

Cambridge University Examinations

General Certificate of Education Ordinary Level
O – LEVEL 5070. Notes, P1, P2 and P4

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Chapter

Periodic Table

Work Sheet Paper 2

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1 Potassium, atomic number 19, is an element in Group I.

(a) Describe what you **observe** when a small piece of potassium is added to water.

.....

[2]

2 Caesium, atomic number 55, is another element in Group I.
 Use your knowledge of Group I elements to complete the table of information for caesium.

symbol	Cs
number of electrons in outer shell	
formula of caesium oxide	
names of products of the reaction between caesium and water	

[3]

The reaction between caesium and water is more vigorous than the reaction between potassium and water.
 Explain why this is so.

.....
[2]

3 Fluorine, chlorine, bromine and iodine are elements in Group VII of the Periodic Table. Scientists are trying to synthesise a new element in Group VII with a proton number of 117.

(a) How many valency electrons will be present in one atom of this new element?

.....[1]

(b) Complete the following table about an isotope of this new element.

nucleon number	280
number of protons	
number of neutrons	

[2]

(c) Predict **two** physical properties of this new element.

1

2[2]

(d) Fluorine reacts with magnesium to form magnesium fluoride.

(i) Write a balanced equation for this reaction.

[1]

(ii) Give both the electronic configuration and the charge on the ions which are present in magnesium fluoride.

[2]

4 When sodium reacts with water, hydrogen is given off and an alkaline solution is formed.

(i) Describe **two** observations that can be made when sodium reacts with water.

.....

.....

..... [2]

(ii) Write an equation, including state symbols, for the reaction of sodium with water.

..... [3]

Sodium is an alkali metal. Iron is a transition element.

State the differences between these two metals in terms of

(i) melting point

..... [1]

(ii) density

..... [1]

5 Potassium reacts violently with water. Complete the word equation for this reaction.

potassium + water → +

6 Look at the list of five elements below.

argon
bromine
chlorine
iodine
potassium

(a) Put these five elements in order of increasing proton number.

..... [1]

(b) Put these five elements in order of increasing relative atomic mass.

..... [1]

(c) The orders of proton number and relative atomic mass for these five elements are different. Which **one** of the following is the most likely explanation for this?

Tick **one** box.

The proton number of a particular element may vary.

The presence of neutrons.

The atoms easily gain or lose electrons.

The number of protons must always equal the number of neutrons.

[1]

(d) Which of the five elements in the list are in the same group of the Periodic Table?

..... [1]

(e) (i) From the list, choose **one** element which has one electron in its outer shell.

..... [1]

(ii) From the list, choose **one** element which has a full outer shell of electrons.

..... [1]

(f) Which **two** of the following statements about argon are correct?

Tick **two** boxes.

Argon is a noble gas.

Argon reacts readily with potassium.

Argon is used to fill weather balloons.

Argon is used in light bulbs.

[2]

(g) Potassium chloride can be made by reacting potassium with chlorine. The bonding in potassium chloride is ionic.

What does this information tell you about

(i) the boiling point of potassium chloride,

..... [1]

(ii) the electrical conductivity of molten potassium chloride?

..... [1]

(h) Describe the change in the electronic structure of potassium and chlorine atoms when they combine to make potassium chloride.

change in potassium atom

.....

change in chlorine atom

..... [2]

- 7 The halogens are a group of diatomic non-metals showing a trend in colour, state and reactivity.

(a) In this description, what is the meaning of

(i) diatomic, [1]

(ii) state? [1]

(b) The table gives some information about some of the halogens.

element	melting point /°C	boiling point /°C	colour	state at room temperature
chlorine	-101	-35	green	
bromine	-7	+59		
iodine	+114		grey-black	

(i) Complete the last column in the table to show the state of each of the halogens at room temperature. [2]

(ii) State the colour of bromine.

..... [1]

(iii) Suggest a value for the boiling point of iodine.

..... [1]

(c) Complete the word equation for the reaction of chlorine with potassium iodide.

chlorine + potassium iodide → +
 [2]

- 8 Astatine, At, is below iodine in Group VII of the Periodic Table.
- (i) In which Period of the Periodic Table is astatine?
..... [1]
- (ii) How many protons does astatine have in its nucleus?
..... [1]
- (iii) Astatine has many isotopes.
What do you understand by the term *isotopes*?
.....
..... [1]
- (iv) The most common isotope of astatine has a nucleon number (mass number) of 210.
Calculate the number of neutrons in this isotope of astatine.
..... [1]

- 9 Sodium and rubidium are alkali metals.
- (a) Explain how metals conduct electricity.
.....[1]
- (b) State **two** trends in the properties of the alkali metals.
.....
.....[2]
- (c) Name the products formed when rubidium reacts with water.
..... and [2]
- (d) Titanium is extracted from titanium(IV) chloride by reduction with molten sodium.
- $$\text{TiCl}_4 + 4\text{Na} \rightarrow 4\text{NaCl} + \text{Ti}$$
- Suggest why sodium reduces titanium(IV) chloride.
.....[1]

- 10 Part of Mendeleev's original Periodic Table showing an arrangement of elements according to their similar properties is shown below. The numbers are the atomic masses of the elements.

			Fe = 56
			Ni / Co = 59
H = 1			Cu = 63.4
	Be = 9.4	Mg = 24	Zn = 65.2
	B = 11	Al = 27.4	element X
	C = 12	Si = 28	element Y
	N = 14	P = 31	As = 75
	O = 16	S = 32	Se = 74.9
	F = 19	Cl = 35.5	Br = 80
Li = 7	Na = 23	K = 39	Rb = 85.4
		Ca = 40	Sr = 87.6

- (a) Mendeleev listed the elements in order of their atomic masses.

What determines the order of the elements in the **modern** Periodic Table?

..... [1]

- (b) Mendeleev predicted the properties of the undiscovered element X. You will find element X in the table above.

Study the pattern in which the elements are arranged in the table above. Deduce to which Group in the **modern** Periodic Table element X belongs.

..... [1]

- (c) Describe **two** other differences between Mendeleev's original Periodic Table and the modern Periodic Table.

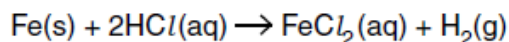
.....

(d) Iron, cobalt and nickel have similar properties.

(i) State the name of the block of elements in the modern Periodic Table which includes iron, cobalt and nickel.

.....[1]

(ii) Iron reacts with dilute hydrochloric acid.



Use ideas about particles to describe and explain the effect of temperature on the speed of this reaction.

.....
.....
.....[2]

(e) Lithium, sodium and potassium are elements which show a trend in melting points and reaction with water.

(i) Describe the trend in the reaction of these elements with water.

.....
.....[1]

(ii) Write an equation for the reaction of sodium with water.

[1]

(iii) The melting points of lithium, sodium and potassium are:

lithium 181 °C
sodium 98 °C
potassium 63 °C

Predict the melting point of rubidium.

.....[1]

11 Chlorine, bromine and iodine are non-metals in Group VII of the Periodic Table. Their molecules are diatomic.

(a) What do you understand by the term *diatomic*?

.....[1]

(b) (i) Describe the trend in colour of the Group VII elements down the Group.

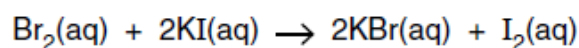
.....[1]

(ii) In what physical state do the following elements exist at room temperature and pressure?

bromine

iodine[2]

(c) Aqueous bromine reacts with aqueous potassium iodide.



(i) Write an ionic equation for this reaction.

[1]

(ii) Describe a positive test for iodide ions.

test

observation[2]

(iii) Explain why aqueous bromine does not react with aqueous potassium chloride.

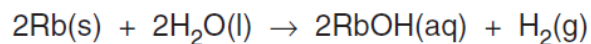
.....

.....[1]

12

The Periodic Table is arranged in groups.

- (a) Rubidium, Rb, is in Group I of the Periodic Table. It reacts with water according to the equation below.



Predict what you would **see** when a small piece of rubidium is added to cold water. [3]

- (b) Chlorine is in Group VII of the Periodic Table.

Chlorine, Cl_2 , reacts with aqueous sodium bromide.

- (i) Predict what you would **see** in this reaction.
(ii) Write a balanced ionic equation for this reaction.

[2]

- (c) Lithium reacts with fluorine to form lithium fluoride.

- (i) Draw a 'dot and cross' diagram to show the bonding in lithium fluoride.

You should show all the electrons.

- (ii) Explain why lithium fluoride conducts electricity when molten but not as a solid.
(iii) State **one other** physical property of lithium fluoride.

[5]

13 **A3** This question is about the Periodic Table.

The diagram below shows part of the original Periodic Table first published by Mendeleev in 1869.

	Period 1	Period 2	Period 3	Period 4		Period 5	
Group 1	H	Li	Na	K	Cu	Rb	Ag
Group 2		Be	Mg	Ca	Zn	Sr	Cd
Group 3		B	Al	*	*	Y	In
Group 4		C	Si	Ti	*	Zr	Sn
Group 5		N	P	V	As	Nb	Sb
Group 6		O	S	Cr	Se	Mo	Te
Group 7		F	Cl	Mn	Br	*	I

The asterisks (*) show gaps in the table that Mendeleev deliberately left.

- (a) Which group of elements in a modern Periodic Table is missing from Mendeleev's Periodic Table?

.....[1]

- (b) Write two **other** differences between Mendeleev's original table and a modern Periodic Table.

.....

.....

.....

.....[2]

- (c) Find rubidium, Rb, in the Periodic Table provided on page 16.
Predict the reaction between rubidium and cold water.
Include observations and the chemical equation.

.....

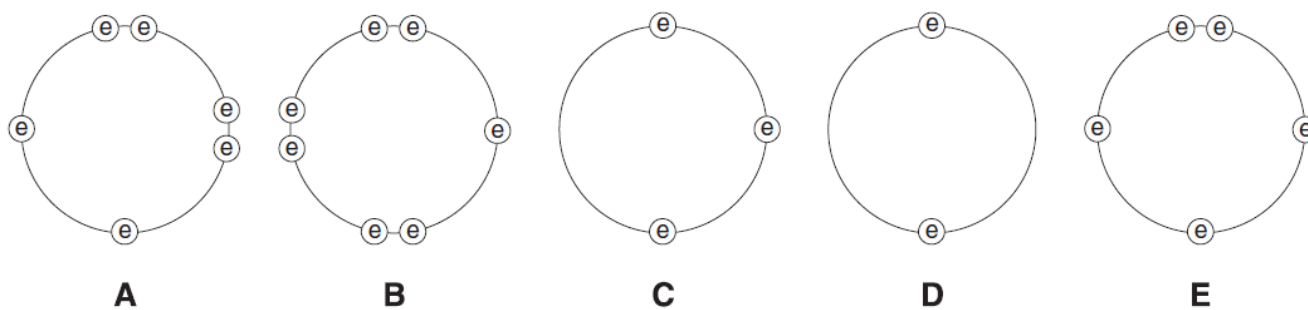
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.....

.....

.....[3]

- 14 1 These diagrams show the electron arrangement in the outer shells of five elements, **A** to **E**. All elements are from Period 3 of the Periodic Table.



- (a) Put the letters **A** to **E** in the table to show which elements are metals and which are non-metals.

	metals	non-metals
elements		

[2]

- (b) Which element is most likely to be in Group VI?

..... [1]

- (c) Which element will form an ion of the type X^{2+} ?

..... [1]

- (d) Which element has an atomic number of 15?

..... [1]

- (e) Which two elements will form an ionic compound with a formula of the type YZ_2 ?

..... [1]

[Total: 6 marks]