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# GCSE CHEMISTRY

Topic Paper: 1.2 The periodic table and Trends (Group 0, 1 and 7)  
Part 2

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Time allowed: 45 minutes

## Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

## Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

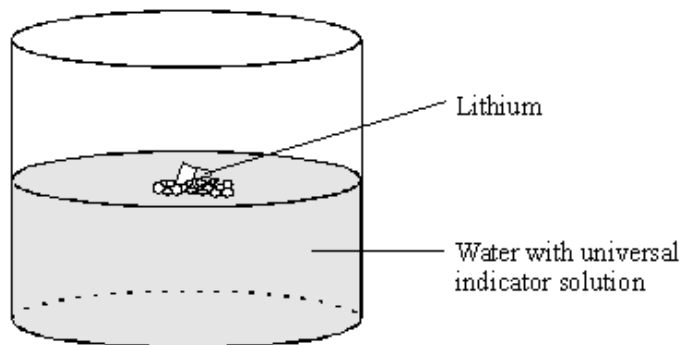


**42 Marks**



**Q6.** Lithium is a very reactive metal.

(a) Lithium reacts with cold water.



(i) Which **physical** property of lithium is seen during this reaction?

.....

(1)

(ii) Which **chemical** property of lithium will be shown by the universal indicator?

.....

(1)

(b) Complete the sentence by writing in the missing numbers.

Lithium has an atomic number of 3 and a mass number of 7.

This means that an atom of lithium has ..... protons ..... electrons  
and ..... neutrons.

(3)

(Total 5 marks)

**Q7.** (a) Dmitri Mendeleev was one of the first chemists to classify the elements by arranging them in order of their atomic weights. His periodic table was published in 1869.

How did Mendeleev know that there must be undiscovered elements **and** how did he take this into account when he designed his periodic table?

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.....  
.....

(2)



- (b) By the early 20th century protons and electrons had been discovered.

Describe how knowledge of the numbers of protons and electrons in atoms allow chemists to place elements in their correct order and correct group.

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

(3)

- (c) The transition elements are a block of elements between Groups 2 and 3 of the periodic table.

- (i) Transition elements have similar properties.

Explain why, in terms of electronic structure.

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

(2)

- (ii) There are **no** transition elements between the Group 2 element magnesium and the Group 3 element aluminium.

Give a reason why, in terms of electronic structure.

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

(1)

(Total 8 marks)

**Q8.** The halogens are in Group 7 of the periodic table.

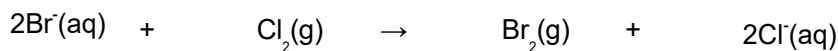
- (a) Why, in terms of electrons, are the halogens in Group 7?

.....  
.....

(1)



- (b) Sea water contains bromide ions ( $\text{Br}^-$ ).  
 The bromide ions can be changed to bromine by bubbling chlorine gas into sea water.  
 Chlorine is able to displace bromine from sea water because chlorine is more reactive than bromine.



Explain, in terms of electrons, why chlorine is more reactive than bromine.

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(3)  
 (Total 4 marks)

**Q9.** The following article appeared recently in the *Manchester Gazette*.

**Sodium Drum Blaze Scare**

A 20 litre drum containing sodium burst into flames when it reacted violently with rainwater at a Manchester factory. It is believed that the sodium, which is normally stored under oil, had been accidentally left outside with the lid off.

A factory worker put out the blaze before the fire services arrived, and a leading fire fighter said, "It was fortunate that potassium wasn't involved as it would have reacted more violently and exploded. These Group 1 *alkali metals* can be very dangerous".

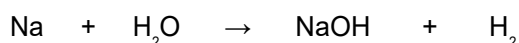
- (a) Group 1 metals are stored under oil.

Suggest why.

.....

(1)

- (b) Balance the equation which represents the reaction between sodium and water.



(1)



(c) Explain why the Group 1 metals are called the *alkali metals*.

.....  
.....

(1)

(d) Explain, in terms of electrons, why potassium reacts more violently than sodium.

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(3)

(Total 6 marks)

**Q10.** Read the information about the development of the periodic table and answer the questions that follow:

Johann Döbereiner was a chemist who realised there was a link between atomic weight and chemical properties. Although it was difficult to measure atomic weights accurately, by 1829 Döbereiner had arranged many elements with similar chemical reactions in groups of three. He noticed that the middle element had an atomic weight that was approximately the average of the other two. These groupings were known as triads. Three of these triads are shown below:

Li 7	S 32	Cl 35.5
Na 23	Se 79	Br 80
K 39	Te 128	I 127

As new elements were discovered, it became difficult to group them in triads, and it was left to others to build on Döbereiner's work. The result was the first periodic table, suggested by Dimitri Mendeleev in 1869.

Our modern periodic table has evolved from Mendeleev's Table. Lithium, sodium and potassium are still together in Group 1, and chlorine, bromine and iodine are in Group 7.

It was many years before chemists understood the nature of the transition elements.



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

- (a) Döbereiner suggested that calcium (Ca), strontium (Sr) and barium (Ba) were also a triad.

Use relative atomic masses to explain why.

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

(1)

- (b) Suggest why Döbereiner's ideas were replaced by those of Mendeleev.

.....  
.....

(1)

- (c) Lithium, sodium and potassium are in Group 1. All these elements react with water.

Describe what you **see** when potassium is added to water.

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

(2)

- (d) In terms of electronic structure, explain why:

- (i) elements in the same group of the periodic table have similar chemical properties

.....  
.....

(1)

- (ii) transition elements have similar properties even though they are not in the same group

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

(2)



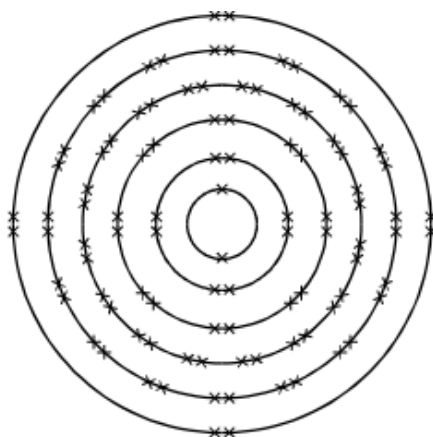
(iii) in Group 1, lithium is **less** reactive than potassium.

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

(2)  
(Total 9 marks)

**Q11.** In 1999 scientists at the University of Berkeley claimed to have discovered the element Ununhexium.

The electron arrangement of this element is thought to be as shown in the diagram below.



(a) Which group of the periodic table should this element be placed in?

Group .....

(1)

(b) Give a reason for your answer.

.....  
.....

(1)  
(Total 2 marks)

**Q12.** Neodymium (Nd) is a member of the group of elements known as the lanthanides. It is a silvery, white metal. It has a number of uses including making special alloys.

In the reactivity series of metals neodymium is above magnesium but below calcium. Predict how neodymium might react with each of the substances in (a) to (c).

If you think a reaction will take place you should suggest **how vigorous** it might be and **name the products** that might be produced.



(a) How might neodymium react with water?

Reaction .....

.....

Products .....

.....

(b) How might neodymium react with air?

Reaction .....

.....

Products .....

.....

(c) How might neodymium react with dilute hydrochloric acid?

Reaction .....

.....

Products .....

.....

**(Total 8 marks)**