AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.1.2.1

The periodic table

Past-paper questions

Tier	**Higher**
Question groups	**10**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

5.1.2.1 The periodic table

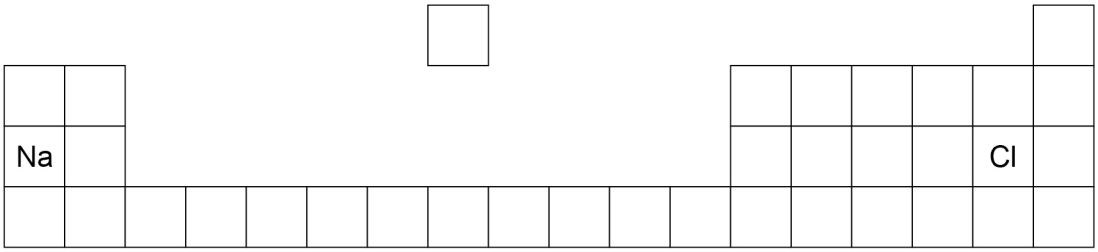
Question 01

June 2018 | 8464/C/1H | Original Q2

0 2 This question is about sodium and chlorine.

Figure 2 shows the positions of sodium and chlorine in the periodic table.

Figure 2



0 2 . 1 State **one** difference and **one** similarity in the electronic structure of sodium and of chlorine.

[2 marks]

Difference _____

_____

Similarity _____

_____

0 2 . 2 Sodium atoms react with chlorine atoms to produce sodium chloride (NaCl).

Describe what happens when a sodium atom reacts with a chlorine atom.

Write about electron transfer in your answer.

[4 marks]

_____

_____

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5.1.2.1 The periodic table

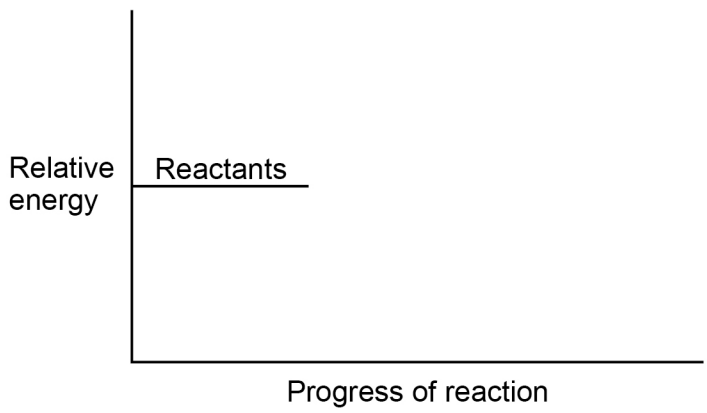
Question 01 · continued

0 2 . 3 The reaction between sodium and chlorine is an exothermic reaction.

Complete the reaction profile for the reaction between sodium and chlorine.

[2 marks]

Figure 3



8

5.1.2.1 The periodic table

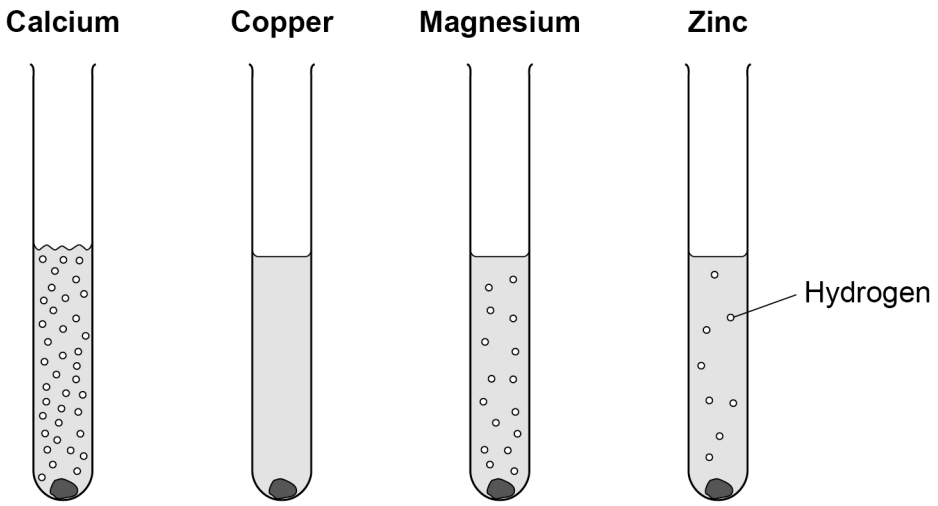
Question 02

June 2019 | 8464/C/1H | Original Q1

0 1 This question is about reactions of metals.

Figure 1 shows what happens when calcium, copper, magnesium and zinc are added to hydrochloric acid.

Figure 1



0 1 . 1 What is the order of decreasing reactivity of these four metals?

[1 mark]

Tick (✓) **one** box.

Zn Ca Cu Mg ☐

Ca Cu Mg Zn ☐

Cu Zn Ca Mg ☐

Ca Mg Zn Cu ☐

5.1.2.1 The periodic table

Question 02 · continued

A student wants to make a fair comparison of the reactivity of the metals with hydrochloric acid.

0 1 . 2 Name **two** variables that must be kept constant.

[2 marks]

1 _____

_____

2 _____

_____

0 1 . 3 What is the independent variable in this reaction?

[1 mark]

_____

_____

0 1 . 4 Predict the reactivity of beryllium compared with magnesium.

Give a reason for your answer.

Use the periodic table.

[2 marks]

_____

Reason _____

_____

_____

0 1 . 5 A solution of hydrochloric acid contains 3.2 g of hydrogen chloride in 50 cm^3

Calculate the concentration of hydrogen chloride in g per dm^3

[3 marks]

_____

_____

_____

_____

Concentration = _____ g per dm^3

9

5.1.2.1 The periodic table

Question 03

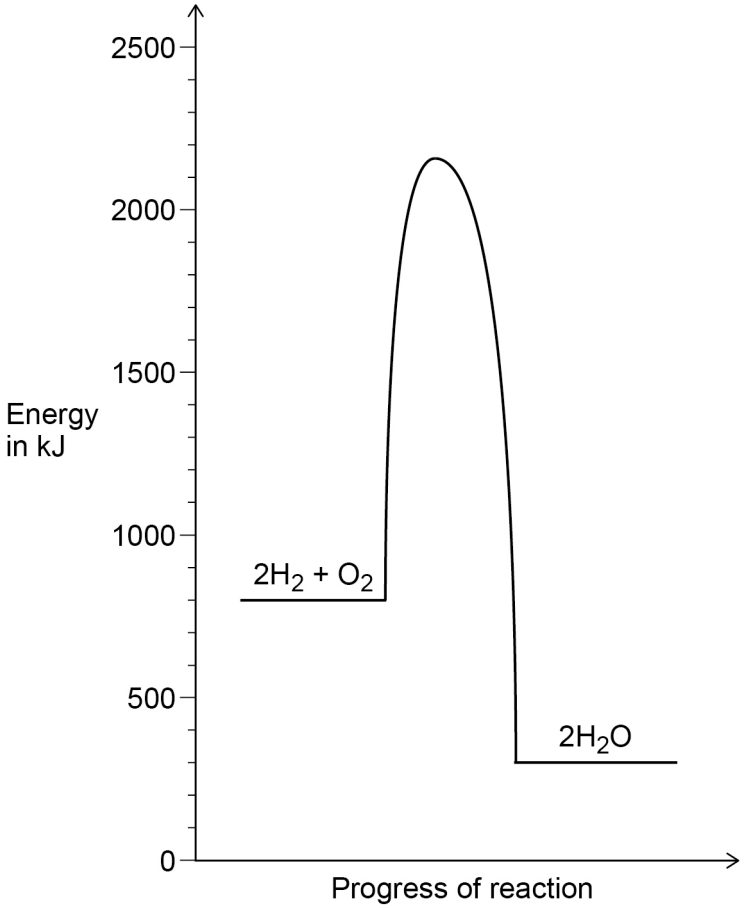
0 3 This question is about oxygen.

0 3 . 1 Hydrogen reacts with oxygen.

$$2\,H_2\,(g) + O_2\,(g) \rightarrow 2\,H_2O\,(g)$$

Figure 2 shows the relative energies of the reactants and products at a certain temperature.

Figure 2



Label the activation energy on **Figure 2**.

[1 mark]

5.1.2.1 The periodic table

Question 03 · continued

0 3 . 2 Determine the overall energy change for the reaction between hydrogen and oxygen shown in Question **03.1**

Use **Figure 2**.

[2 marks]

Energy change = _____ kJ

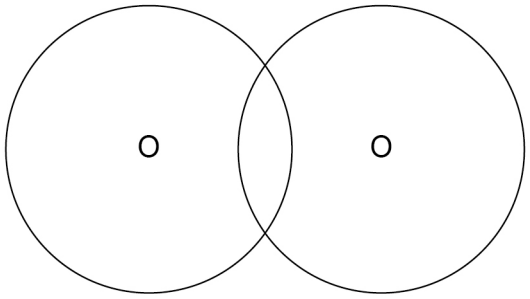
0 3 . 3 Oxygen is in Group 6 of the periodic table.

Figure 3 shows the outer energy levels in one molecule of oxygen (O_2).

Draw the electrons in the outer energy levels in **Figure 3**.

[2 marks]

Figure 3



Question 3 continues on the next page

5.1.2.1 The periodic table

Question 03 · continued

0 3 . 4 The equation shows the decomposition of hydrogen peroxide.

$$2\ H{-}O{-}O{-}H \rightarrow 2\ H{-}O{-}H\ +\ O{=}O$$

Table 1 shows the bond energies.

Table 1

Bond	**O–O**	**O=O**	**O–H**
Bond dissociation energy in kJ per mole	138	496	463

Calculate the overall energy change for the reaction.

[3 marks]

Energy change = _____ kJ

8

5.1.2.1 The periodic table

Question 04

June 2019 | 8464/C/1H | Original Q4

0 4 This question is about elements in the periodic table.

0 4 . 1 What order did scientists use to arrange elements in early periodic tables?

[1 mark]

0 4 . 2 In the early periodic tables some elements were placed in the wrong groups.

Mendeleev overcame this in his periodic table.

Give **one** way Mendeleev did this.

[1 mark]

Question 4 continues on the next page

5.1.2.1 The periodic table

Question 04 · continued

Table 2 shows the boiling points of fluorine, chlorine and bromine.

Table 2

Element	Boiling point in °C
Fluorine	–186
Chlorine	–34
Bromine	+59

0 4 . 3 Explain why the boiling points in **Table 2** are low.

[2 marks]

0 4 . 4 Explain the trend in the boiling points in **Table 2**.

[3 marks]

5.1.2.1 The periodic table

Question 04 · continued

0 4 . 5 Explain why neon is unreactive.

Give the electronic structure of neon in your answer.

[2 marks]

0 4 . 6 How many atoms are there in 1 g of argon?

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

Relative atomic mass (A_r): Ar = 40

[2 marks]

Number of atoms in 1 g = _____

11

5.1.2.1 The periodic table

Question 05

November 2020 | 8464/C/1H | Original Q6

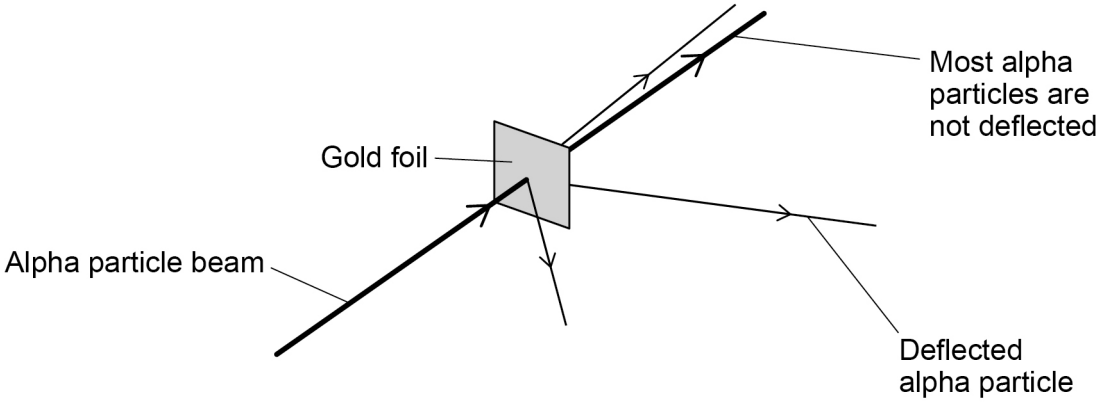
0 6 This question is about gold and compounds of gold.

0 6 . 1 In the alpha particle scattering experiment alpha particles are fired at gold foil.

Alpha particles are positively charged.

Figure 5 shows the results.

Figure 5



What **two** conclusions can be made from the results?

[2 marks]

Tick (✓) **two** boxes.

Atoms are balls of positive charge with embedded electrons. ☐

Atoms are tiny spheres that cannot be divided. ☐

Atoms have a positively charged nucleus. ☐

Mass is concentrated in the nucleus in the centre of atoms. ☐

Neutrons exist within the nucleus. ☐

Question 6 continues on the next page

5.1.2.1 The periodic table

Question 05 · continued

0 6 . 2 The gold foil is:

- 4.00×10^{-7} metres thick
- 2400 atoms thick.

What is the diameter of one gold atom in metres?

Give your answer to 3 significant figures.

[3 marks]

Diameter of one gold atom (3 significant figures) = _____ m

5.1.2.1 The periodic table

Question 05 · continued

0 6 . 3 Gold reacts with the elements in Group 7 of the periodic table.

0.175 g of gold reacts with chlorine.

The equation for the reaction is:

$$2\ Au + 3\ Cl_2 \rightarrow 2\ AuCl_3$$

Calculate the mass of chlorine needed to react with 0.175 g of gold.

Give your answer in mg

Relative atomic masses (A_r): Cl = 35.5 Au = 197

[5 marks]

Mass of chlorine = _____ mg

10

5.1.2.1 The periodic table

Question 06

November 2020 | 8464/C/1H | Original Q7

0 7 This question is about elements.

Caesium is in Group 1 of the periodic table.

0 7 . 1 Explain what happens to caesium atoms and to oxygen atoms when caesium reacts with oxygen to produce caesium oxide.

You should answer in terms of electrons.

[4 marks]

0 7 . 2 Explain why caesium is more reactive than sodium.

You should answer in terms of electrons.

[4 marks]

5.1.2.1 The periodic table

Question 06 · continued

0 7 . 3 **Figure 6** shows part of Mendeleev's periodic table.

Figure 6

16 **O**	19 **F**
32 **S**	35.5 **Cl**
79 **Se**	80 **Br**
128 **Te**	127 **I**

Explain why the early periodic tables placed iodine (I) before tellurium (Te), but then Mendeleev placed tellurium before iodine.

[3 marks]

11

5.1.2.1 The periodic table

Question 07

November 2021 | 8464/C/1H | Original Q1

0 1 This question is about the periodic table.

0 1 . 1 **Figure 1** shows part of Mendeleev's version of the periodic table.

Figure 1

H							
Li	Be	B	C	N	O	F	
Na	Mg	Al	Si	P	S	Cl	
K Cu	Ca Zn		Ti	V As	Cr Se	Mn Br	Fe Co Ni
Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	I	Ru Rh Pd

Which group of elements had **not** been discovered when Mendeleev's version of the periodic table was published?

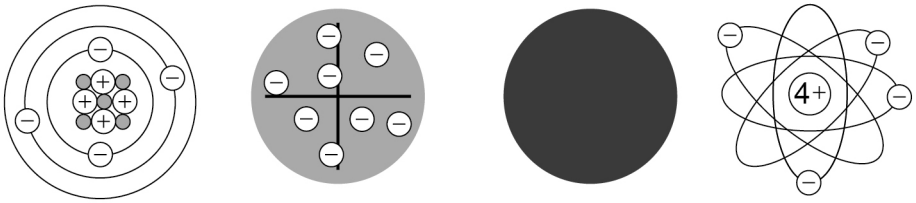
[1 mark]

5.1.2.1 The periodic table

Question 07 · continued

Figure 2 represents different models of the atom.

Figure 2



A **B** **C** **D**

0 1 . 2 Which model represents the plum pudding model?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 3 Which model resulted from Chadwick's experimental work?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Question 1 continues on the next page

5.1.2.1 The periodic table

Question 07 · continued

Potassium has different isotopes.

0 1 . 4 What is meant by 'isotopes'?

You should refer to subatomic particles.

[2 marks]

0 1 . 5 **Table 1** shows the mass numbers and the percentage abundance of two isotopes of potassium.

Table 1

Mass number	Percentage abundance
39	93.1
41	6.9

Calculate the relative atomic mass (A_r) of potassium.

Give your answer to 1 decimal place.

[3 marks]

Relative atomic mass (1 decimal place) = _____

8

5.1.2.1 The periodic table

Question 08

June 2023 | 8464/C/1H | Original Q3

0 3 Sodium is in Group 1 of the periodic table.

Sodium reacts with oxygen to produce sodium oxide.

0 3 . 1 Balance the equation for the reaction.

[1 mark]

$$___\ Na + O_2 \rightarrow ___\ Na_2O$$

0 3 . 2 Explain what happens to sodium atoms and to oxygen atoms when sodium reacts with oxygen to produce sodium oxide (Na_2O).

Answer in terms of electrons.

[4 marks]

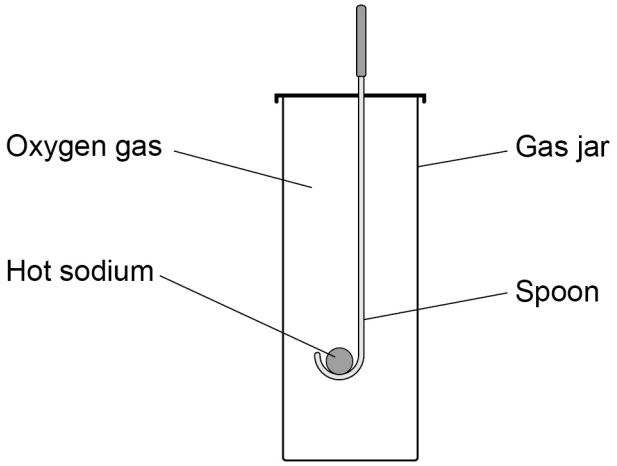
5.1.2.1 The periodic table

Question 08 · continued

0 3 . 3 Sodium burns in a gas jar of oxygen.

Figure 3 shows the apparatus.

Figure 3



Give **two** observations seen during the reaction.

[2 marks]

1 _____

_____

2 _____

_____

0 3 . 4 Describe **two** differences in the observations if potassium is used instead of sodium.

[2 marks]

1 _____

_____

2 _____

_____

9

5.1.2.1 The periodic table

Question 09

June 2024 | 8464/C/1H | Original Q7

0 7 Halogens are elements in Group 7 of the periodic table.

0 7 . 1 Calcium reacts with chlorine to produce calcium chloride.

Explain what happens to calcium atoms and to chlorine atoms when calcium reacts with chlorine to produce calcium chloride.

[4 marks]

0 7 . 2 Explain why chlorine is more reactive than bromine.

[4 marks]

5.1.2.1 The periodic table

Question 09 · continued

0 7 . 3 **Table 4** shows the boiling points of four hydrogen halides.

Table 4

Hydrogen halide	Boiling point in °C
HF	20
HCl	–85
HBr	–67
HI	–35

Describe how the boiling points of the hydrogen halides change as the relative formula mass changes.

[2 marks]

10

5.1.2.1 The periodic table

Question 10

June 2025 | 8464/C/1H | Original Q3

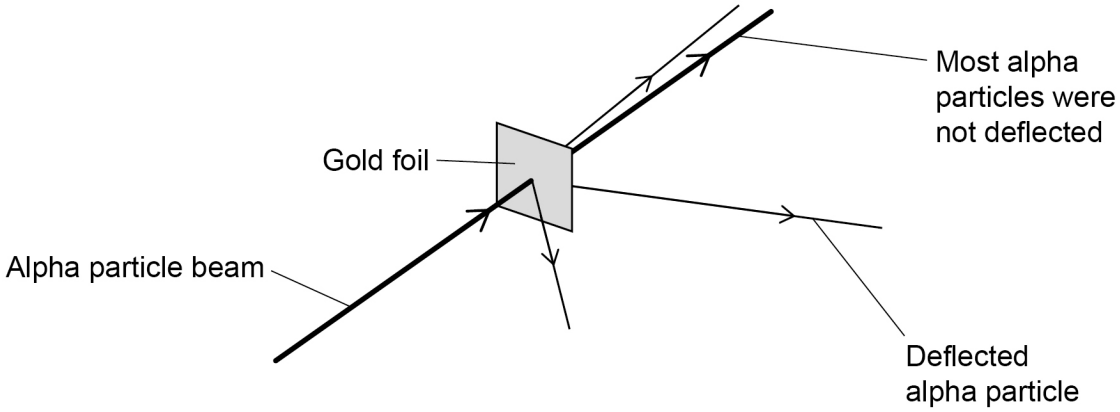
0 3 This question is about atoms, ions and elements.

0 3 . 1 **Figure 3** shows the results of the alpha particle scattering experiment.

In the experiment, alpha particles were fired at gold foil.

Alpha particles are positively charged.

Figure 3



What **two** conclusions were made from the results?

[2 marks]

Tick (✓) **two** boxes.

- Atoms are very small. ☐
- Atoms have a charged nucleus. ☐
- Electrons orbit the nucleus at specific distances. ☐
- Isotopes of an element have a different number of neutrons. ☐
- The mass of an atom is concentrated in the nucleus. ☐

5.1.2.1 The periodic table

Question 10 · continued

Particle **X** consists of:

- 35 protons
- 44 neutrons
- 36 electrons.

0 3 . 2 Why is particle **X not** an atom?

Answer in terms of subatomic particles.

[1 mark]

0 3 . 3 Which is the correct representation of particle **X**?

Use the periodic table.

[1 mark]

Tick (✓) **one** box.

$^{79}_{35}Br^{+}$ ☐

$^{79}_{35}Br^{-}$ ☐

$^{79}_{35}Se^{+}$ ☐

$^{79}_{35}Se^{-}$ ☐

5.1.2.1 The periodic table

Question 10 · continued

Group 7 elements are known as the halogens.

0 3 . 4 **Table 2** shows the boiling points of some Group 7 elements.

Table 2

Element	Boiling point in °C
Fluorine	−188
Chlorine	−35
Bromine	59
Iodine	184

Explain the increase in the boiling points of the Group 7 elements going down the group.

[3 marks]

Question 3 continues on the next page

5.1.2.1 The periodic table

Question 10 · continued

0 3 . 5 Chlorine reacts with fluorine to form a compound with the formula ClF_3

What is the type of bonding in the compound ClF_3?

[1 mark]

0 3 . 6 Chlorine reacts with a solution of sodium bromide.

Complete the word equation for the reaction.

[1 mark]

chlorine + sodium bromide ⟶ _____ + _____

0 3 . 7 Explain why Group 7 elements become less reactive going down the group.

[3 marks]

12