

The Periodic Table

30 questions: 15 multiple choice, 15 structured.

1 Core Arrangement of elements [1]

The elements in the Periodic Table are arranged in order of increasing value of which quantity?

- A mass number
- B number of neutrons
- C proton number
- D relative atomic mass

2 Core Arrangement of elements [1]

Element X is in Group VI of the Periodic Table.

What is the charge on the ion formed by X?

- A 2+
- B 6+
- C 6-
- D 2-

3 Core Group I properties [1]

Which statement about the Group I metals lithium, sodium and potassium is correct?

- A Their density decreases down the group.
- B Their melting point increases down the group.
- C Their reactivity increases down the group.
- D They are hard metals that cannot be cut with a knife.

4 Core Group VII properties [1]

What is the appearance of bromine at room temperature and pressure?

- A a red-brown liquid
- B a grey-black solid
- C a pale yellow-green gas
- D a colourless liquid

5 Core Group VII properties

[1]

Which pair of substances reacts when they are mixed?

- A aqueous iodine and aqueous potassium bromide
 - B aqueous bromine and aqueous potassium chloride
 - C aqueous iodine and aqueous potassium chloride
 - D aqueous chlorine and aqueous potassium iodide
-

6 Core Transition elements

[1]

Which property is typical of transition elements but is **not** typical of Group I metals?

- A They conduct electricity.
 - B They form coloured compounds.
 - C They form positive ions.
 - D They are shiny when freshly cut.
-

7 Core Noble gases

[1]

Why are the noble gases unreactive?

- A Their atoms have a full outer shell of electrons.
- B They are gases at room temperature and pressure.
- C They exist as diatomic molecules.
- D Their atoms contain more protons than electrons.

The table shows the electronic configurations of atoms of five elements. The letters are not the chemical symbols of the elements.

Element	Electronic configuration
V	2,1
W	2,8,2
X	2,8,7
Y	2,8,8
Z	2,8,1

- (a) Identify the **two** elements that are in the same group of the Periodic Table. [1]

- (b) State the group number and the period number of element W. [2]

- (c) Explain, in terms of electronic configuration, why the two elements you identified in (a) have similar chemical properties. [2]

- (d) State the charge on the ion formed by element W. [1]

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The table shows the melting points of four Group I metals, listed in order down the group.

Metal	Melting point / °C
lithium	181
sodium	98
potassium	63
rubidium	39

Caesium is the next element below rubidium in Group I.

- (a) Describe the trend in melting point down Group I. [1]

- (b) Predict a value for the melting point of caesium. [1]

- (c) Predict how each of the following properties of caesium compares with the same property of rubidium.

- (i) density [1]

- (ii) reactivity [1]

Seawater contains dissolved bromide ions, for example from sodium bromide. In one industrial process, chlorine gas is bubbled through concentrated seawater. Bromine is produced.

- (a) Explain why chlorine is able to produce bromine from sodium bromide. [2]

- (b) Write a word equation for the reaction between chlorine and sodium bromide. [1]

- (c) Write a balanced symbol equation for the reaction between chlorine and sodium bromide. [2]

- (d) Suggest why iodine could **not** be used instead of chlorine in this process. [1]

11 **Supplement** Arrangement of elements

[1]

The table gives information about four elements in Group II.

Element	Proton number	Observation when a small piece is added to cold water
magnesium	12	a few bubbles form very slowly
calcium	20	a steady stream of bubbles forms
strontium	38	rapid bubbling
barium	56	very rapid bubbling

Which conclusion can be made from this information?

- A Reactivity increases as proton number increases.
- B Reactivity increases as proton number decreases.
- C Calcium is more reactive than strontium.
- D Barium reacts more slowly than magnesium.

12 **Core** Arrangement of elements

[1]

Element Q is in Period 3. Q is a solid at room temperature and it does not conduct electricity.

Which group is Q most likely to be in?

- A Group I
- B Group II
- C Group III
- D Group VI

13 **Core** Arrangement of elements

[1]

Fluorine and chlorine have similar chemical properties.

Which statement explains this?

- A Their atoms have the same number of occupied electron shells.
- B Their atoms have the same number of electrons in the outer shell.
- C Their atoms have the same number of protons.
- D Their atoms have the same number of neutrons.

14 **Core** Group I properties

[1]

Francium is at the bottom of Group I.

Which row gives the most likely properties of francium compared with potassium?

	Melting point of francium	Reactivity of francium
A	higher	more reactive
B	higher	less reactive
C	lower	more reactive
D	lower	less reactive

15 **Core** Group VII properties

[1]

Which row describes how the density and the reactivity of the halogens change down Group VII from chlorine to iodine?

	Density	Reactivity
A	increases	increases
B	increases	decreases
C	decreases	increases
D	decreases	decreases

This question is about the ions formed by elements in different groups of the Periodic Table.

(a) State the charge on the ion formed by:

(i) calcium, in Group II

[1]

(ii) aluminium, in Group III.

[1]

(b) Describe the relationship between the group number and the charge on the ion formed by the metals in Groups I, II and III.

[2]

(c) Element E forms ions with a charge of 3^{-} . State which group of the Periodic Table element E is in.

[1]

(d) An atom of element G has the electronic configuration 2,8,6. Explain why element G forms an ion with a charge of 2^{-} .

[2]

The table gives information about four metals, labelled J, L, M and N. The letters are not the chemical symbols of the metals.

Metal	Density / g/cm ³	Melting point / °C	Colour of its compounds
J	0.86	63	white
L	7.19	1907	green, orange or yellow
M	1.55	842	white
N	2.70	660	white

- (a) Identify which metal, J, L, M or N, is a transition element. [1]

- (b) Give **two** pieces of evidence from the table that support your answer to (a). [2]

- (c) State **one** other typical property of transition elements that is **not** shown in the table. [1]

- (d) Metal J is in Group I. Give **one** piece of evidence from the table that supports this. [1]

Chlorine, bromine and iodine are elements in Group VII.

- (a) Describe the appearance of each of these elements at room temperature and pressure. Give the colour and the physical state of each.

- (i) chlorine [1]

- (ii) bromine [1]

- (iii) iodine [1]

- (b) Chlorine exists as diatomic molecules. Write the formula of a chlorine molecule. [1]

- (c) State how the density of the halogens changes down the group from chlorine to iodine. [1]

The table gives the melting points and boiling points of four elements in Group VI, listed in order down the group.

Element	Proton number	Melting point / °C	Boiling point / °C
oxygen	8	-218	-183
sulfur	16	115	445
selenium	34	221	685
tellurium	52	450	988

- (a) Describe the trend in boiling point down Group VI. [1]

- (b) Identify the **one** element in the table that is a liquid at 200 °C. Use the data to explain your answer. [2]

- (c) State the physical state of oxygen at 25 °C. Use the data to explain your answer. [2]

- (d) Each element is a liquid between its melting point and its boiling point. Use the data to describe how the size of this temperature range changes down Group VI. [1]

20

Core

Noble gases

[5]

Argon is a noble gas in Group VIII. Its proton number is 18.

(a) State the electronic configuration of an argon atom.

[1]

(b) Explain, in terms of electronic configuration, why argon is unreactive.

[2]

(c) The noble gases are described as monatomic. State what is meant by *monatomic*.

[1]

(d) A helium atom has only two electrons. Suggest why helium is also unreactive.

[1]

21 **Core** Group VII properties

[1]

Fluorine is the element directly above chlorine in Group VII.

Which prediction about fluorine is most likely to be correct?

- A Fluorine is more reactive than chlorine.
- B Fluorine is a dark grey solid at room temperature.
- C Fluorine has a greater density than bromine.
- D Fluorine exists as single atoms, F.

22 **Supplement** Transition elements

[1]

Which pair of compounds shows that iron forms ions with variable oxidation numbers?

- A FeCl_2 and FeSO_4
- B Fe_2O_3 and FeCl_3
- C FeO and FeS
- D FeCl_2 and FeCl_3

23 **Core** Arrangement of elements

[1]

The electronic configuration of an atom of element T is 2,8,8,2.

Which statement about element T is correct?

- A T is a metal in Period 2 that forms T^{2+} ions.
- B T is a metal in Period 4 that forms T^{2+} ions.
- C T is a non-metal in Period 4 that forms T^{2-} ions.
- D T is a non-metal in Period 2 that forms T^{2-} ions.

The table gives information about four elements, labelled E, G, J and L. All four elements are in Period 3. The letters are not the chemical symbols of the elements.

Element	Appearance at room temperature	Conducts electricity as a solid?	Charge on the ion formed
E	shiny silvery solid	yes	2+
G	yellow solid	no	2-
J	shiny silvery solid	yes	3+
L	soft, shiny silvery solid	yes	1+

- (a) Put the four elements in order of increasing proton number. [2]

- (b) State which group of the Periodic Table element G is in. [1]

- (c) Describe how the character of the elements changes across Period 3. Use evidence from the table to support your answer. [2]

Element X is in Group II and Period 5 of the Periodic Table. The letter X is not its chemical symbol.

- (a) Predict whether X is a metal or a non-metal. Explain your answer using the position of X in the Periodic Table. [2]

- (b) State the charge on an ion of X. [1]

- (c) X reacts with chlorine to form an ionic compound. Deduce the formula of this compound. [1]

- (d) X reacts with oxygen to form an ionic compound. Deduce the formula of this compound. [1]

- (a) Describe how the elements are arranged in the Periodic Table. In your answer, refer to groups and periods. [3]

- (b) The table gives information about tellurium and iodine.

Element	Proton number	Relative atomic mass
tellurium	52	128
iodine	53	127

Tellurium is placed before iodine in the Periodic Table, even though tellurium has the larger relative atomic mass. Explain why. [2]

- (c) A potassium atom has the electronic configuration 2,8,8,1. Explain why potassium is placed in Group I and in Period 4. [2]

In a demonstration, a teacher adds a small piece of each of three Group I metals to a large trough of cold water. The table shows the observations.

Metal	Observations
lithium	floats; fizzes steadily; moves slowly on the surface; does not melt
sodium	floats; fizzes rapidly; melts into a ball; moves quickly on the surface
potassium	floats; fizzes very rapidly; melts; bursts into flame

- (a) Use the observations to describe the trend in reactivity down Group I. [1]

- (b) Rubidium is below potassium in Group I. Predict **one** observation when a small piece of rubidium is added to cold water. [1]

- (c) Sodium melts during its reaction with water but lithium does not. Suggest **two** reasons for this difference. [2]

- (d) All three metals float on water. State what this shows about the density of these metals. [1]

The table shows the melting points and boiling points of three halogens, listed in order down Group VII.

Halogen	Melting point / °C	Boiling point / °C
chlorine	-101	-34
bromine	-7	59
iodine	114	184

Astatine is the element below iodine in Group VII.

- (a) Predict the physical state of astatine at room temperature. Use the data to explain your answer. [2]

- (b) Predict a value for the boiling point of astatine. [1]

- (c) Predict whether astatine would react with aqueous potassium iodide. Explain your answer. [2]

In an experiment, a student adds aqueous solutions of three halogens to colourless aqueous solutions of three potassium halides. The table shows the results.

Halogen solution added	Potassium chloride	Potassium bromide	Potassium iodide
chlorine	not tested	turns orange	turns brown
bromine	no change	not tested	turns brown
iodine	no change	no change	not tested

- (a) Use the results to deduce the order of reactivity of chlorine, bromine and iodine. Put the most reactive halogen first.

[1]

- (b) Explain why bromine reacted with potassium iodide but did **not** react with potassium chloride.

[2]

- (c) Write a balanced symbol equation for the reaction between bromine and potassium iodide.

[2]

- (d) Name the substance formed in the reaction between bromine and potassium iodide that causes the brown colour.

[1]

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Transition elements form ions with variable oxidation numbers.

(a) Iron forms two different oxides, iron(II) oxide and iron(III) oxide. Write the formula of:

(i) iron(II) oxide

[1]

(ii) iron(III) oxide.

[1]

(b) Write the formula of the iron ion present in iron(II) chloride.

[1]

(c) Copper forms two different chlorides, with the formulae CuCl and CuCl_2 . Name each of these compounds, showing the oxidation number of copper in each name.

[2]

(d) Sodium only forms ions with a charge of $1+$. State how the ions formed by iron are different from the ions formed by sodium.

[1]
