

## 12.1 The Periodic Table: an overview

1. a. A 'cell' of the Periodic table is shown below.

48
<b>Cd</b>
112

- i. What does 48 represent ..... [1]
- ii. What does 112 represent ..... [1]
- b. Complete these sentences about the Periodic Table.
  - i. The elements in the Periodic Table are arranged in order of increasing ..... [1]
  - ii. The groups are numbered ..... to ..... [1]
  - iii. The period number tells you the number of ..... in an atom. [1]
  - iv. The outer shell electrons in an atom are called ..... [1]
2. Explain why Group VIII elements are unreactive.
 

.....

..... [2]
3. Describe the position of metals and non-metals in the Periodic Table both across a period and down a group.
 

.....

.....

..... [4]
4. Both hydrogen and Group I elements have one electron in their outer shell.
 

Why is hydrogen not placed in Group I in the Periodic Table?

.....

..... [2]

Extension

5. Use textbooks or the internet to describe:

- a. how the structure of the Group V elements changes down the group in terms of being metals or non-metals [4]
- b. how the type of oxides formed by Group V elements changes down the group. [4]

## 12.2 Group I: the alkali metals

1. The table shows some properties of some Group I metals.

Group I metal	Density in g/cm <sup>3</sup>	Melting point / °C	Metallic radius / nm	Observations when the metal reacts with water
lithium	0.53	181	0.157	Moves over the surface very slowly Fizzes gently Does not melt or go into a ball Does not burst into flame
sodium	0.97	98	0.191	..... ..... ..... .....
potassium	0.86		0.235	Moves over surface very rapidly Fizzes very rapidly Melts and goes into a ball then bursts into flame Slight 'pop' when reaction near the end
rubidium	1.53	39		..... ..... ..... .....

a. Complete the table by writing in

i. The observations in the last column for sodium and rubidium. [6]

ii. A prediction for the melting point of potassium and the metallic radius of rubidium. [2]

b. Caesium is below rubidium in the Periodic Table. Predict a value for the density of caesium.

..... [1]

2. Explain what happens in terms of electron transfer when sodium reacts with chlorine.

.....  
.....  
..... [4]

Extension

3. Use textbooks or the internet to find out why it is easier to remove the outer electron from a potassium atom than it is to remove the outer electron from a sodium atom.

[5]



## 12.3 Group VII: the halogens

1. The table shows some properties of fluorine, chlorine, bromine and iodine.

Halogen	Melting point / °C	Boiling point / °C	State at -40 °C	Colour	Atomic radius / nm
fluorine	-220	-188			
chlorine	-101	-35			
bromine	-7	59			
iodine	114	184			

- a. What is the trend in the melting points of the halogens? [1]  
 ..... [1]
- b. Use the values of the melting and boiling points in the table to deduce the state of the halogens at -40 °C. Write your answers in the table. [4]
- c. Complete the fifth column to show the colours of the halogens at room temperature. [4]
- d. Draw an arrow in the sixth column to show the trend in atomic radius (smaller → larger). [1]
2. a. Complete these sentences about the displacement reactions of halogens using words from the list.

**bromine    chlorine    colourless    halide    halogen    less    more    orange**

When aqueous ..... is added to a ..... solution of potassium bromide, the solution turns ..... because ..... has been displaced.

This is because a ..... reactive ..... displaces a ..... reactive halogen from an aqueous solution of its ..... [8]

- b. What would you observe when an aqueous solution of bromine is added to an aqueous solution of potassium iodide. Explain these observations.

..... [4]  
 .....  
 .....

3. Write ionic equations for:

- a. the reaction of aqueous chlorine with aqueous magnesium iodide [2]
- b. the reaction of aqueous bromine with aqueous potassium astatide, KAt. [2]

## 12.4 More about the trends

1. The table shows some information about some of the elements in Period 3.

Element	Na	Mg	Al	Si	P	S	Cl
Electronic structure	2,8,1						
Melting point / °C	98	649	660	1410	590	119	-101
Formula of typical compounds	NaCl Na <sub>2</sub> O	MgCl <sub>2</sub> MgO	AlCl <sub>3</sub>	SiCl <sub>4</sub> SiH <sub>4</sub>	PCl <sub>3</sub> PH <sub>3</sub>	H <sub>2</sub> S	HCl
Valency in compound	1	2	3	4	3	2	1

a. Complete the second line of the table to show the electronic structures. [1]

b. Complete the fourth line of the table to show the formulae of the three oxides. [3]

c. i. Describe how the melting points of the elements change across the period. [2]

ii. What type of structures are Na, Mg, and Al? [2]

iii. Explain in terms of structure and bonding why Si has the highest melting point in this period. [2]

iv. Explain in terms of structure and bonding why the melting points P, S, and Cl are relatively low. [2]

2. Phosphorus also forms a chloride with the formula, PCl<sub>5</sub>. [1]

a. Deduce the valency of the phosphorus in this compound. [1]

b. Deduce the formula of the oxide of phosphorus which has the same valency as the phosphorus in PCl<sub>5</sub>. [1]

Extension

3. Explain why the reactivity of the metals decreases from sodium to aluminium. [3]



## 12.5 The transition elements

1. The boxes below show the properties of five non-transition elements and of five transition elements. The boxes are muddled up. (M = metal)

A Melting point 1890 °C

B Forms a chloride of formula  $MCl_2$  only

C Forms chlorides which are pink and green

D Density 7.87 g/cm<sup>3</sup>

E Forms chloride of type  $MCl_2$ ,  $MCl_3$ , and  $MCl_4$

F Forms a colourless chloride

G A compound of M is a good catalyst

H Melting point 725 °C

I Density 0.97 g/cm<sup>3</sup>

J Compounds of M show no catalytic activity

- a. Which letters represent the properties of transition elements?

..... [3]

- b. Write the formulae of the transition element ions in the following compounds.

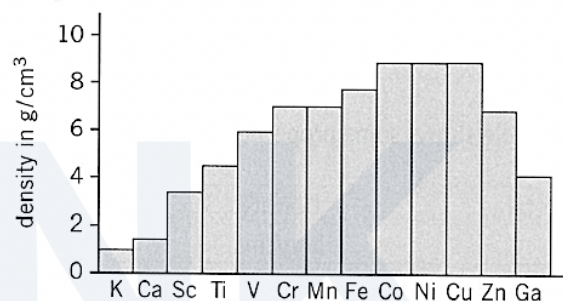
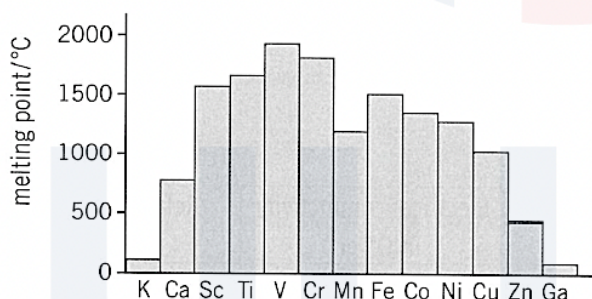
i.  $Ag_2O$  ..... ii.  $CuSO_4$  ..... [1]

iii.  $Cr(NO_3)_3$  ..... iv.  $Fe_2(SO_4)_3$  ..... [1]

- c. Give two other typical properties of transition elements which are not mentioned above.

..... [2]

2. The bar charts show the melting point and densities of some metals in Period 3.



- a. What information in the bar charts suggests that calcium is not a transition element?

..... [2]

- b. What is the pattern in the density of the metals across Period 3?

..... [2]

Extension

3. Zinc is in the central block of the Periodic Table. Use textbooks and the internet to find out about the properties of zinc which suggest that it not a transition element.

[4]

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- The diagram shows a simplified periodic table with the following layout:
- Row 1:** V (left), W (middle), X (right), and an empty cell at the far right.
  - Row 2:** Y (left), followed by several empty cells, and then an empty cell at the far right.
  - Row 3:** A series of empty cells.
  - Row 4:** A series of empty cells.
- Shading is present in the bottom two rows (Rows 3 and 4):
- Row 3: The 4th, 5th, and 6th columns are shaded light red. The 10th and 11th columns are shaded light blue.
  - Row 4: The 4th, 5th, and 6th columns are shaded light red. The 10th, 11th, and 12th columns are shaded light blue.

	Non-metal	Metal
A	Y	V
B	Y	X
C	W	X
D	W	V

	Group I	Group VII
A	Cs $\rightarrow$ Li	F $\rightarrow$ I
B	Li $\rightarrow$ Cs	I $\rightarrow$ F
C	Li $\rightarrow$ Cs	F $\rightarrow$ I
D	Cs $\rightarrow$ Li	I $\rightarrow$ F

Group I	Group VII
lithium, <b>Li</b>	
sodium, <b>Na</b>	chlorine, <b>Cl</b>
potassium, <b>K</b>	bromine, <b>Br</b>
	iodine, <b>I</b>

[1]

d the two elements that would react most violently with each other

[2]

[Total: 5]

4. A list of statements about elements of the Periodic Table is given below. State whether each of the following statements is **true** or **false**.

a Elements are arranged in order of their mass numbers.

[1]

b All elements in Group VIII, the noble gases, have eight electrons in their outer shell.

[1]

c Transition elements have high densities.

[1]

d Transition elements are all metals.

[1]

e Elements in the same period of the Periodic Table have the same number of electron shells.

[1]

[Total: 5]

5. a Manganese is an important transition metal. Information about three manganese compounds is given below.

- Manganese(II) sulfate is a pale pink crystalline solid.
- Manganese(IV) oxide is a black solid which speeds up the decomposition of hydrogen peroxide.
- Manganese(VII) oxide is a purple liquid. Which three characteristic properties of transition metals are shown in this information?

[3]

b Chromium forms three different metal oxides:

chromium(II) oxide, CrO

chromium(III) oxide, Cr<sub>2</sub>O<sub>3</sub>

chromium(VI) oxide, CrO<sub>3</sub>

CrO is a basic oxide, while CrO<sub>3</sub> dissolves in water to form a strong acid. What does this tell you about the type of bonding present in these two oxides?

[2]

c Cr<sub>2</sub>O<sub>3</sub> has similar bonding to aluminium oxide, Al<sub>2</sub>O<sub>3</sub>. What type of oxide is it likely to be?

[1]

[Total: 6]

**Key points****Details****Summary**



**Self-reflection:**

<p><b>How was I doing for this parts?</b></p>	
<p><b>The parts I have confidence is/are</b></p>	
<p><b>The part I still confused is/are</b></p>	
<p><b>Did I achieve my goal that I set last time?</b>  <b>If not, why? If so, what are the reasons behind?</b></p>	
<p><b>One thing that I need to improve?</b></p>	
<p><b>My objective of my next topic learning?</b></p>	
<p><b>My plan to achieve my objective are:</b></p>	