OCR A-Level Chemistry A

Electrons, bonding and structure mark scheme · goes with “Electrons, bonding and structure” · whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/

Mark schemes

Electrons, bonding and structure · 8 questions

Q1 · June 2024 · AS Paper 1 (Breadth in chemistry) · Q1 · [1 mark]

Answer: **C**

Q2 · June 2024 · AS Paper 1 (Breadth in chemistry) · Q5 · [1 mark]

Answer: **B**

$C + O_2 \rightarrow$

Q3 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q10 · [1 mark]

Answer: **A**

H_2S

Q4 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q2 · [1 mark]

Answer: **C**

OCR MARK SCHEME

11

EXAMINER GUIDANCE

ALLOW 11

Q5 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q8 · [1 mark]

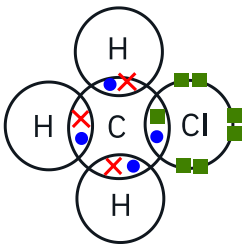
Answer: **B**

BCl_3

Q6 · June 2025 · AS Paper 2 (Depth in chemistry) · Q5 · [16 marks]

OCR MARK SCHEME

5(a)(i)



✓

Check that lone pairs on Cl are included

EXAMINER GUIDANCE

Circles are **NOT** required

IGNORE *inner shells*

ALLOW *non-bonding electrons unpaired*

Must have three different symbols (one for C, another for H and another for Cl)

e.g.

Cl has 6 non-bonded electrons (3 LPs)

[1 mark]

= C electron
× = H electron
= Cl electron

5(a)(ii)

Tetrahedral ✓

109.5° ✓

ALLOW *109 to 110°*

[2 marks]

5(b)

Bond Angle

120° ✓

Number of bonded regions

CH_3Cl has 4 bonded pairs (of electrons)

AND

$H_2C=CHCl$ has 3 bonded regions ✓

Electron pair repulsion (seen anywhere)

Electron pairs/bonded pairs repel (as far apart as possible) ✓

Electron pairs/bonded pairs essential

DO NOT ALLOW *'bonded atoms' for this mark*

ALLOW *116-124°*

IGNORE *names of shapes (even if wrong)*

ALLOW *bp for bonded/bonding pair (of electrons)*

Bonded/Bonding is essential

ALLOW *for CH_3Cl/chloromethane:*

- 4 bonded areas/environments/regions
- 4 bonded groups/atoms

ALLOW *for $H_2C=CHCl$/chloroethene:*

- 2 bonded pairs and 1 double bond
- 2 bonded pairs and 1 bonded area/environment/region
- 3 bonded groups/atoms

IGNORE *areas of electron density*

ALLOW *alternative phrases/words for 'repel' e.g. 'push apart'*

DO NOT ALLOW *'atoms repel'*

IGNORE

- electrons repel
- bonds repel
- electron region **OR** electron density repel
- lone pairs repel (more) (irrelevant here)

[3 marks]

5(c)

Indicative scientific points may include:

Level 3 (5–6 marks)

Describes ALL purification steps in correct order

AND

Explains MOST purification steps

AND

Calculates correct mass of $CH_3CH_2CHClCH_3$

There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.

Level 2 (3–4 marks)

Describes ALL the purification steps

AND

Explains SOME purification steps.

OR

Describes **AND** explains a purification step

AND

Calculates correct mass of $CH_3CH_2CHClCH_3$

OR

Describes MOST purification steps

AND

Calculates mass of $CH_3CH_2CHClCH_3$ with some errors

There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.

Level 1 (1–2 marks)

Describes MOST purification steps

OR

Describes **AND** explains a purification step.

OR

Calculates a mass of $CH_3CH_2CHClCH_3$ with some errors

OR

Describes a purification step **AND** attempts calculation of mass

There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.

0 marks

No response or no response worthy of credit.

Main purification steps

- Use a separating funnel
- Add anhydrous salt (to organic layer)
- Distillation

Explanations for each purification step

- Separating funnel to separate the organic layer from aqueous layer

AND Organic layer is the top layer

- Dry (the organic layer) with an anhydrous salt

OR Dry with $MgSO_4$ or $CaCl_2$

- Collect fraction at 70°C to separate product from unreacted reactants/side products

IGNORE *washing with carbonate/water*

not in spec.

Calculation of mass of $CH_3CH_2CHClCH_3$

Using moles method:

- $n\,(CH_3CH_2CHOHCH_3) = \frac{9.25}{74}$

= 0.125 (mol)

- moles of $CH_3CH_2CHClCH_3$ for 65% yield

= 0.125 × 0.65 = 0.08125 (mol)

- mass for 65% yield = 0.08125 x 92.5

= 7.52 g (3 sf)

Calculator value: 7.51625 g

Using mass method:

- $n\,(CH_3CH_2CHOHCH_3) = \frac{9.25}{74}$

[6 marks]

= 0.125 (mol)

- mass if 100% yield $CH_3CH_2CHClCH_3$ = 0.125 × 92.5

= 11.5625 g

- mass for 65% yield = 11.5625 x 0.65

= 7.52 g (3 sf)

CHECK for extent of errors by **ECF**

ALLOW *3SF up to calculator value throughout*

TAKE CARE: values shown may be truncated calculator values.

ALLOW *for correct calculation, one small slip e.g using M_r of 73 instead of 74 or a rounding error*

Aspects of the communication statement might typically have been met when:

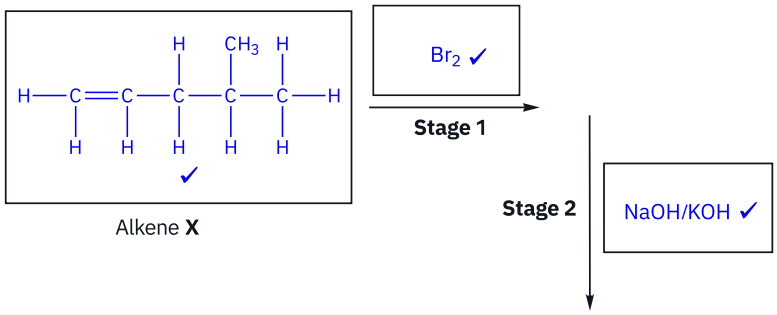
- All information given is correct and relevant using appropriate scientific language
- Purification steps are described in a logical order
- Calculations are set out in a clear and logical way
- No small slips/rounding errors
- Final value for mass given to an appropriate number of significant figures/decimal places.

5(d)(i)

ALLOW *any combination of skeletal* ***OR*** *structural* ***OR*** *displayed formula as long as unambiguous*

CHECK alkene carefully for correct number of Hs or missing CH_3 group.

ALLOW *names for reagents e.g. bromine if formula not given*



[3 marks]

DO NOT ALLOW *other additional reagents*

IGNORE *conditions e.g. reflux, heat*

IGNORE *solvent*

For Stage 2:

ALLOW *$OH^-(aq)$* ***OR*** *any other hydroxide*

ALLOW *H_2O but* ***DO NOT ALLOW*** *steam*

5(d)(ii)

Nucleophilic substitution ✓

[1 mark]

DO NOT ALLOW *hydrolysis*

Q7 · June 2025 · Paper 1 (Periodic table, elements and physical chemistry) · Q16 · [17 marks]

OCR MARK SCHEME

EXAMINER GUIDANCE

16(a)(i)

S higher than P

AND

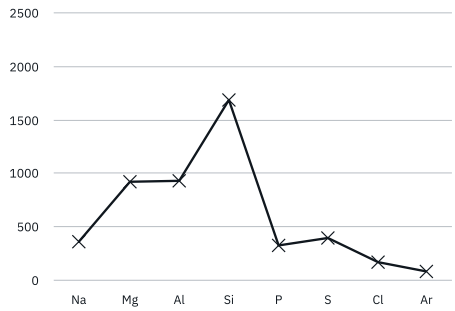
P higher than Cl

AND

Cl higher than Ar ✓

All points / line below the height of Mg ✓

[2 marks]



16(a)(ii)

Al giant (metallic) **AND** Si giant (covalent) ✓

Al metallic **AND** Si covalent ✓

Covalent bonds (in Si) stronger / more energy needed to break covalent bonds (than metallic in Al) ✓

[3 marks]

ALLOW *macromolecular for Si*

ALLOW *correct description of each bonding type*

CON if intermolecular forces are compared in Al

16(b)(i)

$S(g) \rightarrow S^+(g) + e^-$ ✓

[1 mark]

IGNORE *state symbols on the electron*

16(b)(ii)

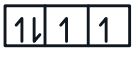
Paired electrons in (p-) orbital / sub shell (in S) ✓

Repulsion (between the paired electrons) ✓

[2 marks]

ALLOW *if seen in a diagram*

i.e.



ALLOW *2 electrons in an (p-) orbital*

DO NOT ALLOW *shell alone*

DO NOT ALLOW *s-orbital*

IGNORE *distance from nucleus*

16(c)

(aqueous bromine + sodium iodide)

(Orange solution) turns brown ✓

(aqueous bromine + sodium chloride)

Stays orange ✓

$Br_2 + 2I^- \rightarrow 2Br^- + I_2$ ✓

[3 marks]

ALLOW *one mark for only final colours*

ALLOW *shade of brown for dilute I_2*

DO NOT ALLOW *purple*

DO NOT ALLOW *incorrect colour for aqueous bromine*

ALLOW *shade of orange for dilute Br_2*

ALLOW *No colour change*

IGNORE *No reaction / No change*

DO NOT ALLOW *turns orange*

ALLOW *multiples, e.g. $\frac{1}{2}Br_2 + I^- \rightarrow Br^- + \frac{1}{2}I_2$*

IGNORE *state symbols*

IGNORE *half-equations, even if wrong*

16(d)

Level 3 (5–6 marks)

For all three molecules:

correct dot and cross diagrams drawn

AND correct shapes

AND correct trend of bond angles

AND an explanation of electron pair repulsion on shape

There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.

Level 2 (3–4 marks)

For two molecules:

correct dot and cross diagrams drawn

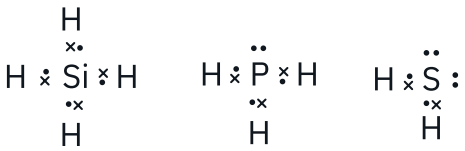
AND correct shapes

AND correct trend of bond angles

AND an explanation of electron pair repulsion on shape

Indicative scientific points may include:

Dot and cross diagrams



Shapes

SiH_4 tetrahedral

PH_3 (trigonal) pyramidal

H_2S v-shaped / bent / angular / non-linear

IGNORE *planar / 'not straight'*

Trend of bond angles

Bond angles in the order (numerical bond angles are not required)

OR

For all three molecules:

One correct and three attempts from:

dot cross diagrams

shapes

trend in bond angles

explanation of electron pair repulsion on the shapes

There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.

Level 1 (1–2 marks)

For one molecule:

correct dot and cross diagram drawn

AND correct shape

AND an explanation of electron pair repulsion on shape or any molecule

OR

For two molecules:

correct dot and cross diagrams

OR correct shapes

OR an explanation of electron pair repulsion on shape

There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.

0 marks

No response or no response worthy of credit.

[6 marks]

$SiH_4 > PH_3 > H_2S$

$SiH_4 = 109.5° > PH_3$ (less than 109.5) > H_2S (less than PH_3) > 90°

Explanation of bond angles

SiH_4 Four bonding pairs (no lone pairs)

PH_3 Three bonding pairs one lone pair

H_2S Two bonding pairs two lone pairs

Electron pairs repel

Lone pairs repel more than bonding pairs

ALLOW *lp for lone pair (of electrons)*

ALLOW *bp for bonding pair (of electrons)*

ALLOW *regions for electron pairs (electron pairs seen in diagram)*

IGNORE *electron density*

IGNORE *'bonds' for 'bonded pair'*

IGNORE *'electrons repel'*

DO NOT ALLOW *'atoms repel'*

Q8 · June 2025 · Paper 1 (Periodic table, elements and physical chemistry) · Q7 · [1 mark]

Answer: **C**

The strength of the induced dipole–dipole interactions (London forces) increases.

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