

OCR A-Level Chemistry A

Periodicity

Questions only

The newest questions, about an hour. All 11 are in the exam generator.

Questions

10

Total marks

44

Time allowed

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 OCR Data Sheet.
- Print the separate mark scheme when you are ready to mark your answers.

For marking

Q	Source	Marks	Score
1	2018 P1 Q5	1	
2	2019 P1 Q7	1	
3	2022 P1 Q18	9	
4	2023 P1 Q6	1	
5	2023 P3 Q1	9	
6	2024 P1 Q15	1	
7	2024 P1 Q20	11	
8	2024 P2 Q1	1	
9	2020 P1 Q21	9	
10	2021 P1 Q7	1	

Total _____ / 44 Percentage _____ %

Questions from OCR past papers, 2018–2024, reproduced for revision. Practise these topics online, with instant marking:
whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/?topics=periodicity&len=0

Questions

Periodicity · 10 questions · 44 marks · time allowed 59 min

Q1 · June 2018 · Paper 1 (Periodic table, elements and physical chemistry) · Q5 · [1 mark]

Which statement best explains why nitrogen has a larger first ionisation energy than oxygen?

Tick (✓) one box.

- ☐ **A** N atoms have less repulsion between p-orbital electrons than O atoms.
- ☐ **B** N atoms have a smaller nuclear charge than O atoms.
- ☐ **C** N atoms lose an electron from the 2s subshell, while O atoms lose an electron from the 2p subshell.
- ☐ **D** N atoms have an odd number of electrons, while O atoms have an even number.
-

Q2 · June 2019 · Paper 1 (Periodic table, elements and physical chemistry) · Q7 · [1 mark]

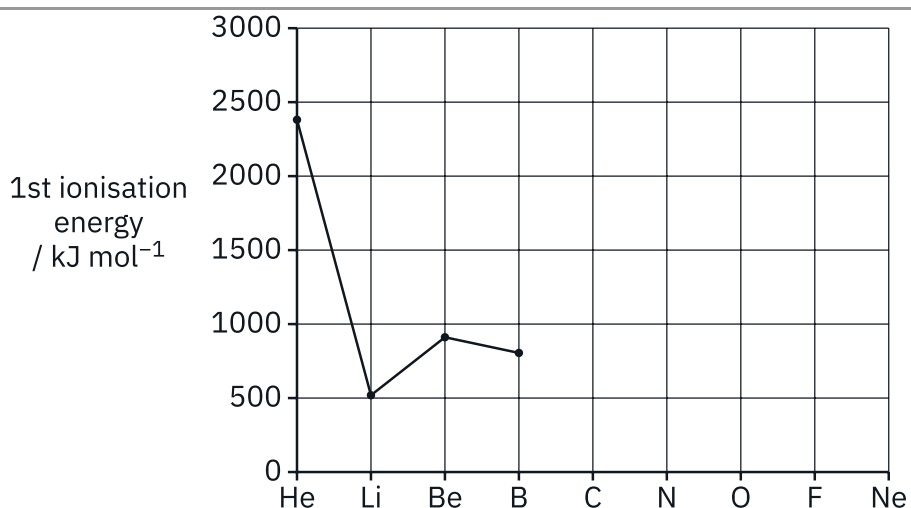
Which set of elements in the solid state contain a simple molecular lattice, a giant covalent lattice and a giant metallic lattice?

Tick (✓) one box.

- ☐ **A** S, Si, Al
- ☐ **B** P, Si, C
- ☐ **C** S, P, Si
- ☐ **D** Mg, P, S
-

Q3 · June 2022 · Paper 1 (Periodic table, elements and physical chemistry) · Q18 · [9 marks]

The graph shows the first ionisation energies for elements from helium, He, to boron, B, in the periodic table.



18(a) Complete the graph for C, N, O, F and Ne.

[2 marks]

18(b) Estimate the energy required to form **one** $\text{Li}^+(\text{g})$ ion from one $\text{Li}(\text{g})$ atom.

Give your answer in kJ, in standard form, and to **two** significant figures.

energy = kJ

[1 mark]

18(c) Explain why the first ionisation energies of He and Be are both higher than the first ionisation energy of Li.

Explanation for He:

Explanation for Be:

[4 marks]

18(d) Explain why the first ionisation energy of Be is higher than the first ionisation energy of B.

[2 marks]

Q4 · June 2023 · Paper 1 (Periodic table, elements and physical chemistry) · Q6 · [1 mark]

Which element has the largest third ionisation energy?

Tick (✓) one box.

- ☐ **A** Li
- ☐ **B** F
- ☐ **C** Ne
- ☐ **D** Na

Q5 · June 2023 · Paper 3 (Unified chemistry) · Q1 · [9 marks]

This question is about the first 36 elements in the periodic table:

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr

From these 36 elements **only**, write the symbol for the element(s) that fit each description.

1(a) The **three** elements that, when in a molecule, can form hydrogen bonds with other suitable molecules.

[1 mark]

1(b) The element in Period 2 with the successive ionisation energies shown below.

Ionisation number	1st	2nd	3rd	4th	5th	6th	7th	8th
Ionisation energy / kJ mol^{-1}	1000	2251	3361	4564	7012	8496	27 107	31 671

[1 mark]

1(c) An element that is a solid at RTP with a simple molecular lattice structure.

[1 mark]

1(d) The **two** elements with atoms containing five unpaired electrons.

[2 marks]

1(e) The element in Period 3 that exists in the solid state as a network of atoms bonded by strong covalent bonds.

[1 mark]

1(f) The p-block element in Period 3 that forms a compound with fluorine with octahedral molecules.

[1 mark]

1(g) The element that forms $1-$ ions most readily.

[1 mark]

1(h) The element with an average atomic mass of 1.244×10^{-22} g.

[1 mark]

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

Which statement(s) about elements in the periodic table is/are correct?

- 1 The position of an element is determined by its relative atomic mass.
- 2 The elements in a group have similar chemical properties.
- 3 Transition elements are used as catalysts in the manufacture of chemicals.

Tick (✓) one box.

- ☐ **A** 1, 2 and 3
- ☐ **B** Only 1 and 2
- ☐ **C** Only 2 and 3
- ☐ **D** Only 1

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

This question also needs Group 2 and the halogens and Rate equations.

This question is about elements in the periodic table.

Chlorine has many uses.

20(a)(i) Chlorine is used to treat water in large-scale water treatment plants.

Suggest why chlorine is added to water in large-scale water treatment plants.

[1 mark]

20(a)(ii) Sea water contains aqueous bromide ions.

Chlorine is used to extract bromine from sea water.

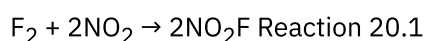
Construct the ionic equation for this reaction and explain why chlorine is suitable for this extraction of bromine but iodine is **not**.

[2 marks]

Equation

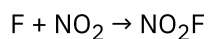
Explanation

20(b) Fluorine, F_2 , reacts with nitrogen dioxide, NO_2 , to form nitryl fluoride, NO_2F , as shown in Reaction 20.1 below.



The mechanism for this reaction involves two steps. Step 1 is the 'slow' step and Step 2 is the 'fast' step.

The equation for Step 2 is shown below:



Suggest the equation for Step 1 and the rate equation for Reaction 20.1.

Equation for Step 1:

Rate equation for Reaction 20.1:

[2 marks]

20(c) The table shows the melting points of some of the elements in Period 3 of the periodic table.

Element	Al	Si	P ₄	S ₈
Melting point / °C	660	1410	44	119

Explain the melting points in terms of bonding and structure.

[6 marks]

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

All organic compounds have covalent bonds.

What is the electrostatic attraction in a covalent bond between?

Tick (✓) one box.

- ☐ **A** A shared pair of electrons and the nuclei of the bonded atoms
- ☐ **B** Cations and delocalised electrons
- ☐ **C** Oppositely charged ions
- ☐ **D** Two molecules

Q9 · November 2020 · Paper 1 (Periodic table, elements and physical chemistry) · Q21 · [9 marks]

This question also needs Amount of substance, Group 2 and the halogens and Lattice enthalpy, entropy and free energy.

This question is about halogens.

21(a) A student adds a solution of bromine in an organic solvent to two test tubes.

The student adds aqueous sodium chloride to one test tube, and aqueous sodium iodide to the other test tube.

The student shakes the mixtures, allows them to settle, and records the colour of the organic layer in each mixture.

Sodium halide	Colour of organic layer
Sodium chloride	orange
Sodium iodide	violet

Explain how the student's results provide evidence for the trend in reactivity of the halogens down group 17(7) and write an ionic equation for any reaction that takes place.

Use your chemical knowledge to explain the trend in reactivity.

[5 marks]

21(b) Chlorine is used in water treatment.

State one benefit and one risk of using chlorine in water treatment.

[1 mark]

Benefit

Risk

21(c) Compound A contains bromine and fluorine only, and has a boiling point of 41 °C.

1.26 g of compound A is heated to 80 °C.

The volume of gas produced is 0.209 dm³.

Under the conditions used, 1 mol of gas molecules has a volume of 29.0 dm³.

Determine the molecular formula of compound A.

molecular formula =

[3 marks]

Q10 · November 2021 · Paper 1 (Periodic table, elements and physical chemistry) · Q7 · [1 mark]

Which row shows elements in order of increasing first ionisation energy?

Tick (✓) one box.

- ☐ **A** Ca < Si < P < N
- ☐ **B** N < P < Si < Ca
- ☐ **C** Ca < N < P < Si
- ☐ **D** C < Si < P < Ca

Source: OCR A-Level Chemistry A past papers. Reproduced for revision at whiteboardchemistry.com.

Mark scheme:

whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/pdf/periodicity-mark-scheme.pdf