AQA GCSE Chemistry

Bonding, structure, and the properties of matter · Higher tier

Questions only

The newest questions on the Higher papers, about an hour. All 8 are in the exam generator.

Questions	Total marks	Time allowed
5	**56**	**59 min**

Name _____ Class or teacher _____ Date _____

Instructions

- Answer all questions in the spaces provided.
- Use black ink. Show your working for every calculation.
- You may use a scientific calculator and the periodic table insert.
- Print the separate mark scheme when you are ready to mark your answers.

For marking

Q	Source	Marks	Score
1	2022 P1H Q1 / P1F Q9	13	
2	2022 P1H Q3	11	
3	2023 P1H Q4	12	
4	2023 P1H Q6	9	
5	2025 P1H Q2 / P1F Q9	11	

Total _____ / 56 **Percentage** _____ %

Questions from AQA GCSE past papers, 2022–2025, reproduced for revision. Practise these topics online, with instant marking:
`whiteboardchemistry.com/revision/gcse-chemistry/exam-questions?topics=c2-bonding-structure&demand=standard,high&len=0`

Questions

Bonding, structure, and the properties of matter · Higher tier · 5 questions · 56 marks · time allowed 59 min

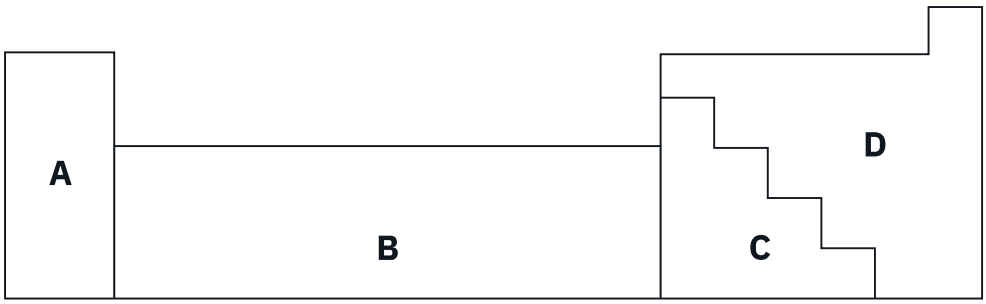
Q1 · June 2022 · Paper 1 Foundation · Q9 · Paper 1 Higher · Q1 · [13 marks]

This question also needs Atomic structure and the periodic table.

This question is about metals and non-metals.

Figure 15 shows an outline of part of the periodic table.

Figure 15



09.1 Element Q is a dull solid with a melting point of 44 °C.

Element Q does not conduct electricity.

Which section of the periodic table in Figure 15 is most likely to contain element Q?

Tick (✓) **one** box.

A	☐
B	☐
C	☐
D	☐

[1 mark]

09.2 Element R forms ions of formula R^{2+} and R^{3+}

Which section of the periodic table in Figure 15 is most likely to contain element R?

Tick (✓) **one** box.

A	☐
B	☐
C	☐
D	☐

[1 mark]

09.3 Give **two** differences between the physical properties of the elements in Group 1 and those of the transition elements.

[2 marks]

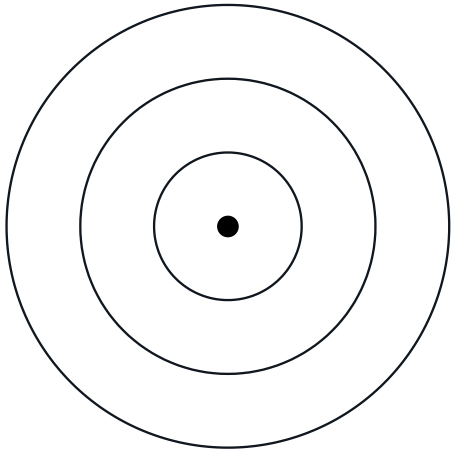
1

2

09.4 Complete Figure 16 to show the electronic structure of an aluminium atom.

Use the periodic table.

Figure 16



[1 mark]

Draw your answer on the figure above.

09.5 Aluminium is a metal.

Describe how metals conduct electricity.

Answer in terms of electrons.

[3 marks]

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

[1 mark]

09.7 Magnesium oxide is a compound formed from the metal magnesium and the non-metal oxygen.

Describe what happens when a magnesium atom reacts with an oxygen atom.

You should refer to electrons in your answer.

[4 marks]

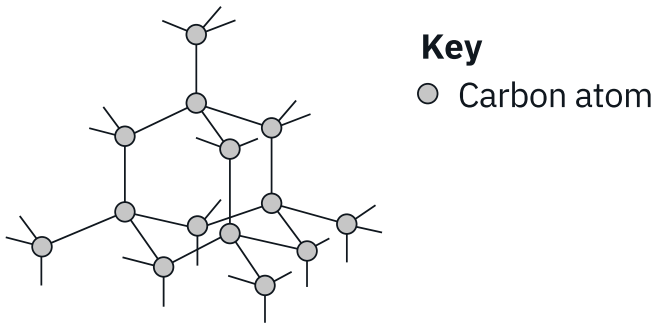
Q2 · June 2022 · Paper 1 Higher · Q3 · [11 marks]

This question also needs Quantitative chemistry.

This question is about different forms of carbon.

Figure 5 represents the structure of diamond.

Figure 5



03.1 Describe the structure and bonding of diamond.

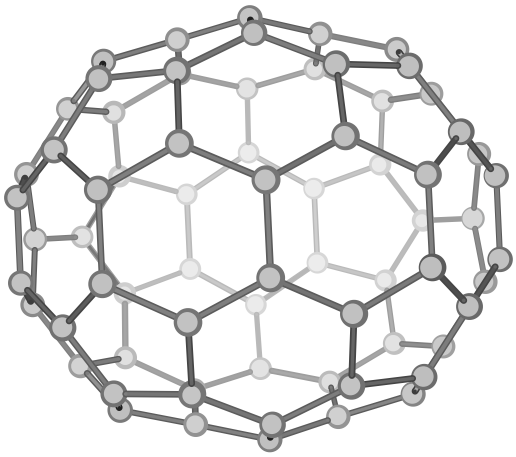
[3 marks]

03.2 Explain why diamond has a very high melting point.

[3 marks]

03.3 Figure 6 represents the molecule C_{70}

Figure 6



What is the name of this type of molecule?

Tick (✓) **one** box.

Fullerene	☐
Graphene	☐
Nanotube	☐
Polymer	☐

[1 mark]

03.4 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]

03.5 Calculate the number of C_{70} molecules that can be made from one mole of carbon atoms.

The Avogadro constant = 6.02×10^{23} per mole

Number of molecules = _____

[3 marks]

Q3 · June 2023 · Paper 1 Higher · Q4 · [12 marks]

This question also needs Energy changes.

This question is about hydrogen and compounds of hydrogen.

Figure 3 shows the displayed formulae for the reaction between hydrogen and chlorine.

Figure 3

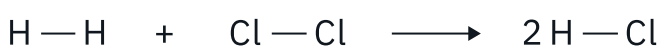


Table 4 shows the bond energies.

Table 4

Bond	H–H	Cl–Cl	H–Cl
Bond energy in kJ/mol	436	346	432

04.1 Which expression shows how to calculate the overall energy change for the reaction in Figure 3?

Use Table 4.

Tick (✓) **one** box.

436 + 346 + 432 kJ/mol	☐
436 + 346 + (2 × 432) kJ/mol	☐
436 + 346 – 432 kJ/mol	☐
436 + 346 – (2 × 432) kJ/mol	☐

[1 mark]

04.2 The reaction between hydrogen and chlorine is exothermic.

Explain why this reaction releases energy to the surroundings.

[2 marks]

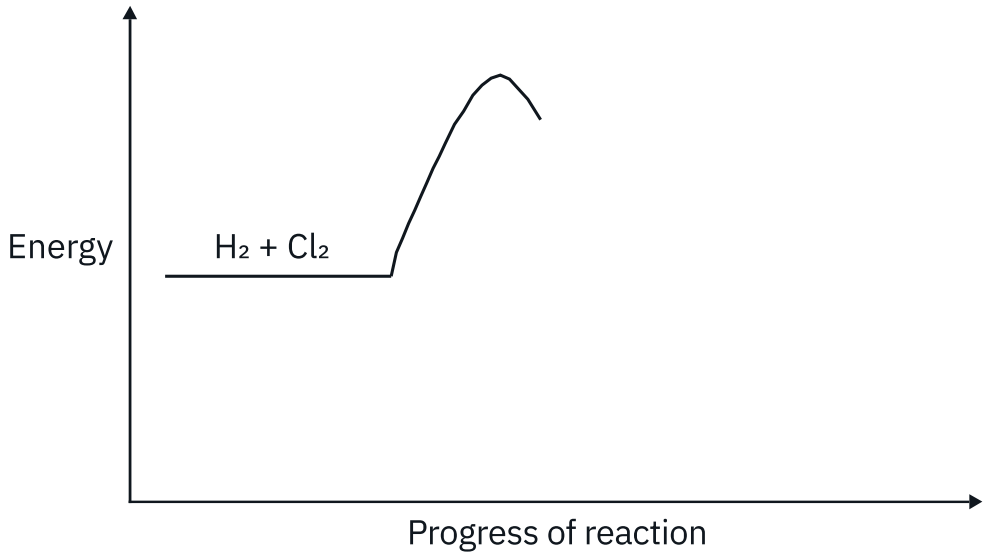
04.3 Figure 4 shows part of a reaction profile for the reaction between hydrogen and chlorine.

Complete the reaction profile in Figure 4.

You should:

- label the activation energy
- label the overall energy change.

Figure 4



[3 marks]

Draw your answer on the figure above.

04.4 Draw a dot and cross diagram for a molecule of hydrogen chloride (HCl).

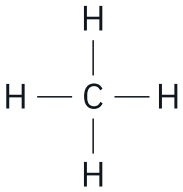
Show the outer shell electrons only.

[2 marks]

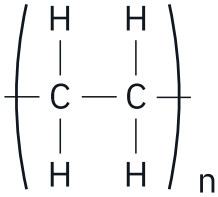
04.5 Figure 5 represents molecules of methane and of poly(ethene).

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]

Q4 · June 2023 · Paper 1 Higher · Q6 · [9 marks]

This question also needs Chemical changes.

This question is about uses of metals in electrical wires.

Electrical wires can be made from:

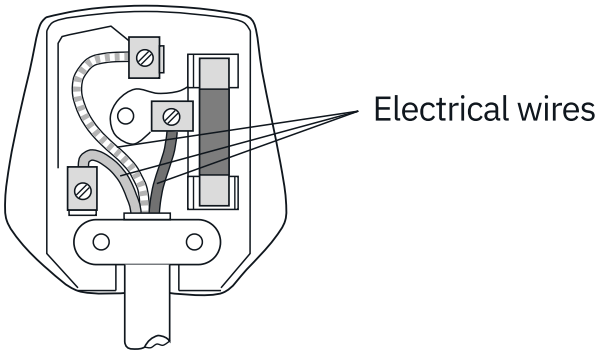
- aluminium
- copper
- silver.

Figure 6 shows three uses of electrical wires.

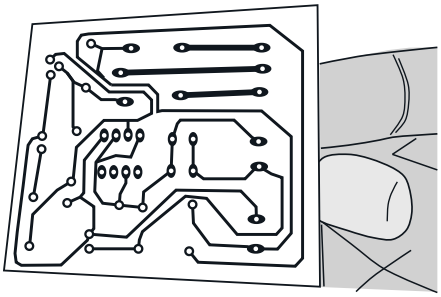
Figure 6



Overhead power cables



Wiring in homes



Printed circuit boards

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

06.1 Evaluate the use of aluminium, copper and silver for the types of electrical wires shown in

Figure 6.

Use Table 5.

[4 marks]

06.2 Describe how metals conduct electricity.

[3 marks]

06.3 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]

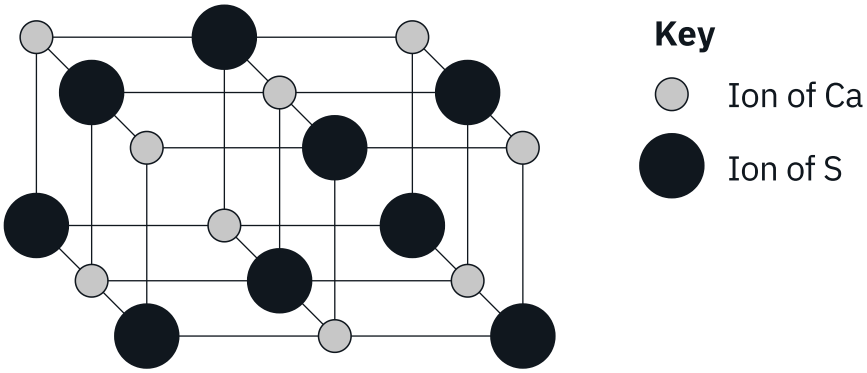
Q5 · June 2025 · Paper 1 Foundation · Q9 · Paper 1 Higher · Q2 · [11 marks]

This question is about structure and bonding.

Calcium sulfide is an ionic compound.

Figure 13 represents the structure of calcium sulfide.

Figure 13



09.1 Determine the empirical formula of calcium sulfide.

Empirical formula

[1 mark]

09.2 Calcium is in Group 2 of the periodic table.

Sulfur is in Group 6 of the periodic table.

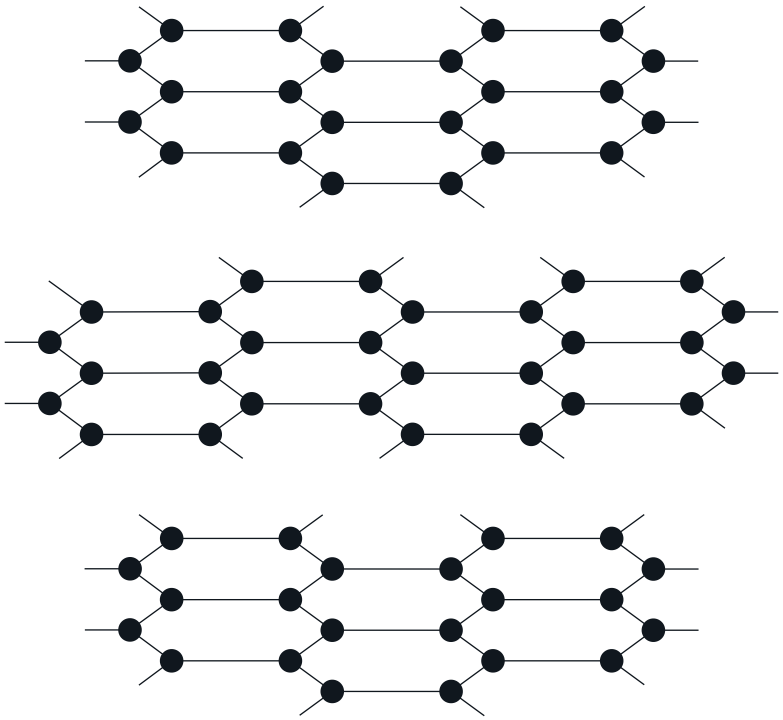
Describe what happens when a calcium atom reacts with a sulfur atom.

Answer in terms of electrons and ions.

[4 marks]

09.3 Figure 14 shows the structure of graphite.

Figure 14



Key

● Carbon atom

Describe the structure and bonding of graphite.

[4 marks]

09.4 Substances that consist of small molecules do **not** conduct electricity.

Give **one** reason why.

[1 mark]

09.5 Methane consists of small molecules.

Poly(ethene) is a polymer.

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

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.	☐

[1 mark]

Source: AQA GCSE Chemistry past papers. Reproduced for revision at whiteboardchemistry.com.

Mark scheme:
whiteboardchemistry.com/revision/gcse-chemistry/exam-questions/pdf/c2-bonding-structure-higher-mark-scheme.pdf