OCR A-Level Chemistry A

Periodicity mark scheme · goes with “Periodicity” · whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/

Mark schemes

Periodicity · 9 questions

Q1 · June 2022 · AS Paper 1 (Breadth in chemistry) · Q1 · [1 mark]

Answer: **B**

silicon

Q2 · June 2023 · AS Paper 1 (Breadth in chemistry) · Q6 · [1 mark]

Answer: **C**

Al_2O_3

Q3 · June 2023 · Paper 1 (Periodic table, elements and physical chemistry) · Q6 · [1 mark]

Answer: **A**

OCR MARK SCHEME

Li

EXAMINER GUIDANCE

ALLOW Li

Q4 · June 2023 · Paper 3 (Unified chemistry) · Q1 · [9 marks]

OCR MARK SCHEME

ALLOW *upper case when it is obvious, e.g.* ***ALLOW*** *CR for Cr, AS for As*

ALLOW *names for elements*

1(a)

THREE from: N O F H ✓

[1 mark]

EXAMINER GUIDANCE

DO NOT ALLOW *ANY OTHER ELEMENTS (CON)*

1(b)

O ✓

[1 mark]

ALLOW *S*

BOD

1(c)

P **OR** S ✓

[1 mark]

ALLOW *S_8, P_4*

ALLOW *As, Se*

1(d)

Cr ✓

IGNORE *ions*

Mn ✓

[2 marks]

1(e)

Si ✓

[1 mark]

1(f)

S ✓

ALLOW SF_6

[1 mark]

1(g)

F ✓

[1 mark]

1(h)

As ✓

[1 mark]

Q5 · June 2024 · AS Paper 2 (Depth in chemistry) · Q2 · [17 marks]

OCR MARK SCHEME

2(a)(i)

Be: $1s^2 2s^2$ F: $1s^2 2s^2 2p^5$ ✓

Mg: $1s^2 2s^2 2p^6 3s^2$ Cl: $1s^2 2s^2 2p^6 3s^2 3p^5$ ✓

Block: s p ✓

[3 marks]

EXAMINER GUIDANCE

1 mark per correct row

ALLOW upper case letter S and P, and subscripts, e.g. $2S_2 2P_5$

IGNORE *superscripts/numbers given on block (e.g.* s^2 *and* p^5*) if the letter is clear*

2(a)(ii)

Across period 2, the (2)s subshell fills first, followed by the (2)p ✓

same pattern or trend of filling (the subshells) repeated in other periods ✓

[2 marks]

ALLOW Elements in the same group have same number of electrons in their outer shells or subshell

e.g. s^2 in group 2/ s^2p^5 in group 17(7)

ALLOW Elements in the same period have the same number of energy levels/shells

ALLOW for both marks for indication that the pattern repeats across each period e.g

Across each period, elements repeat the pattern of electrons filling the s-subshell then p-subshell ✓✓

2(a)(iii)

Mg loses (2) electrons

AND

Cl gains an electron ✓

To gain a full/complete shell

OR

Noble gas configuration

OR

Stable/full octet ✓

*ALLOW Mg is oxidised **AND** Cl is reduced*

[2 marks]

2(a)(iv)

$2Mg + O_2 \rightarrow 2MgO$ ✓

ALLOW multiples

e.g. $Mg + ½O_2 \rightarrow MgO$

***IGNORE** state symbols even if wrong*

[1 mark]

2(b)(i)

Ca loses 2 electrons **AND** Oxidised ✓

H gains 1 electron (per atom) **AND** Reduced ✓

ALLOW H gains an electron OR gains electrons OR gains 2 electrons

*ALLOW 1 mark for Ca is oxidised **AND** H is reduced*

*ALLOW 1 mark for Ca loses electron(s) **AND** H gains electron(s)*

***IGNORE** oxidation numbers even if incorrect*

[2 marks]

2(b)(ii)

n(HCl) = 0.012 (mol) ✓

n(Ca) required to react with HCl = 0.006 (mol)

OR

0.0100 mol Ca would need 0.02 mol HCl to completely react ✓

Ca reacts with water ✓

Second mark must show recognition of the 2:1 ratio

e.g. ALLOW ratio is 1:2 but here only 1:1.2 so Ca is in excess

[3 marks]

2(c)(i)

B is below Be but above Li (about 800 kJ mol^{-1}) ✓

Mg is above Na but below Be (about 700 kJ mol^{-1}) ✓

***DO NOT ALLOW** if on the line of 900 kJ mol^{-1}. It must be clear that IE for Mg is less than Be as below it*

[2 marks]

in group 2

2(c)(ii)

$B^+(g) \rightarrow B^{2+}(g) + e^-$

Equation correct ✓

Correct state symbols ✓

[2 marks]

ALLOW $B^+(g) - e^- \rightarrow B^{2+}(g)$ for 2 marks

The second mark is dependent upon the first mark except for the following close attempts:

ALLOW one mark for the following for state symbols

$B(g) \rightarrow B^{2+}(g) + 2e^-$

$B^+(g) + e^- \rightarrow B^{2+}(g) + 2e^-$

$B(g) \rightarrow B^+(g) + e^-$

ALLOW e for electron (i.e. charge omitted)

***IGNORE** states on the electron*

Q6 · June 2024 · Paper 1 (Periodic table, elements and physical chemistry) · Q15 · [1 mark]

Answer: **C**

Only 2 and 3

Q7 · June 2024 · Paper 1 (Periodic table, elements and physical chemistry) · Q20 · [11 marks]

OCR MARK SCHEME

EXAMINER GUIDANCE

20(a)(i)

killing bacteria ✓

[1 mark]

***ALLOW** killing microorganisms / microbes / sterilises water*

***IGNORE** 'removing' bacteria*

20(a)(ii)

$Cl_2 + 2Br^- \rightarrow Br_2 + 2Cl^-$ ✓

Chlorine is more reactive than bromine

AND iodine is less reactive than bromine

OR

chlorine is a stronger oxidising agent than bromine **AND** iodine is a weaker oxidising agent than bromine. ✓

[2 marks]

***DO NOT ALLOW** full equation*

***IGNORE** state symbols*

CARE with endings (e.g. ide and ine)

***ALLOW** ORA*

***ALLOW** reactivity Cl > Br > I*

***ALLOW** bromide is a stronger reducing agent than chloride **AND** bromide is a weaker reducing agent than iodide*

***IGNORE** displacement*

***IGNORE** references to down the group.*

IGNORE *all comparisons of electron structure/electron affinity*

20(b)

Equation for Step 1

$F_2 + NO_2 \rightarrow F + NO_2F$ ✓

Rate Equation

Rate = $k\,[F_2][NO_2]$ ✓

Mark independently

ALLOW *rate = k* $[NO_2][F_2]$

Care – *k* must be included.

[2 marks]

20(c)

Level 3 (5–6 marks)

Describe the types of structure and bonding of all four elements **AND** explains most of the differences in melting points in terms of the relative strengths of the forces between the particles.

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)

Attempt to describe the types of bonding of three elements **AND** explains most of the differences in melting points in terms of the relative strengths of the forces between the particles.

OR

Describe in detail and bonding of two of the three types of structure **AND** explains most of the differences in melting points in terms of the relative strengths of the forces between the particles.

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)

Attempt to describe the bonding of two elements **AND** explains most of the differences in melting points in terms of the relative strengths of the forces between the particles.

OR

Describes in detail the bonding of one of the three types of structure **AND** explains the melting point in terms of the strength of the forces between the particles.

Indicative scientific points may include:

ALLOW *minor omissions as we are looking for a holistic approach to LoR marking.*

Al (Giant metallic)

- Giant metallic structure/lattice
- Strong metallic bonding
- Electrostatic attraction between (positive) metal ions/cations and delocalised electrons
- A lot of energy needed to break bonds

Si (Giant covalent)

- Each Si atom forms 4 bonds / bonds with 4 other Si atoms
- Giant covalent structure/lattice
- Strong covalent bonds between atoms
- Between shared pair of electrons and adjacent nuclei.
- Most energy needed to break bonds

P, S (Simple covalent)

- Simple covalent / molecular structure/lattice
- Strong covalent bonds between atoms

The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.

0 marks

No response or no response worthy of credit.

[6 marks]

- Weak induced dipole–dipole interactions between molecules*
- Least energy to overcome the forces
- Melting point of S_8 > P_4
- More electrons
- Stronger induced dipole–dipole interactions
- **DO NOT ALLOW** breaks BONDS
- **IGNORE** van der Waals' (VDW)

***ALLOW** London (dispersion) forces for induced dipole–dipole interactions.

Aspects of the communication statement might typically not have been met when irrelevant information (e.g. ionisation energies, ionic radius etc) have been included.

Q8 · June 2024 · Paper 2 (Synthesis and analytical techniques) · Q1 · [1 mark]

Answer: **A**

A shared pair of electrons and the nuclei of the bonded atoms

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Q9 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q9 · [1 mark]

Answer: **C**

$Mg^{+}(g) \rightarrow Mg^{2+}(g) + e^{-}$

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