

The periodic table

1. Use the periodic table on the Data Sheet to answer these questions.

The table below gives the electronic structures of four elements, **W**, **X**, **Y** and **Z**.

Element	Electronic structure
W	2,5
X	2,7
Y	2,8,8
Z	2,8,8,1

(a) Which element **W**, **X**, **Y** or **Z**:

- (i) is a Group 0 gas?
- (ii) is nitrogen?
- (iii) is a Group 7 gas?
- (iv) reacts violently with water?

(3)

(b) Which **two** Groups of the periodic table do **not** contain any non-metals?

.....

(1)

(Total 4 marks)

2. The periodic table on the Data Sheet may help you to answer some of these questions.

(a) Draw a ring around the correct answer to complete these sentences.

(i)

Dimitri Mendeleev attempted to classify

- | |
|--------------------------------------|
| compounds.
elements.
mixtures. |
|--------------------------------------|

(1)

(ii)

He arranged them in order of their

- | |
|--|
| atomic weight.
boiling point.
electrical conductivity. |
|--|

(1)

(iii)

They are now arranged in order of their

atomic (proton) number.
atomic weight.
mass number.

(1)

(b) In the periodic table between Groups 2 and 3 there is a block of metals which includes chromium, iron and nickel.

(i) Which **one** of the following is the correct name for this block of metals?

Draw a ring around the correct answer.

alkali metals **reactive metals** **transition metals**

(1)

(ii) The properties of iron and those of the Group 1 metal sodium are different.

Put a tick (✓) next to the **two** correct phrases which could complete the following sentence.

Compared to sodium, iron

	(✓)
has a higher melting point.	
has a lower density.	
is harder.	
is more reactive.	
is weaker.	

(2)

(Total 6 marks)

3. Read the information about the development of the periodic table and answer the questions that follow.



John Newlands was one of the first chemists to arrange the known elements in order of increasing atomic mass. In 1866, he put forward the Law of Octaves. He suggested that there was a repeating pattern of elements with similar chemical properties every eighth element, just like the eighth note of an octave of music. A version of his periodic table is shown below.

H	Li	G	Bo	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co, Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce, La	Zr	Di, Mo	Ro, Ru
Pd	Ag	Cd	U	Sn	Sb	Te
I	Cs	Ba, V	Ta	W	Nb	Au
Pt, Ir	Os	Hg	Tl	Pb	Bi	Th

However, other chemists did not accept Newlands' ideas. It was not until much later that his contribution to the development of the modern periodic table was recognised.

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The modern periodic table on the Data Sheet may help you to answer these questions.

- (a) What is the modern symbol for the element 'Bo'?

(1)

(b) Describe **one** piece of evidence to support the Law of Octaves.

.....
.....
.....

(2)

(c) Suggest **two** reasons why other chemists did not accept Newlands' ideas.

1

2

(2)

(d) The alkanes are a series of hydrocarbons with similar chemical properties. They have the general formula C_nH_{2n+2} .

Suggest why the alkanes do not appear in the periodic table.

.....
.....

(1)

(Total 6 marks)

4. Read the information about the periodic table.



Portrait of Dimitri Mendeleev by Ilya Repin

When the Russian chemist Dimitri Mendeleev put forward his periodic table in 1869, the atomic structure of elements was unknown.

Mendeleev tried to arrange the elements in a meaningful way based on their chemical reactions. First he put the elements in order of their increasing atomic weight. He then put elements with similar properties in the same column.

However, he left gaps, and sometimes did not follow the order of increasing atomic weight – for example, he placed iodine (atomic weight 127) after tellurium (atomic weight 128).

Within a few years there was sufficient evidence to prove that Mendeleev was correct.

Our modern periodic table has evolved from Mendeleev’s table.

The modern periodic table on the Data Sheet may help you to answer these questions.

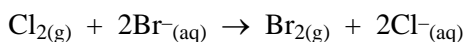
- (a) (i) State why Mendeleev left gaps.
.....
..... (1)
- (ii) State why some elements were **not** placed in order of increasing atomic weight.
.....
..... (1)
- (b) (i) The periodic table is now based on atomic structure.
Explain how.
.....
.....
..... (3)
- (ii) Suggest why it is impossible to have an undiscovered element that would fit between sodium and magnesium.
.....
..... (1)

(c) Explain, in terms of electrons, why fluorine is the most reactive element in Group 7.

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.....

(3)
(Total 9 marks)

5. In sea water the bromine is present as bromide ions (Br⁻). The equation below shows how chlorine can be used to displace bromine from sea water.



Explain, as fully as you can, why chlorine can displace bromine from sea water. To obtain full marks your answer should refer to electronic structure.

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(Total 3 marks)

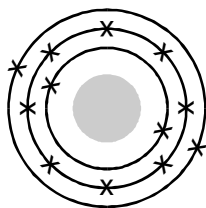
6. Sodium and potassium are both in Group 1 of the Periodic Table.

(a) Explain, by reference to their electronic structures, why both elements are placed in Group 1.

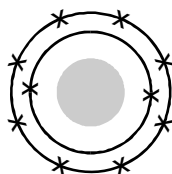
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(1)

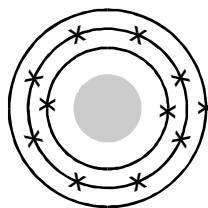
- (b) Use the Data Sheet to help you to answer this question.
The diagrams below represent the electronic structures of some atoms and ions.



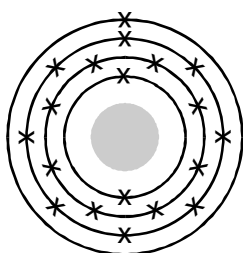
A



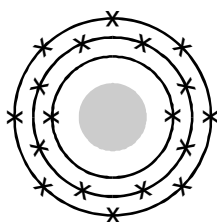
B



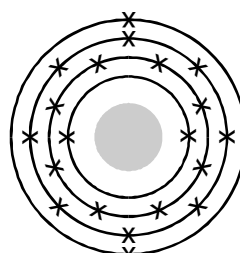
C



D



E



F

Which one of the structures, A - F

- (i) represents a sodium **atom**, (1)
- (ii) represents a potassium **ion**? (1)
- (c) Sodium and potassium both react with cold water.

- (i) The word equation represents the reaction of sodium with water.



Complete and balance the symbol equation for this reaction.



(2)

- (ii) How does the reactivity of potassium with water differ from that of sodium with water?

.....

Explain this difference in reactivity by reference to the electronic structures of the potassium and sodium atoms.

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.....

(4)

(Total 9 marks)

7. Use the Periodic Table of Elements on the Data Sheet to help you to answer this question.

Francium (Fr) is a very rare element. It is estimated that there is only 25 g of francium in the Earth's crust. Francium is radioactive and has a half-life of only a few minutes.

Mendeleev predicted the existence of francium in the 1870s but the element was not discovered until 1939.

(a) Explain why Mendeleev was able to predict the existence of francium in the 1870s.

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(2)

(b) Suggest why there is not much experimental evidence for the properties of francium.

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(1)

(c) (i) If you could react francium with water, how would the reaction compare with that of sodium with water?

.....
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(1)

(ii) Explain the reason for your answer.

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(2)

(Total 6 marks)