

GCSE Chemistry (9 – 1)

The Periodic Table

Name:

Group:.....

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/5
2	/6
3	/13
4	/10
5	/9
6	/8
Total	/51
%	
Grade	

Information

- The maximum mark for this paper is 51 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. The periodic table arranges all of the known chemical elements in order of increasing atomic number, organising them into vertical groups and horizontal periods to reveal clear trends in their atomic structure and properties. Circle the letter of the correct answer for each of the following questions.

- a. A neutral sodium atom has 11 electrons.

Which of the following statements about sodium is correct?

- A** Sodium is in Group 2 of the Periodic Table.
- B** Sodium is in Period 3 of the Periodic Table.
- C** Sodium is in Period 2 of the Periodic Table.
- D** Sodium is in Group 3 of the Periodic Table.

(1 mark)

- b. What is the element that is in period 3 and group 2 of the Periodic Table?

- | A | B | C | D |
|-----------|---------|-------|-----------|
| Magnesium | Calcium | Boron | Aluminium |
- (1 mark)**

- c. A version of the Periodic Table is shown in the figure below.

Which element is used as a catalyst?

A 10x10 grid with a 2x2 square at the top center and a 2x2 square at the top right. The grid contains letters Q, R, S, and P. Q is at row 4, column 1. R is at row 4, column 8. S is at row 5, column 5. P is at row 1, column 10.

(1 mark)

- d. Which property of elements increases across a period of the Periodic Table?

- A** tendency to form positive ions.
- B** number of outer shell electrons.
- C** number of electron shells.
- D** metallic character.

(1 mark)

- e. Which statement about elements in Group I and Group VII of the Periodic Table is correct?

- A** Sodium is more reactive with water than potassium.
- B** Lithium has a higher melting point than potassium.
- C** Iodine is a monoatomic non-metal.
- D** Bromine reacts with potassium chloride to produce chlorine.

(1 mark)

(Total for Question 1 is 5 marks)

2. The figure below shows part of the modern Periodic Table.

I	II											III	IV	V	VI	VII	VIII
																	He
Na	Mg						Fe			Cu		Al	C	N	O		
K	Ca															Br	
																I	

Use only the elements shown in the figure above to answer the following questions.
Give the symbol for the element in each case.

a. Which element is the most abundant gas in clean, dry air?

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(1 mark)

b. Which element shown has a stable electron arrangement with a full outer shell?

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(1 mark)

c. Identify the element located in the fifth period of the periodic table.

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(1 mark)

d. Which element's atoms typically gain two electrons to achieve a full outer shell?

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(1 mark)

e. When tested with sodium hydroxide solution, a solution containing ions of this element forms a green solid. Name the element.

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(1 mark)

f. Name the element used for making items like drink cans and kitchen foil because it is protected by a strong, unreactive oxide layer.

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(1 mark)

(Total for Question 2 is 6 marks)

3. The elements in Group 1 of the periodic table, known as the alkali metals, show clear trends in their properties.

The table below shows data for the first three elements in Group 1.

Element	Boiling point (°C)	Atomic radius (pm)	Relative thermal conductivity	Reaction in Water
Lithium	1,342		2.4	fizzes steadily
Sodium	883	186	3.8	rapid bubbling but does not burst into flame.
Potassium	759	227	1.6	very rapid bubbling and bursts into flame
Rubidium	688	248		explodes

- a. The table below has two missing pieces of data.
- Suggest a value for the atomic radius of Lithium. (1 mark)
 - Suggest a value for the thermal conductivity of Rubidium. (1 mark)

- b. The reactivity of the alkali metals **increases** as you go down the group from lithium to caesium. **Explain** this trend in terms of atomic structure.

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(3 marks)

Magnesium is a metal found in Group 2 of the Periodic Table.

- c. Describe the structure and bonding in a metal.
You **may** include a diagram in your answer.

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(2 marks)

The element caesium (Cs) has a proton number of 55 and is radioactive.

- d. What is meant by the term proton number?

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(1 mark)

- e. A student investigates the reaction between sodium hydride and iron(III) oxide.
The chemist starts to write out the balanced equation but leaves two gaps.

Balance the equation.



(2 marks)

Look at the formula for iron(III) oxide (Fe_2O_3) and the formula for iron (Fe).

- f. **State** what has been lost from the iron(III) oxide to show it has been reduced.

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(1 mark)

Hydrogen's position in the periodic table is unique.

- g. Explain **one** similarity between hydrogen and the Group 1 elements, and one key difference that sets it apart from them.

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(2 marks)

(Total for Question 3 is 13 marks)

4. The modern periodic table is based on an earlier version by Dmitri Mendeleev.
As you can see in the figure below, a key feature of his table was that he left gaps for elements that had not yet been discovered.

I						
H	II	III	IV	V	VI	VII
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca		Ti	V	Cr	Mn
Cu	Zn			As	Se	Br
Rb	Sr	Y	Zr	Nb	Mo	
Ag	Cd	In	Sn	Sb	Te	I
Ce	Ba	La		Ta	W	
Au	Hg	Pt	Pb	Bi		

- a. Identify **two** key features of the way elements were organised in Mendeleev's original periodic table.

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(2 marks)

- b. Describe how the elements are arranged in the modern Periodic Table.

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(2 marks)

Mendeleev's great genius was not just in arranging the known elements, but in **predicting the properties** of those yet to be discovered.

- c. The table below shows the properties Mendeleev predicted for an element he called 'eka-aluminium'.

Appearance	Soft, silver metal
Melting point (°C)	Low
Relative atomic mass	68
Density (g/cm³)	6.0

The next table shows the actual properties of some elements that were discovered later.

	Zinc (Zn)	Gallium (Ga)	Germanium (Ge)	Arsenic (As)
Appearance	Silver-grey metal	Silver-blue metal	Grey-white metal	Grey metalloid
Melting point (°C)	420	30	947	817
Relative atomic mass	65.4	69.7	72.6	74.9
Density (g/cm ³)	7.1	5.9	5.35	5.7

- i. Use the data in both tables to identify which of the discovered elements is **eka-aluminium**.

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(1 mark)

- ii. Give **two** reasons for your choice, using data from the tables to support your answer.

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(2 marks)

- d. Argon (Ar) is an unreactive gas that was discovered after Mendeleev created his periodic table.
 Its electron arrangement is 2,8,8.

- i. Describe the reactivity of argon.

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(1 mark)

- ii. Explain why argon has this level of reactivity. Refer to its electron arrangement in your answer.

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(2 marks)

(Total for Question 4 is 10 marks)

5. The table below shows some information about the first four elements in Group 7.

Element	Symbol	State at Room Temperature	Boiling Point (°C)
Fluorine	F	Gas	-188
Chlorine	Cl	Gas	-35
Bromine	Br	Liquid	59
Iodine	I		184

- a. Complete the table to state the physical state of iodine at room temperature (25°C). **(1 mark)**

- b. Describe and explain the trend in the boiling points of the halogens as you go down Group 7.

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(2 marks)

- c. The reactivity of the halogens **decreases** as you go down the group from fluorine to iodine.

Explain this trend in terms of atomic structure.

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(3 marks)

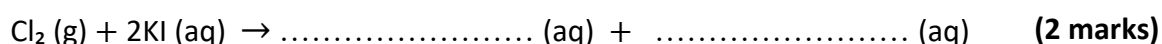
- d. Chlorine gas is bubbled through a solution of potassium iodide. A displacement reaction occurs.

- i. Name the substance that is displaced from the solution.

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(1 mark)

- ii. Complete the balanced symbol equation for this reaction.



(Total for Question 5 is 9 marks)

6. The central block of the periodic table contains the transition metals. Iron (Fe) and copper (Cu) are two examples.
- a. State **three** properties of transition metals that are different from the properties of the Group 1 alkali metals.

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(3 marks)

The table below shows the appearance of some different metal compounds when dissolved in water.

Compound	Colour of Aqueous Solution
Sodium Chloride	Colourless
Copper(II) Sulfate	Blue
Iron(III) Chloride	Yellow

- b. What property of transition metal ions allows them to form coloured compounds?

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(1 mark)

- c. Transition metals are often used as catalysts in industrial processes.

- i. What is the role of a catalyst in a chemical reaction?

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(2 marks)

- ii. Name a transition metal used as a catalyst and the industrial process it is used in.

Transition metal:

Process:

(2 marks)

(Total for Question 6 is 8 marks)