AQA GCSE Chemistry

Bonding, structure, and the properties of matter mark scheme · goes with “Bonding, structure, and the properties of matter · Higher tier” · whiteboardchemistry.com/revision/gcse-chemistry/exam-questions

Mark schemes

Bonding, structure, and the properties of matter · Higher tier · 5 questions

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

09.1

D

[1 mark]

09.2

B

[1 mark]

09.3

allow converse statements for transition elements

any **two** from:

(Group 1 elements)

- have lower melting / boiling points
- have lower densities
- are less strong
- are softer

allow (Group 1 elements are) more malleable / ductile

allow (Group 1 elements) are not useful as catalysts

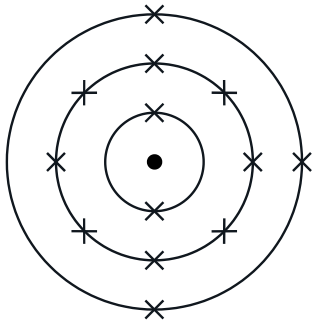
ignore transition elements form coloured compounds

ignore transition elements form ions with different charges

ignore references to chemical properties

[2 marks]

09.4



allow any combination of x, •, o, $e^{(-)}$ for electrons

[1 mark]

09.5

delocalised electrons

allow free electrons

(the electrons) carry (electrical) charge

ignore current / electricity for charge

(the electrons move) through the metal / aluminium / structure

ignore throughout for through

[3 marks]

09.6

ionic

[1 mark]

09.7

magnesium (atom) loses electrons

oxygen (atom) gains electrons

two electrons (are transferred)

magnesium ions **and** oxide ions are formed

*allow Mg^{2+} (ions) **and** O^{2-} (ions) are formed*

allow magnesium forms positive ions and oxygen forms negative ions

allow (both) form a complete outer shell

[4 marks]

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

03.1

giant structure

allow macromolecular

allow (giant) lattice

covalent (bonds)

four bonds per carbon / atom

[3 marks]

03.2

(covalent) bonds are strong

(and many covalent) bonds must be broken

(so) a lot of energy is required

[3 marks]

03.3

fullerene

[1 mark]

03.4

ignore references to ease of movement around the body

any **one** from:

- (C_{70} is) hollow

  allow (C_{70}) acts as a cage

  allow (C_{70}) traps the drug

- (C_{70} is) unreactive
- (C_{70} is) not toxic
- (C_{70} has) a large surface area to volume ratio

[1 mark]

03.5

(moles of C_{70} molecules = (1)/(70) =) $0.0\dot{1}42857\dot{}$

(molecules =)

$0.0\dot{1}42857\dot{} \times 6.02 \times 10^{23}$

allow correct use of an incorrect attempt at the calculation of the number of moles of C_{70} molecules

$= 8.6 \times 10^{21}$

[3 marks]

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

04.1

436 + 346 – (2 × 432) kJ/mol

[1 mark]

04.2

energy is needed to break bonds

and

energy is released when bonds form

(and) the energy released is greater than the energy needed

allow the energy transferred in bond making is greater than the energy transferred in bond breaking

allow 2 x 432 (kJ/mol) is greater than 436 + 346 (kJ/mol)

allow the overall energy change is negative

[2 marks]

04.3

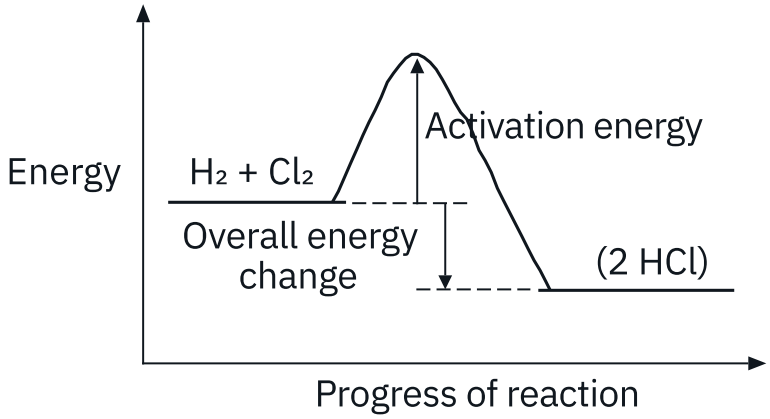
ignore arrow heads

profile completed with product energy below reactant energy

activation energy labelled from reactant energy to top of curve

overall energy change labelled from reactant energy to product energy

an answer of



scores **3** marks

[3 marks]

04.4

allow any combination of x, o, $e^{(-)}$, • for electrons

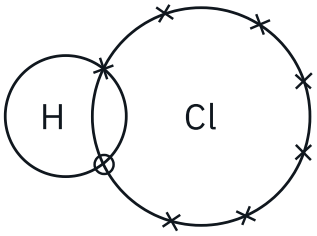
do not accept molecules containing more than 2 atoms

bonded pair of electrons in the overlap

chlorine with 6 non-bonded electrons

do not accept if extra electrons on H

an answer of



scores 2 marks

or

an answer of



scores 2 marks

[2 marks]

04.5

(methane)

methane has (much) smaller molecules

(so) has weaker intermolecular forces

do not accept reference to weak(er) covalent bonds

(so the intermolecular forces) need less energy to overcome

do not accept reference to breaking covalent bonds

(so) the boiling / melting point is lower (and methane is a gas)

OR

(poly(ethene))

poly(ethene) has (much) larger molecules (1)

(so) has stronger intermolecular forces (1)

do not accept reference to weak(er) covalent bonds

(so the intermolecular forces) need more energy to break (1)

do not accept reference to breaking covalent bonds

(so) the melting / boiling point is higher (and poly(ethene) is a solid) (1)

[4 marks]

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

06.1

Level 3 (3–4 marks): A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

Level 1 (1–2 marks): Relevant points are made. They are not logically linked.

No relevant content (0 marks)

Indicative content

relevant points

- silver is the best electrical conductor
- aluminium is the least dense
- aluminium is the least expensive
- copper is a better conductor than aluminium **or** copper is almost as good a conductor as silver
- copper is much less expensive than silver

- overhead power cables need a low density metal
- wiring in homes needs to be affordable
- printed circuit boards only require small amounts of material

judgements

- use aluminium for overhead wires because of aluminium's low density and/or lower cost
- use copper for domestic wiring because copper is a very good conductor and not too expensive
- use silver only for small uses such as circuit boards due to high cost
- copper is a good compromise between electrical conductivity and cost

[4 marks]

06.2

(metals have) delocalised electrons

the electrons carry (electrical) charge

ignore current / electricity for charge

the electrons move through the structure / metal

ignore throughout for through

[3 marks]

06.3

in alloys different sized atoms distort the layers / structure

(so) the movement of (delocalised) electrons is restricted

[2 marks]

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

09.1

CaS

[1 mark]

09.2

calcium (atom) loses electrons

sulfur (atom) gains electrons

reference to transfer of two electrons

calcium forms positive ions **and** sulfur forms negative ions

*allow Ca^{2+} (ions) **and** S^{2-} (ions) are formed*

*allow calcium ions **and** sulfide ions are formed*

[4 marks]

09.3

Level 2 (3–4 marks): Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

Level 1 (1–2 marks): Facts, events or processes are identified and simply stated but their relevance is not clear.

No relevant content (0 marks)

Indicative content

- giant structure
- layers
- of hexagonal rings
- each (carbon) atom forms three bonds
- has no covalent bonds between layers
- with delocalised electrons
- one delocalised electron from each carbon atom
- the bonds are covalent
- with shared (pairs of) electrons
- the (covalent) bonds are strong

[4 marks]

09.4

the molecules do not have an (overall electric) charge

allow there are no ions

allow there are no delocalised electrons

[1 mark]

09.5

poly(ethene) has stronger intermolecular forces to overcome than methane

[1 mark]

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