Question 16 · continued



**0 5 . 4** **Figure 10** shows the structure of a carbon compound.

**Figure 10**




Complete the formula of the carbon compound.

**[1 mark]**

C__ F__

**0 5 . 5** Methane:

- is a carbon compound
- exists as small molecules
- has a low boiling point.

What is the reason for the low boiling point of methane?

**[1 mark]**

Tick (✓) **one** box.

Covalent bonds **and** intermolecular forces are weak. ☐

Only covalent bonds are weak. ☐

Only intermolecular forces are weak. ☐

4.2.3.2 Graphite

Question 16 · continued



**0 5 . 6** Buckminsterfullerene ($C_{60}$) is a form of carbon.

Buckminsterfullerene was the first fullerene to be discovered.

What is the shape of a buckminsterfullerene molecule?

**[1 mark]**

Tick (✓) **one** box.

Cubic ☐

Cylindrical ☐

Spherical ☐

**Question 5 continues on the next page**

4.2.3.2 Graphite

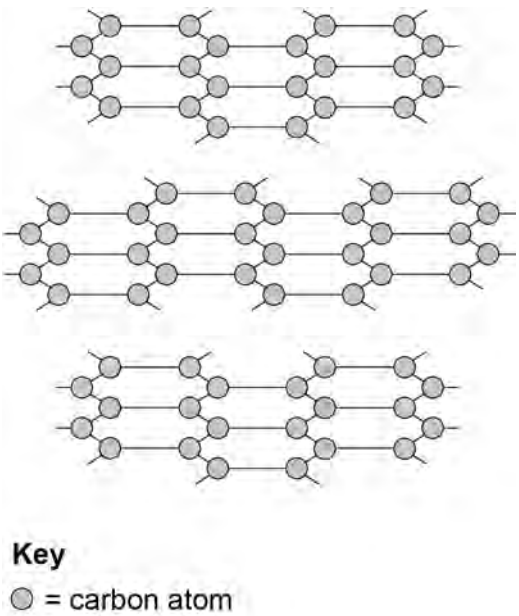
Question 16 · continued



**0 5 . 7** Graphite is a form of carbon.

**Figure 11** represents the structure of graphite.

**Figure 11**




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

**[1 mark]**

Tick (✓) **one** box.

1 ☐

2 ☐

3 ☐

4 ☐

4.2.3.2 Graphite

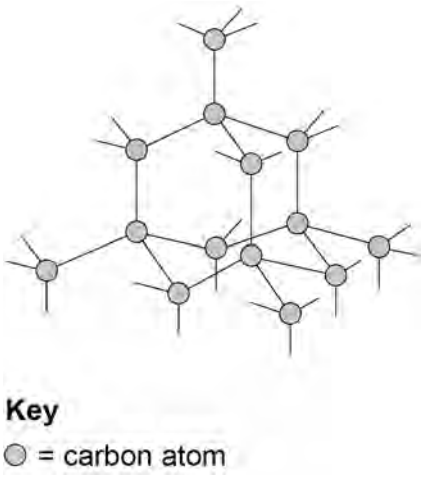
Question 16 · continued



**0 5 . 8** Diamond is another form of carbon.

**Figure 12** represents the structure of diamond.

**Figure 12**




Describe the structure and bonding in diamond.

**[3 marks]**

10

4.2.3.2 Graphite

Question 17

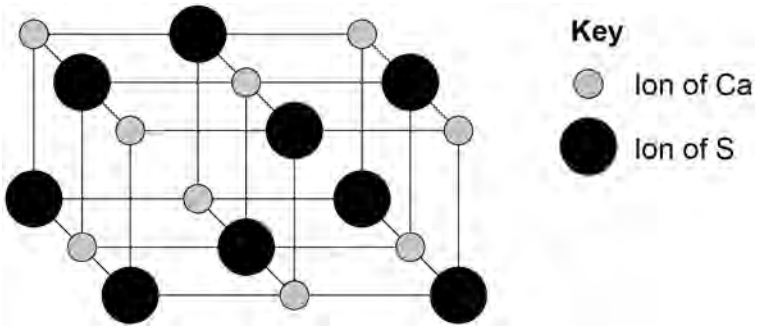
June 2025 | 8462/1F | Original Q9

**0 9** This question is about structure and bonding.

Calcium sulfide is an ionic compound.

**Figure 13** represents the structure of calcium sulfide.

**Figure 13**




**0 9 . 1** Determine the empirical formula of calcium sulfide.

**[1 mark]**

Empirical formula _____

**Question 9 continues on the next page**

4.2.3.2 Graphite

Question 17 · continued



**0 9 . 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]**

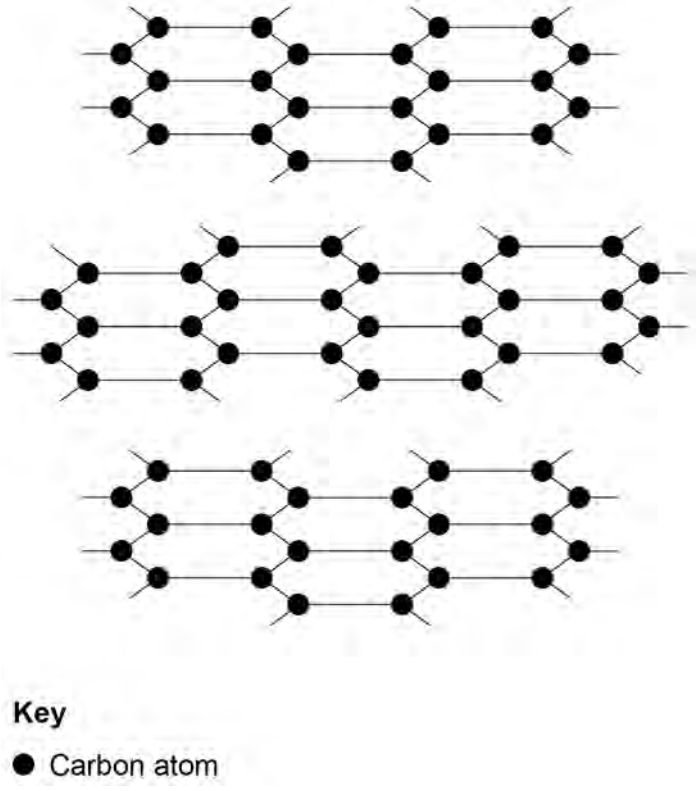
4.2.3.2 Graphite

Question 17 · continued



**Figure 14** shows the structure of graphite.

**Figure 14**




**0 9 . 3** Describe the structure and bonding of graphite.

**[4 marks]**

Extra space

4.2.3.2 Graphite

Question 17 · continued



**0 9 . 4** Substances that consist of small molecules do **not** conduct electricity.

Give **one** reason why.

**[1 mark]**

**0 9 . 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. ☐

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