Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3430U20-1

S25-3430U20-1

FRIDAY, 13 JUNE 2025 – MORNING

SCIENCE (Double Award)

Unit 2 – CHEMISTRY 1
FOUNDATION TIER

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**5**	
3.	**7**	
4.	**9**	
5.	**6**	
6.	**6**	
7.	**7**	
8.	**6**	
9.	**3**	
10.	**6**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this examination paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **6** is a quality of extended response (QER) question where your writing skills will be assessed.

The Periodic Table is printed on the back cover of this paper and the formulae for some common ions on the inside of the back cover.

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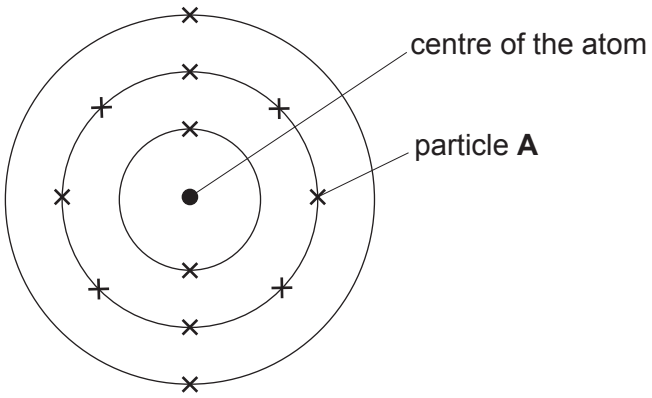
Answer **all** questions.

1. The diagram shows an atom of magnesium.



(a) Use the words in the box to complete the following sentences.

nucleus	**positive**	**neutral**	**negative**	**shell**

(i) The centre of the atom is called the ..... . [1]

(ii) Particle **A** has a ..... charge. [1]

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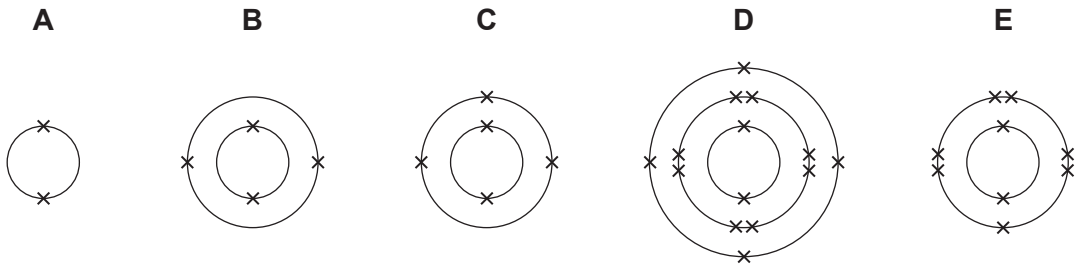
(b) The diagram shows the electronic structure of five different atoms, **A-E**.



A-E are not the chemical symbols for the atoms.

Give the letter that represents an atom

that contains five electrons .....

of an element in Group 7 of the Periodic Table .....

of an element in Period 3 of the Periodic Table ..... [3]

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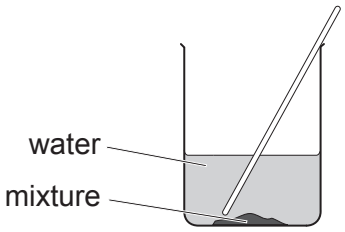
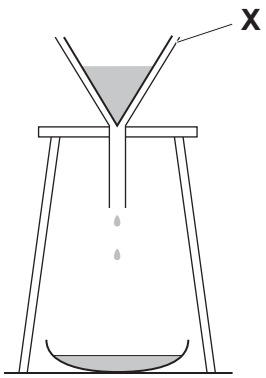
2. Gwion carried out an experiment to separate a mixture of sand and salt.

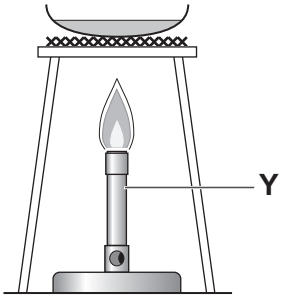
The diagrams show the stages of the experiment he carried out.



stage **1**



stage **2**



stage **3**

(a) Give the names of apparatus **X** and **Y** in the diagrams.

Choose the names from the box. [2]

beaker	**filter funnel**	**glass rod**
test tube	**Bunsen burner**	**evaporating basin**

Apparatus **X** .....

Apparatus **Y** .....

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(b) (i) In stage **1** the salt dissolves in water.

Tick (✓) the box next to the statement that describes why the salt dissolves. [1]

it decomposes ☐

it is soluble ☐

it evaporates ☐

(ii) Choose a word from the box to complete each of the following sentences. [2]

distillation	**filtration**	**neutralisation**	**evaporation**

The process used to remove the sand in stage **2** is

..... .

The process used to remove water in stage **3** is

..... .

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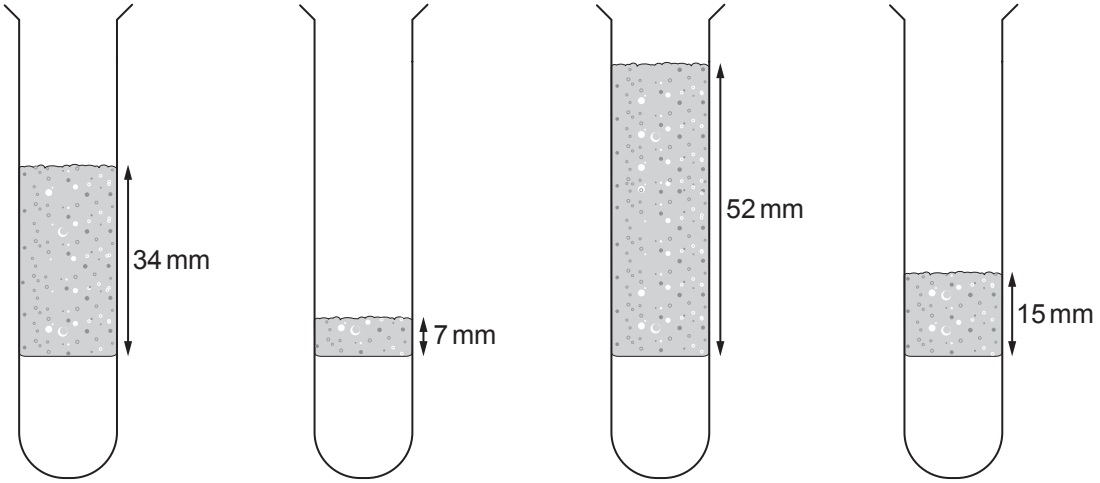
Turn over.

3. (a) A group of Year 10 students carried out an experiment to test the hardness of four water samples, **A-D**.

1 cm^3 of soap solution was added to 10 cm^3 of each water sample in a test tube. The test tubes were shaken 20 times.

The froth height for each sample is shown in the diagram below.



Sample **A** Sample **B** Sample **C** Sample **D**

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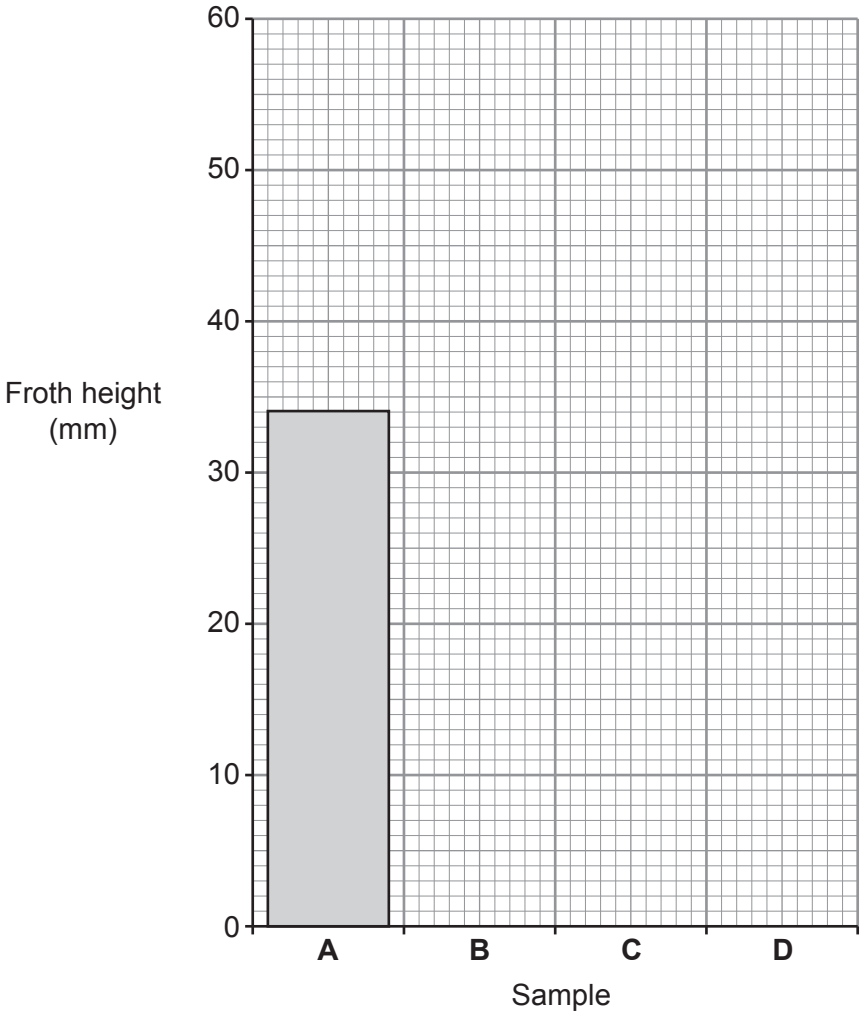
(i) Use the information in the diagram opposite to draw a bar chart of the results.

The first bar has been drawn for you. [2]



(ii) Use the results to determine the sample that contained the hardest water. Give a reason for your answer. [2]

Sample .....

Reason .....

.....

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(b) Tick (✓) the box next to the statement that gives an advantage of hard water. [1]

wastes soap ☐

strengthens bones and teeth ☐

forms fur in kettles ☐

cleans pipes ☐

(c) One method of removing the hardness from water is by boiling.

Tick (✓) the box next to the statement that gives another method that can be used to remove the hardness from water. [1]

add limescale ☐

add fluoride ☐

add washing soda ☐

(d) Calcium chloride causes hardness in water. It contains Ca^{2+} and Cl^{-} ions.

Give the formula of calcium chloride. [1]

.....

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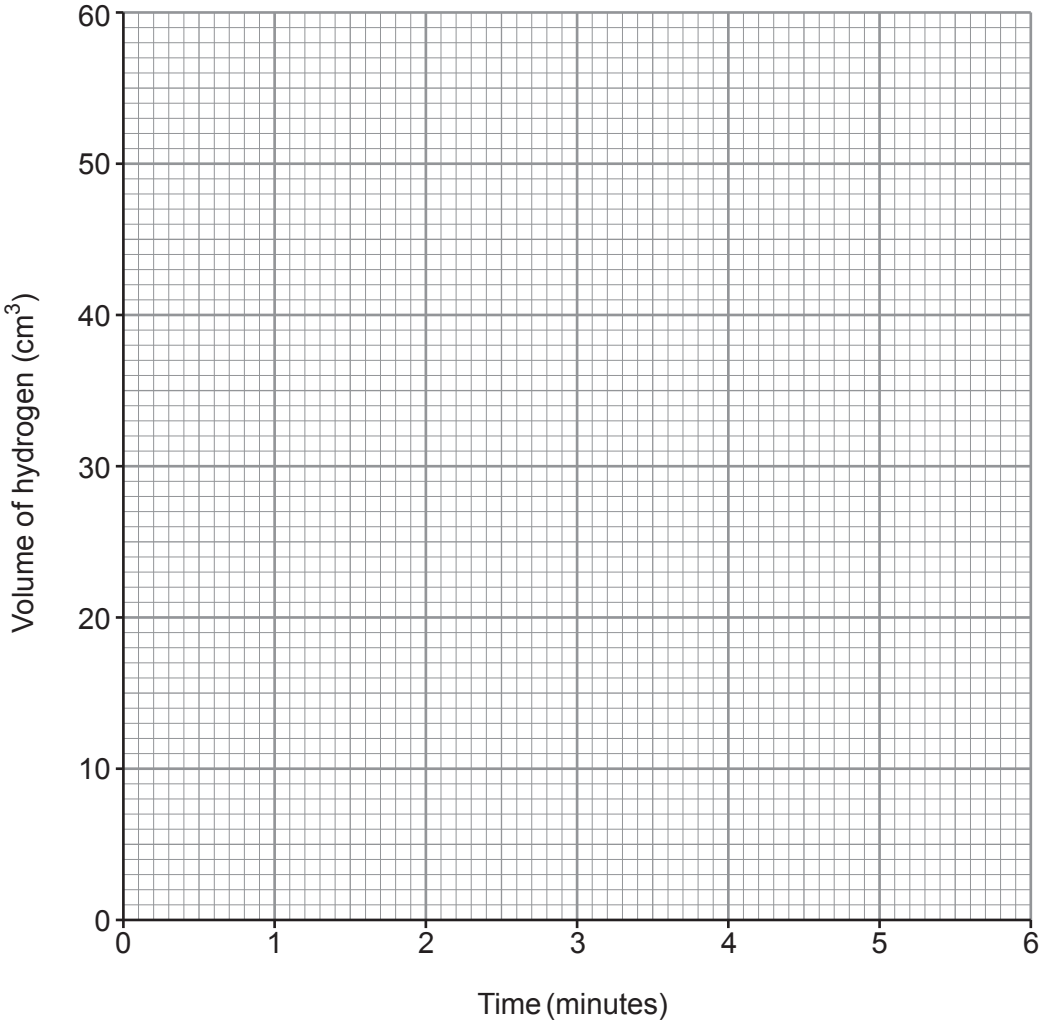
4. (a) Zinc reacts with dilute sulfuric acid to produce hydrogen gas.

A small piece of zinc was placed in excess dilute sulfuric acid at 20 °C. The volume of hydrogen produced was recorded every minute for 6 minutes and the results obtained are shown in the table.

Time (minutes)	0	1	2	3	4	5	6
Volume of hydrogen (cm^3)	0	19	33	43	49	50	50

(i) Plot the volume of hydrogen against time on the grid. Draw a suitable line. [3]



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(ii) Tick (✓) the box to show when the reaction stopped. [1]

between 4 and 5 minutes ☐

between 3 and 4 minutes ☐

between 5 and 6 minutes ☐

(b) Underline the correct word(s) in the brackets to complete each sentence. [3]

On repeating the experiment at a higher temperature, it takes **(less / the same / more)** time to produce 50 cm^3 of hydrogen.

At a higher temperature, the particles have **(less / the same / more)** energy.

This **(decreases / does not affect / increases)** the chance of successful collisions between the reacting particles.

(c) The reaction between zinc and dilute sulfuric acid produces zinc sulfate.

Calculate the relative formula mass (M_r) of zinc sulfate, $ZnSO_4$. [2]

$A_r(Zn) = 65$ $A_r(S) = 32$ $A_r(O) = 16$

M_r = ...

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5. (a) Since 2020, hot tubs have been installed in many homes in the UK.

The water in these tubs needs to be treated with chlorine every week to kill bacteria that can live in the water. A high concentration of chlorine is toxic to humans.

The table shows the time taken for different concentrations of chlorine to kill the bacteria in water at 20 °C.

Concentration of chlorine (mg / l)	Time to kill bacteria (minutes)
1.0	90
2.0	70
3.0	50
4.0	40
5.0	30
6.0	30

mg / l = milligrams per litre

(i) Tick (✓) the box next to the correct statement. [1]

1 mg / l chlorine takes 40 minutes longer to kill bacteria than 2 mg / l chlorine ☐

2 mg / l chlorine takes 30 minutes longer to kill bacteria than 3 mg / l chlorine ☐

3 mg / l chlorine takes 20 minutes longer to kill bacteria than 4 mg / l chlorine ☐

4 mg / l chlorine takes 10 minutes longer to kill bacteria than 5 mg / l chlorine ☐

(ii) State why there is no benefit to using 6 mg / l chlorine rather than 5 mg / l chlorine. [1]

.....

.....

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(iii) A hot tub holds 1500 litres of water.

Use the table opposite. Calculate the minimum mass of chlorine that would need to be added to this hot tub to kill the bacteria in 40 minutes.

Tick (✓) the correct box. [1]

6000 mg	☐
6500 mg	☐
7000 mg	☐
7500 mg	☐

(b) Chlorine reacts with sodium to produce sodium chloride.

(i) Balance the equation for this reaction by putting numbers in the boxes. [1]

☐ Na + Cl_2 ⟶ ☐ NaCl

(ii) Dylan calculated that if he reacted 7.1 g of chlorine with sodium, then 11.7 g of sodium chloride would be produced.

In an experiment, only 9.4 g of sodium chloride was produced.

Use the following formula to calculate the percentage yield for this reaction.

$$\text{percentage yield} = \frac{\text{actual mass of sodium chloride}}{\text{expected mass of sodium chloride}} \times 100$$ [2]

Percentage yield = ... %

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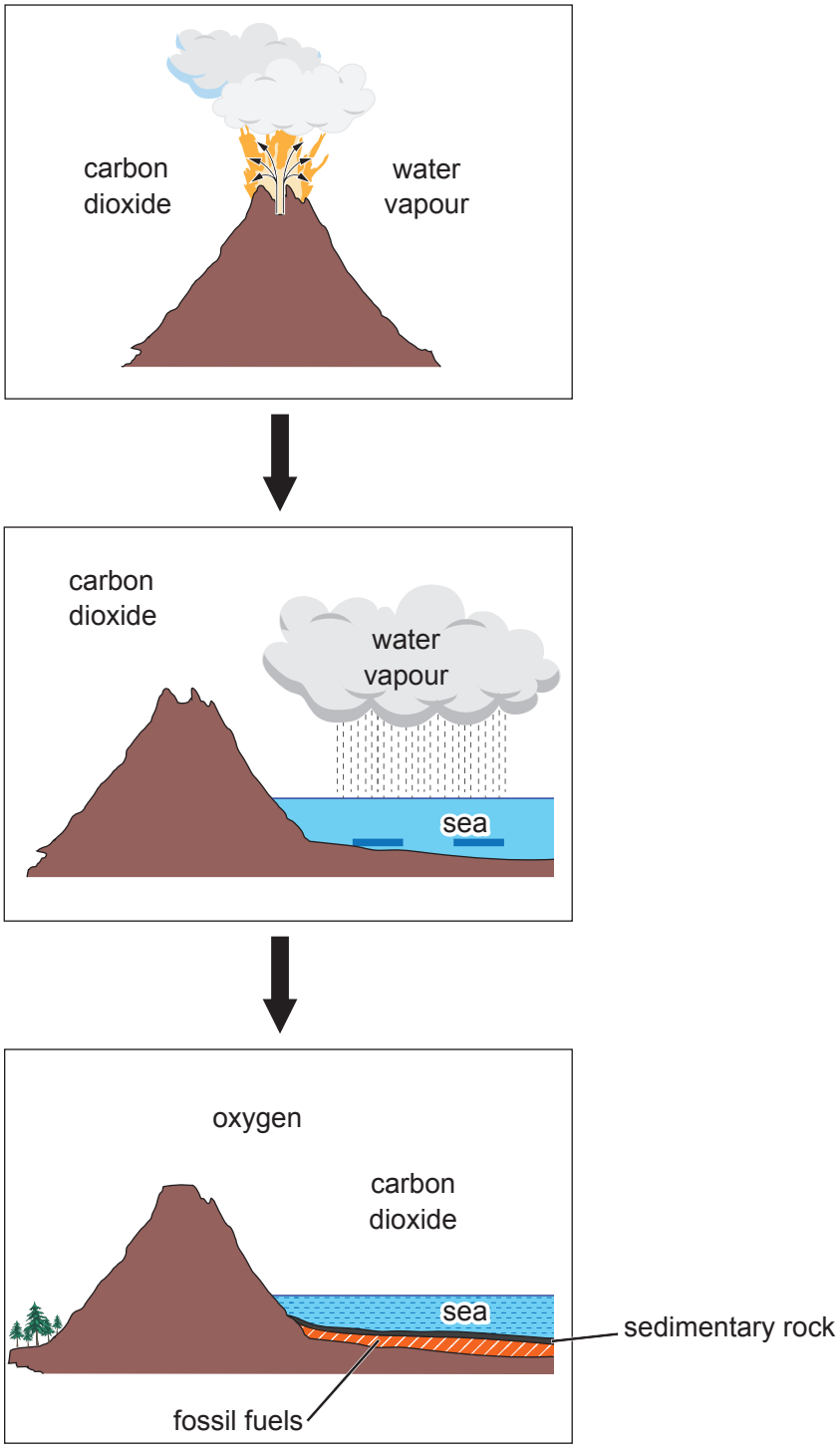
6. The Earth's atmosphere is very different to when it first formed.

The diagrams show some of the changes that happened over billions of years.



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Use the diagrams to explain how the levels of carbon dioxide, water vapour and oxygen changed over geological time. [6 QER]

6

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7. Potassium and lithium react with water.

(a) (i) State **one** observation seen when potassium and lithium react with water. [1]

.....

(ii) State **one** difference in the observations seen. [1]

.....

(b) When potassium reacts with water, the alkali potassium hydroxide and hydrogen gas are produced.

(i) Complete the symbol equation for this reaction by

- giving the formula of potassium hydroxide
- putting a number in the box to balance the equation. [2]

$$2K + \boxed{}\ H_2O \longrightarrow 2\ \ldots\ldots\ldots\ldots + H_2$$

(ii) Universal indicator is added to the solution at the end of the reaction to show that an alkali has been made.

State the colour of the universal indicator at the end of the reaction. [1]

.....

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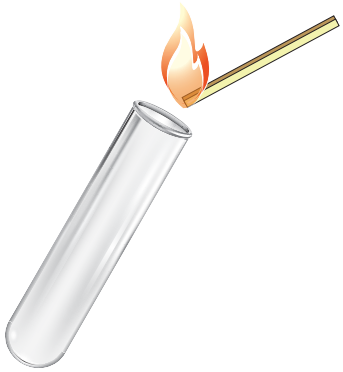
(c) State what you would observe when a lit splint is placed in a test tube containing hydrogen gas. [1]



.....

(d) Rubidium is below potassium in Group 1 of the Periodic Table.

Tick (✓) the box next to the statement that describes the reactivity of rubidium. [1]

same reactivity as potassium ☐

more reactive than potassium ☐

less reactive than potassium ☐

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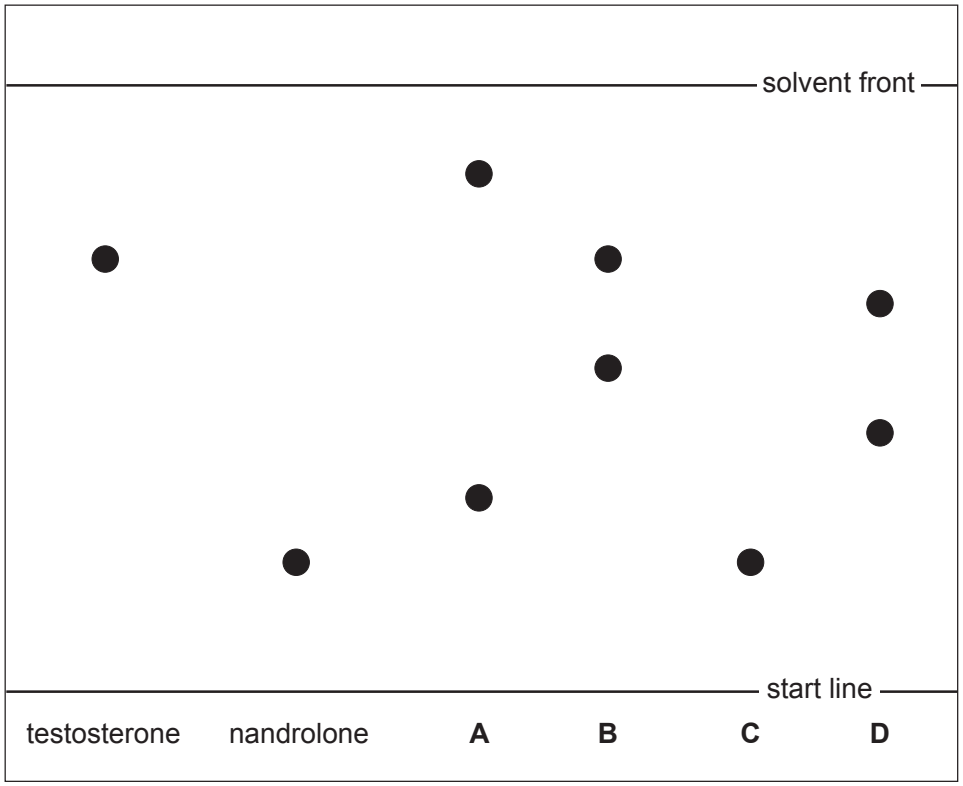
8. (a) Testosterone and nandrolone are anabolic steroids, which have been used by some athletes to enhance performance. Chromatography can be used to test if athletes have taken these steroids.

Urine samples from four athletes, **A-D**, were tested to find out whether they have taken testosterone or nandrolone.

The chromatogram shows the results obtained.



(i) Measure the required distances and find the R_f value of the spot given by testosterone. [1]

$$R_f = \frac{\text{distance travelled by spot}}{\text{distance travelled by solvent front}}$$

R_f = ...

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(ii) State the conclusions that can be drawn about athletes **A-D**. [3]

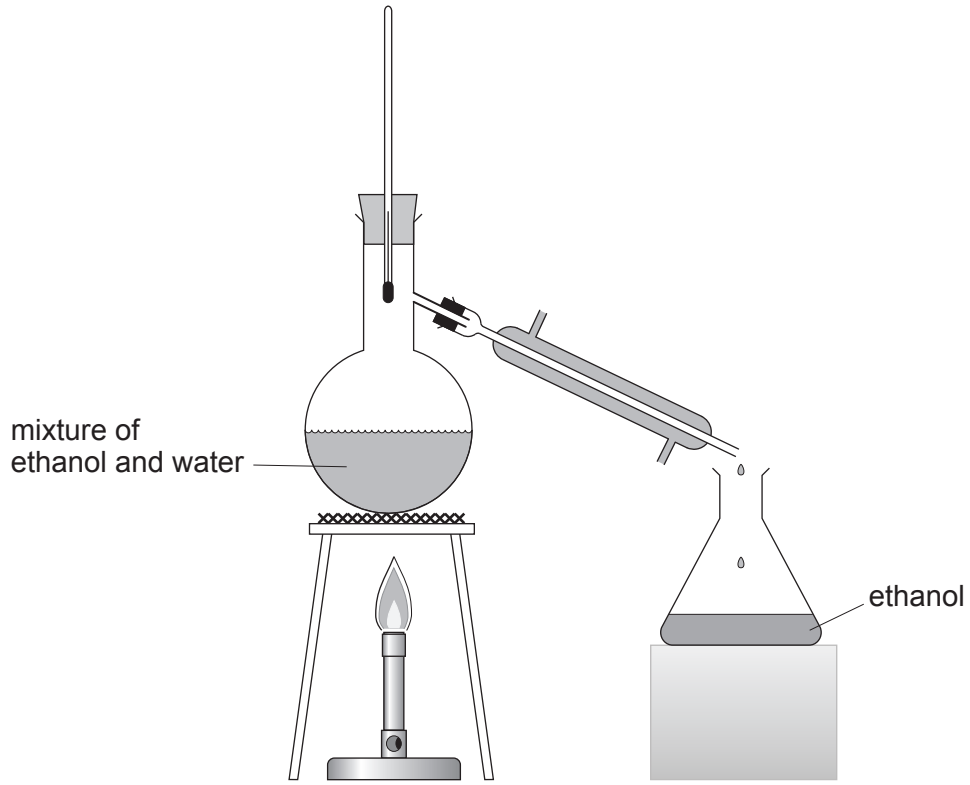
.....

.....

.....

.....

(b) Ethanol can be separated from water by distillation using the apparatus shown.



Explain why ethanol can be separated from water by distillation. [2]

.....

.....

.....

.....

6

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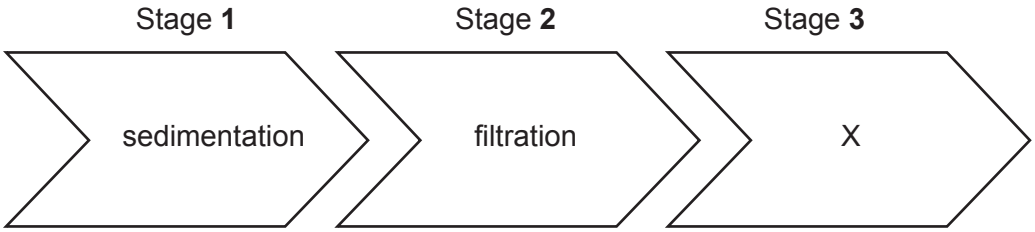
9. Drinking water needs to be treated and purified before it is safe to drink.

The diagram shows the three main stages in the treatment of water before it enters the mains water system.



(a) Describe what happens in stage **1**. [1]

.....

.....

(b) Stage **3** makes water safe to drink.

Name the substance that is added to water in stage **3** and state why this makes water safe to drink. [2]

.....

.....

3

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10. (a) A Year 10 class carried out two tests to identify compounds **X** and **Y**.

Some of their results and conclusions are shown in the table.

Compound	Flame test		Add silver nitrate solution	
	Observation	Symbol of ion	Observation	Symbol of ion
X	yellow flame seen	.....	....	Cl^-
Y	....	K^+	yellow precipitate formed	I^-

Both compounds contain only two ions.

(i) Use the information given to **complete the table**. [3]

(ii) Name compound **Y**. [1]

.....

(b) Complete the symbol equation for the reaction between silver nitrate solution and lithium bromide solution by writing the formulae for the products. [2]

silver nitrate + lithium bromide ⟶ silver bromide + lithium nitrate

$AgNO_3$ + LiBr ⟶ ..... + ...

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END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
aluminium	Al^{3+}	bromide	Br^-
ammonium	NH_4^+	carbonate	CO_3^{2-}
barium	Ba^{2+}	chloride	Cl^-
calcium	Ca^{2+}	fluoride	F^-
copper(II)	Cu^{2+}	hydroxide	OH^-
hydrogen	H^+	iodide	I^-
iron(II)	Fe^{2+}	nitrate	NO_3^-
iron(III)	Fe^{3+}	oxide	O^{2-}
lithium	Li^+	sulfate	SO_4^{2-}
magnesium	Mg^{2+}		
nickel	Ni^{2+}		
potassium	K^+		
silver	Ag^+		
sodium	Na^+		
zinc	Zn^{2+}		

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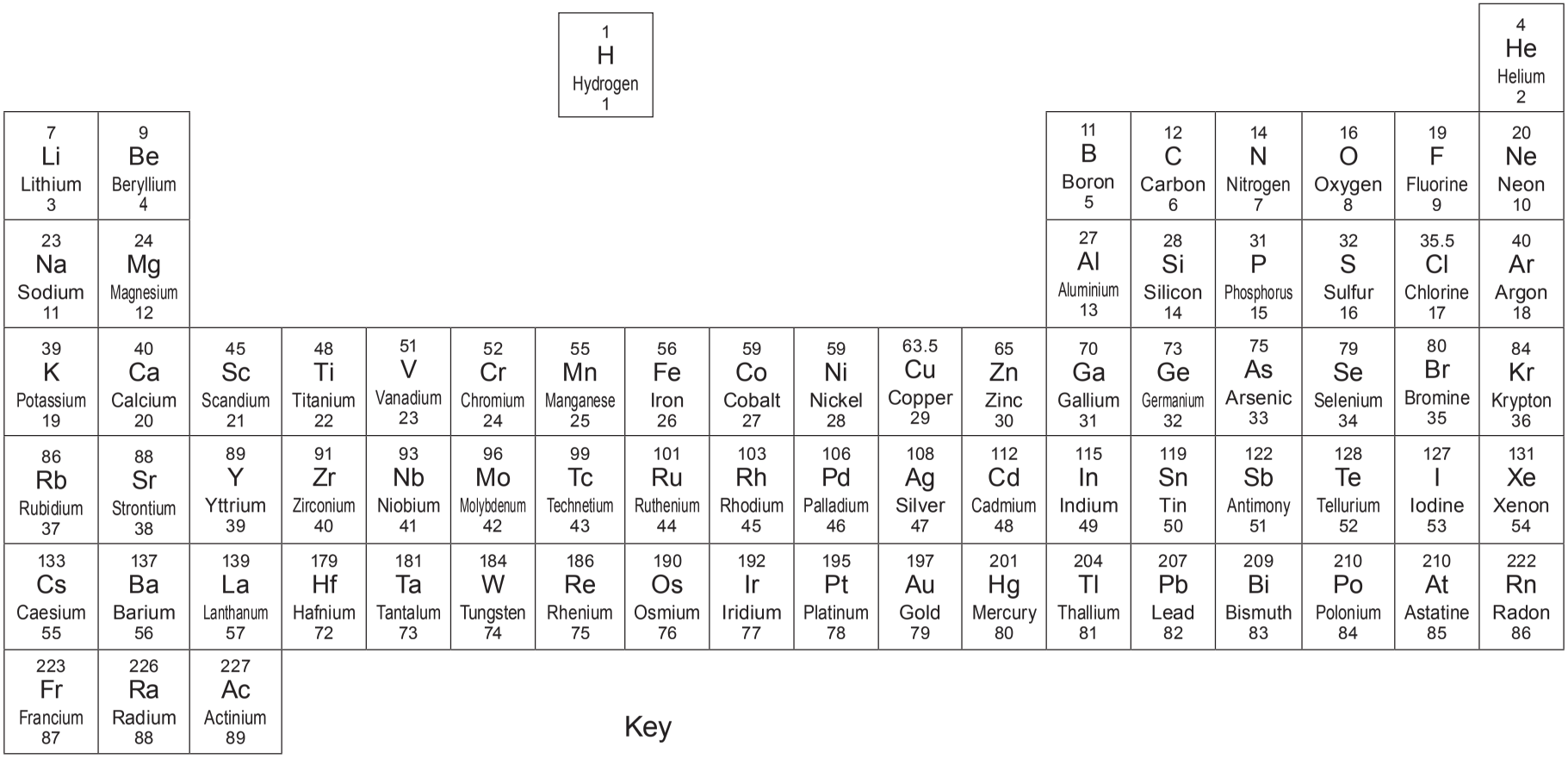
THE PERIODIC TABLE



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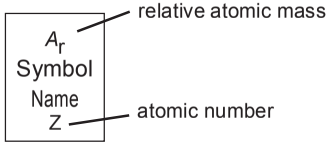

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