GCSE

3410U10-1

FRIDAY, 16 JUNE 2023 – MORNING

CHEMISTRY – Unit 1:

Chemical Substances, Reactions and Essential Resources
FOUNDATION TIER

1 hour 45 minutes plus your additional time allowance

Surname _____

First name(s) _____

Centre Number _____

Candidate Number 0 _____

ADDITIONAL MATERIALS

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

ITEMS INCLUDED WITH QUESTION PAPER

A separate Data Booklet.

A separate Diagram Booklet.

The Diagram Booklet MUST be handed in to the invigilators and sent for marking.

INSTRUCTIONS TO CANDIDATES

Use black ink, black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces provided on the front cover.

Answer ALL questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional pages 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.

The assessment of the quality of extended response (QER) will take place in question 5(b).

The Periodic Table and the formulae for some common ions are printed in the separate Data Booklet.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**8**	
3.	**7**	
4.	**10**	
5.	**9**	
6.	**6**	
7.	**5**	
8.	**8**	
9.	**9**	
10.	**11**	
Total	**80**	

Answer ALL questions.

1. (a) DIAGRAMS 1.1, 1.2, 1.3 and 1.4 in the separate diagram booklet show four methods, A, B, C and D, used to separate different mixtures.

(i) Choose from the box below the names of methods B and D. [2 marks]

distillation	chromatography	
filtration	evaporation	boiling

Method B _____

Method D _____

(ii) Give the letter, A, B, C or D, of the method used to [3 marks]

remove sand from water _____

obtain pure water from sea water _____

separate red and yellow dyes _____

1 (b) **Sodium carbonate reacts with dilute hydrochloric acid forming sodium chloride, water and carbon dioxide.**

DIAGRAMS 1.5 and 1.6 in the separate diagram booklet show the apparatus before and after sodium carbonate is added to hydrochloric acid.

Tick (✓) TWO observations that show a chemical reaction is taking place. [2 marks]

- ☐ **The solid stays the same**
- ☐ **A gas is formed**
- ☐ **A temperature change occurs**
- ☐ **The mass of the beaker and contents stays the same**

7

2 (a) **Atoms contain particles called protons, neutrons and electrons. DIAGRAM 2.1 in the separate diagram booklet shows a model of an atom of boron.**

State whether the statements in TABLE 2.2 in the separate diagram booklet are TRUE or FALSE. [4 marks]

(b) **The formula of boron trioxide is B_2O_3.**

Calculate the relative formula mass (M_r) of boron trioxide. [2 marks]

A_r(B) = 11

A_r(O) = 16

Relative formula mass = _____

2 (c) DIAGRAM 2.3 in the separate diagram booklet represents atoms of boron and fluorine.

Boron trifluoride has the formula BF_3.

Look at DIAGRAM 2.4 in the separate diagram booklet. Choose the LETTER that represents a molecule of boron trifluoride. [1 mark]

Letter _____

(d) Magnesium fluoride contains the ions Mg^{2+} and F^-.

UNDERLINE the correct formula for magnesium fluoride. [1 mark]

Mg2F Mg_2F MgF^2 MgF_2

8

3 (a)(i) **DIAGRAM 3.1 in the separate diagram booklet shows the position of the Earth's continents today.**

In 1912 Alfred Wegener suggested that all the continents must once have been joined together as one big land mass.

Look at DIAGRAM 3.2 in the separate diagram booklet. A, B and C show the position of the Earth's continents 50 million, 100 million and 150 million years ago, but not necessarily in that order.

Give the letter, A, B or C, which shows the position of the Earth's continents 150 million years ago. [1 mark]

Letter _____

3 (a)(ii)

Wegener's theory of continental drift was not accepted by other scientists until several years after his death in 1930. The evidence to support his theory was found in 1960 when part of the ocean floor was surveyed around a plate boundary. TABLE 3.3 in the separate diagram booklet shows data collected from the survey.

Calculate the mean speed at which the ocean floor is spreading. [1 mark]

$$\text{mean speed (km / million years)} = \frac{\text{distance (km)}}{\text{time (million years)}}$$

Mean speed = _____ km / million years

3 (a)(iii)

DIAGRAM 3.4 in the separate diagram booklet is a map that shows some information about tectonic plates and three locations, X, Y and Z.

Give the LETTER of the location you would expect to have earthquakes but not volcanic eruptions. [1 mark]

Letter _____

(b) **DIAGRAM 3.5 in the separate diagram booklet is a photograph that shows 'pillow lava' which was formed from volcanoes on the sea bed at a CONSTRUCTIVE plate boundary millions of years ago.**

(i) **Look at DIAGRAM 3.6 in the separate diagram booklet. A, B and C show different plate boundaries. Give the letter, A, B or C, that shows a constructive plate boundary where the pillow lava was formed. [1 mark]**

Letter _____

3 (b)(ii)

Complete the sentences by <u>UNDERLINING</u> the correct word(s) in the brackets. [2 marks]

Pillow lava is formed at a constructive plate boundary when (magma / sea water / crust) rises and cools, forming new rock.

The movement of the Earth's tectonic plates is caused by (electric currents / convection currents / ocean currents) within the mantle.

3 (c) **Charles Richter developed the Richter Scale in 1935 to measure the strength of earthquakes.**

In June 2018 an earthquake occurred in the Caernarfon area, with a minor tremor being felt.

Look at DIAGRAM 3.7 in the separate diagram booklet. Circle the number below that best shows the size of the earthquake in Caernarfon. [1 mark]

1 4 6 8

7

4 **Dilute hydrochloric acid reacts with magnesium forming magnesium chloride and hydrogen gas.**

(a) **Tick (✓) the box next to the correct equation for the reaction between magnesium and hydrochloric acid. [1 mark]**

☐ $Mg + HCl \longrightarrow MgCl_2 + H$

☐ $Mg + 2HCl \longrightarrow MgCl_2 + 2H$

☐ $Mg + 2HCl \longrightarrow MgCl_2 + H_2$

4 (b) **DIAGRAM 4.1 in the separate diagram booklet shows an experiment.**
Osian wanted to find out how changing the concentration of the acid affects the rate of the reaction. He carried out five experiments at room temperature (20 °C). He added a 4 cm piece of magnesium ribbon to 100 cm^3 of hydrochloric acid of five different concentrations. He recorded the time it took to half-fill a test tube with gas.

His results are shown in TABLE 4.2 in the separate diagram booklet.

(i) **Plot the acid concentration against time on GRAPH 4.3 in the separate diagram booklet and draw a suitable line.**

One point has been plotted for you. [3 marks]

4 (b)(ii)

<u>UNDERLINE</u> the correct word(s) in the brackets to complete the following sentences. [2 marks]

As the acid concentration increases,

the TIME to half-fill the test tube with gas

(increases / stays the same / decreases).

As the acid concentration increases,

the RATE of the reaction

(increases / stays the same / decreases).

4 (b)(iii)

Using your knowledge of particle theory, UNDERLINE the correct words in the brackets to complete the following sentence. [2 marks]

At a higher concentration, there are

(more / less / the same number of)

particles present so there will be

(an equal / a smaller / a greater)

chance of collision.

4 (b)(iv)

There are other ways the rate of the reaction can be changed.

Tick (✓) the TWO statements that correctly describe other ways the rate of reaction can be increased. [2 marks]

- ☐ **Increasing the temperature of the acid**
- ☐ **Using a lump of magnesium**
- ☐ **Using a different apparatus**
- ☐ **Using magnesium powder**
- ☐ **Decreasing the temperature of the acid**

10

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$CaCO_3$
+

5 (a) **Look at DIAGRAMS 5.1 and 5.2 in the separate diagram booklet.**
A student carried out a two-stage experiment to change limestone (calcium carbonate) into slaked lime (calcium hydroxide).

(i) **On the opposite page, write the formulae for calcium oxide and carbon dioxide to complete the equation for the reaction taking place in stage 1. [2 marks]**

(ii) **Calcium hydroxide contains one Ca^{2+} ion for every two OH^- ions.**

Write the chemical formula for calcium hydroxide. [1 mark]

5 (b) **Look at DIAGRAM 5.3 in the separate diagram booklet. Describe the economic benefits and environmental drawbacks of limestone quarrying. [6 marks QER]**

continue answer on the next page

9

6 (a) **Look at DIAGRAM 6.1 in the separate diagram booklet. Rhian investigated the decomposition of three different metal carbonates.**

She measured the time taken for limewater to turn milky using the apparatus shown in DIAGRAM 6.1.

Her results are shown in TABLE 6.2 in the separate diagram booklet.

(i) **Place the carbonates in order of stability. [1 mark]**

Most stable _____

_____

Least stable _____

6 (a)(ii)

If sodium carbonate was used in the investigation the limewater would not turn milky however long it was heated.

Tick (✓) the reason why the limewater would not turn milky. [1 mark]

- ☐ **Sodium carbonate only decomposes a small amount on heating**
- ☐ **Sodium carbonate is very unstable**
- ☐ **Sodium carbonate does not decompose on heating**
- ☐ **Sodium carbonate decomposes too quickly**

6 (a)(iii) On heating copper(II) carbonate, Rhian expected to make 5.0 g of copper(II) oxide. She actually made 3.5 g.

Use the formula below to calculate the percentage yield of copper(II) oxide in her experiment. [2 marks]

$$\text{percentage yield} = \frac{\text{actual mass}}{\text{expected mass}} \times 100$$

Percentage yield = _____ %

(iv) One of the ions present in copper(II) carbonate is CO_3^{2-}. [1 mark]

Give the formula of the other ion present.

_____

6 (b) **Rhian carried out a flame test to show that sodium carbonate contains sodium ions.**

Give the colour of the flame seen. [1 mark]

_____

6

7 Is it right to waste helium on party balloons?

Helium is a colourless inert gas found in Group 0 of the Periodic Table.

Helium is one of the commonest elements in the Universe, second only to hydrogen. However, on Earth it is relatively rare, as shown in TABLE 7.1 in the separate diagram booklet.

Gases which have a density less than air can escape the Earth's gravity and leak away into space. The density of air is $1.2\,g/m^3$. BAR CHART 7.2 in the separate diagram booklet shows the densities of Group 0 gases.

Helium has the lowest boiling point of any element. This makes it of key importance for magnets used in hospital MRI scanners, which must be super-cooled to generate the hugely powerful magnetic fields required.

Some scientists believe that because helium is a finite resource it should not be used for party balloons.

7 (a) Answer the following questions using the information given.

(i) Tick (✓) the box next to the MOST important property that makes helium a suitable material to fill FLOATING party balloons. [1 mark]

- ☐ **Helium is a gas**
- ☐ **Helium is the second most common element in the Universe**
- ☐ **Helium is less dense than air**
- ☐ **Helium is colourless**

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

- ☐ **The Earth's atmosphere contains more helium than argon**
- ☐ **The Earth's atmosphere contains more xenon than helium**
- ☐ **The Earth's atmosphere contains more helium than krypton**

7 (a) continued

(iii) Tick (✓) the box next to the BEST reason for not using helium to fill party balloons. [1 mark]

- ☐ **There isn't much helium in the Earth's atmosphere**
- ☐ **Scientists say helium shouldn't be used to fill balloons**
- ☐ **Helium is a finite resource**

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

- ☐ **Only helium gas can leak away into space**
- ☐ **Helium and neon gases can leak away into space**
- ☐ **Only argon can leak away into space**
- ☐ **All inert gases can leak away into space**

7 (b) **TABLE 7.3 in the separate diagram booklet shows the electronic structure of three Group 0 elements.**

Tick (✓) the box next to the statement that BEST explains why Group 0 elements are unreactive. [1 mark]

- ☐ **All Group 0 elements have 2 electrons in their inner shell**
- ☐ **All Group 0 elements have 8 electrons in their outer shell**
- ☐ **All Group 0 elements have full outer shells**
- ☐ **All Group 0 elements have some full shells**

5

8 (a) Look at GRAPH 8.1 in the separate diagram booklet. Three samples of water, A, B and C, from different parts of the UK were tested in a laboratory.

1 cm^3 of soap solution was added to 25 cm^3 of the three different water samples. Each sample was shaken for 1 minute. The height of the froth was measured.

The experiment was repeated using new samples of water, A, B and C, that had been boiled.

Use the information in GRAPH 8.1. Give the LETTER of the water sample which is [2 marks]

temporary hard water _____

permanent hard water _____

soft water _____

8 (b) **There are advantages and disadvantages of living in a hard water area.**

Give TWO disadvantages of living in a hard water area. [2 marks]

1. _____

_____

_____

2. _____

_____

_____

8 (c) **GRAPH 8.2 in the separate diagram booklet shows the solubility of lead nitrate in water at different temperatures.**

(i) **State what point X on the graph tells you about lead nitrate. [1 mark]**

_____

_____

_____

(ii) **The solubility of lead nitrate at 20 °C is 53 g per 100 g of water.**

Use the graph to find its solubility at 50 °C and hence calculate the mass of lead nitrate crystals that form when a saturated solution containing 100 g of water cools from 50 °C to 20 °C. [2 marks]

Mass = _____ g

8 (c)(iii)

Use GRAPH 8.2 to find the solubility of lead nitrate at 5 °C. [1 mark]

_____ **g per 100 g of water**

8

9 (a) **DIAGRAM 9.1 in the separate diagram booklet shows an outline of part of the Periodic Table.**

The letters shown are NOT the chemical symbols of the elements.

Choose LETTERS from the diagram to complete TABLE 9.2 in the separate diagram booklet. [4 marks]

(b) **DIAGRAM 9.3 in the separate diagram booklet shows the electronic structure of an element in the Periodic Table.**

Draw a diagram in the space below to show the electronic structure of the element which lies directly ABOVE it. [1 mark]

9 (c) **TABLE 9.4 in the separate diagram booklet shows information about atoms X, Y and Z.**

(i) **Complete the table. [3 marks]**

(ii) **UNDERLINE the term used to describe atoms Y and Z. [1 mark]**

ions inert insoluble isotopes

9

10 (a) **TABLE 10.1 in the separate diagram booklet shows information about some Group 1 elements.**

Use the information in the table to answer parts (i) and (ii).

(i) **State the information which explains why the elements have similar chemical properties.**
[1 mark]

_____

_____

(ii) **State which PROPERTY has a value which does NOT fit the trend down the group.**
[1 mark]

_____

10 (b) The flow diagram in DIAGRAM 10.2 in the separate diagram booklet shows some reactions of sodium.

(i) State how REACTION 1 is prevented when storing sodium in the laboratory. [1 mark]

_____

_____

(ii) Give the names of alkaline solution A and gas B. [2 marks]

_____

and

_____

(iii) Name the Group 1 metal which would react LEAST violently with water. [1 mark]

_____

(iv) Complete the symbol equation for REACTION 3. [1 mark]

$2Na + F_2 \longrightarrow 2$ _____

10 (c) **Sodium fluoride is added to some UK public water supplies to reduce tooth decay in children.**

In America sodium hexafluorosilicate, Na_2SiF_6, is more commonly used. The relative formula mass of sodium hexafluorosilicate is 188.

(i) **Calculate the percentage of fluorine in sodium hexafluorosilicate. [2 marks]**

A_r(F) = 19 **M_r(Na_2SiF_6) = 188**

Percentage = _____ %

10 (c)(ii)

State an ETHICAL reason why some people oppose the fluoridation of water supplies. [1 mark]

(iii) **Apart from water supplies, state the most commonly used source of fluoride to reduce tooth decay. [1 mark]**

11

END OF PAPER

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

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FRIDAY, 16 JUNE 2023 – MORNING

CHEMISTRY – Unit 1:

Chemical Substances, Reactions and Essential Resources
FOUNDATION TIER

1 hour 45 minutes plus your additional time allowance

DIAGRAM BOOKLET

This Diagram Booklet MUST be handed in to the invigilators and sent for marking.

Surname _____

First name(s) _____

Centre Number _____

Candidate Number 0 _____

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DIAGRAM 1.1 – Method A

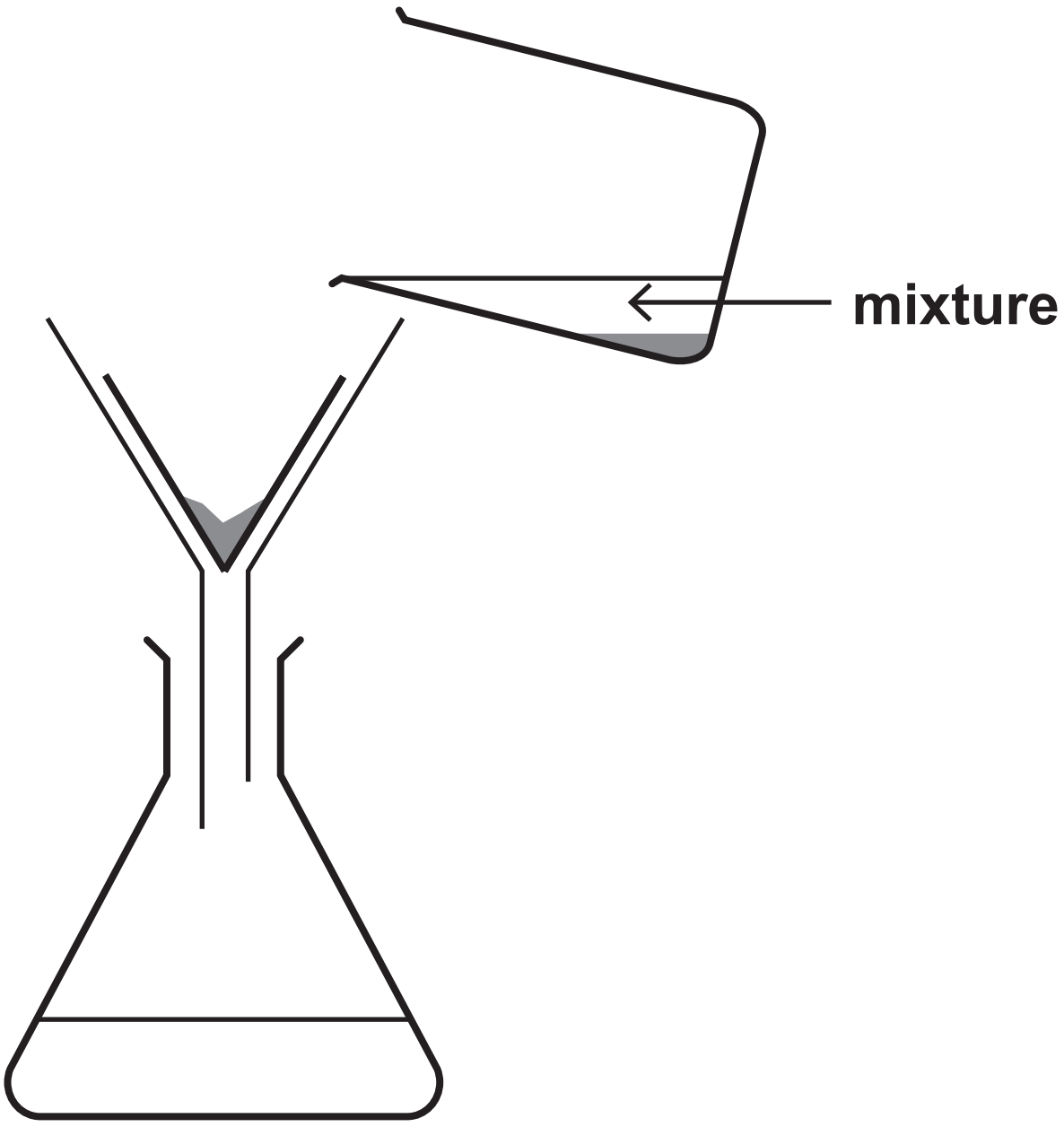

DIAGRAM 1.2 – Method B

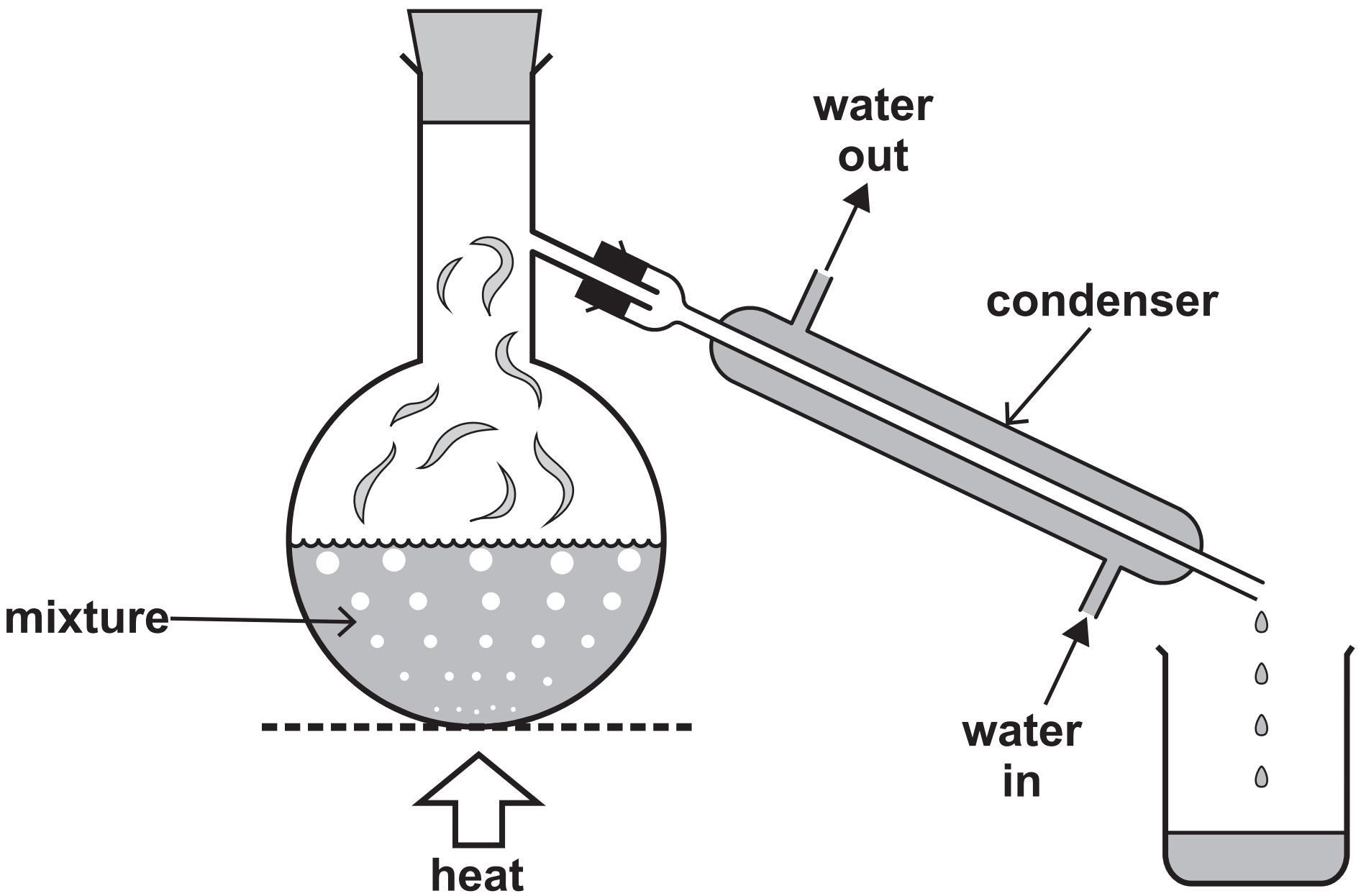

DIAGRAM 1.3 – Method C

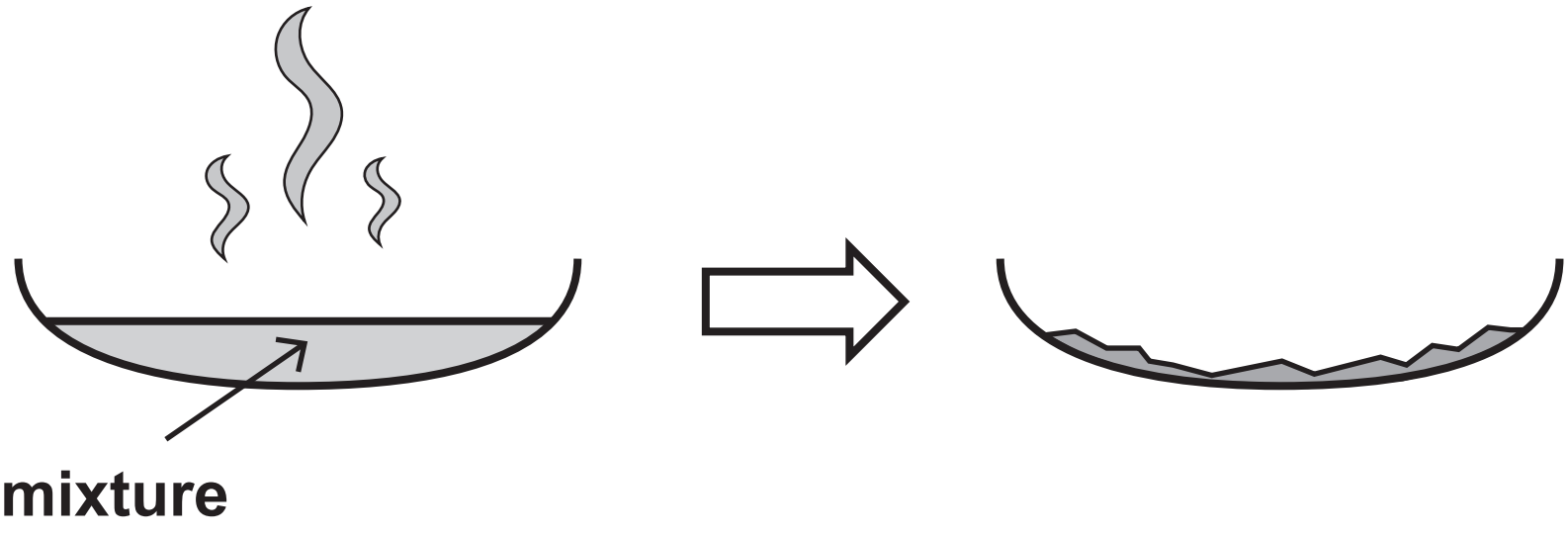

DIAGRAM 1.4 – Method D

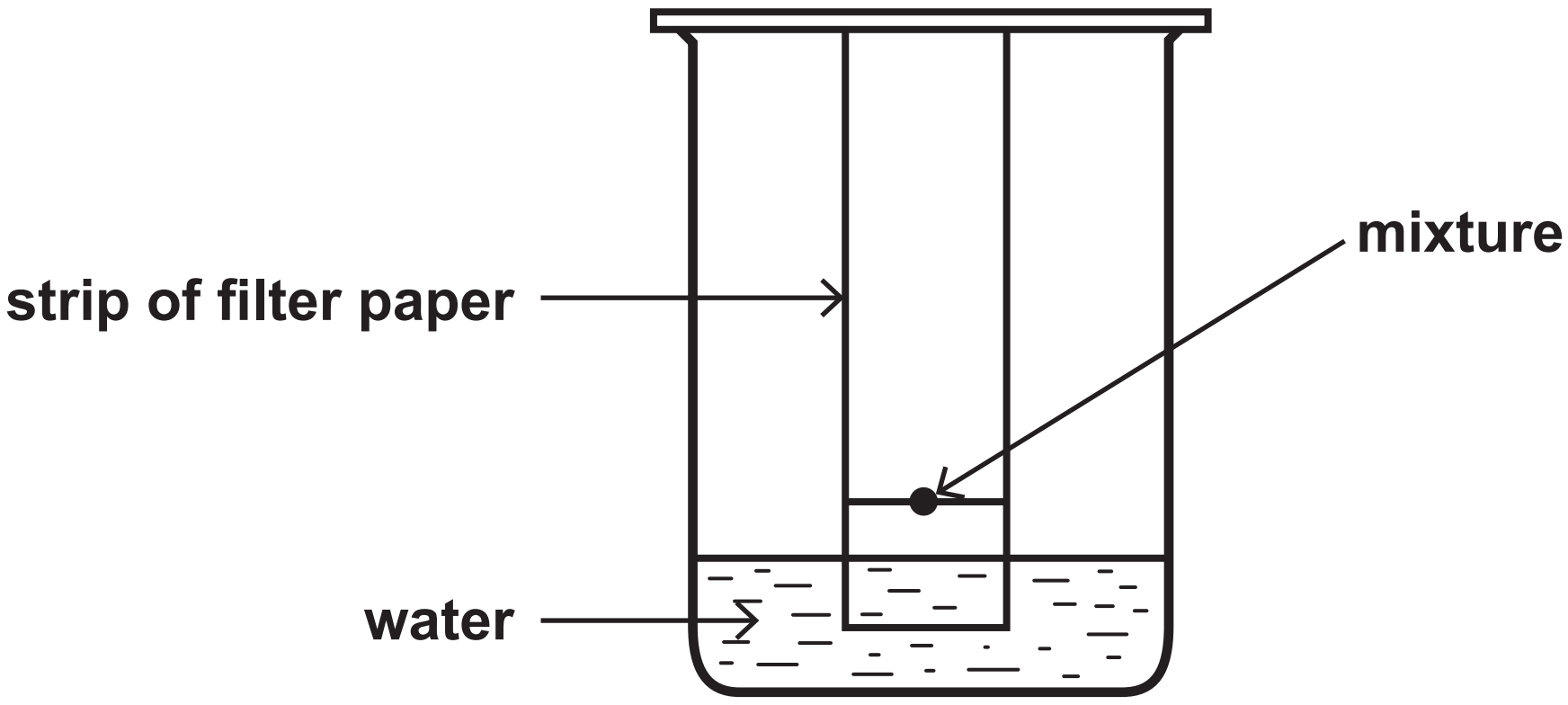

DIAGRAM 1.5 – BEFORE ADDING

temperature = 25 °C

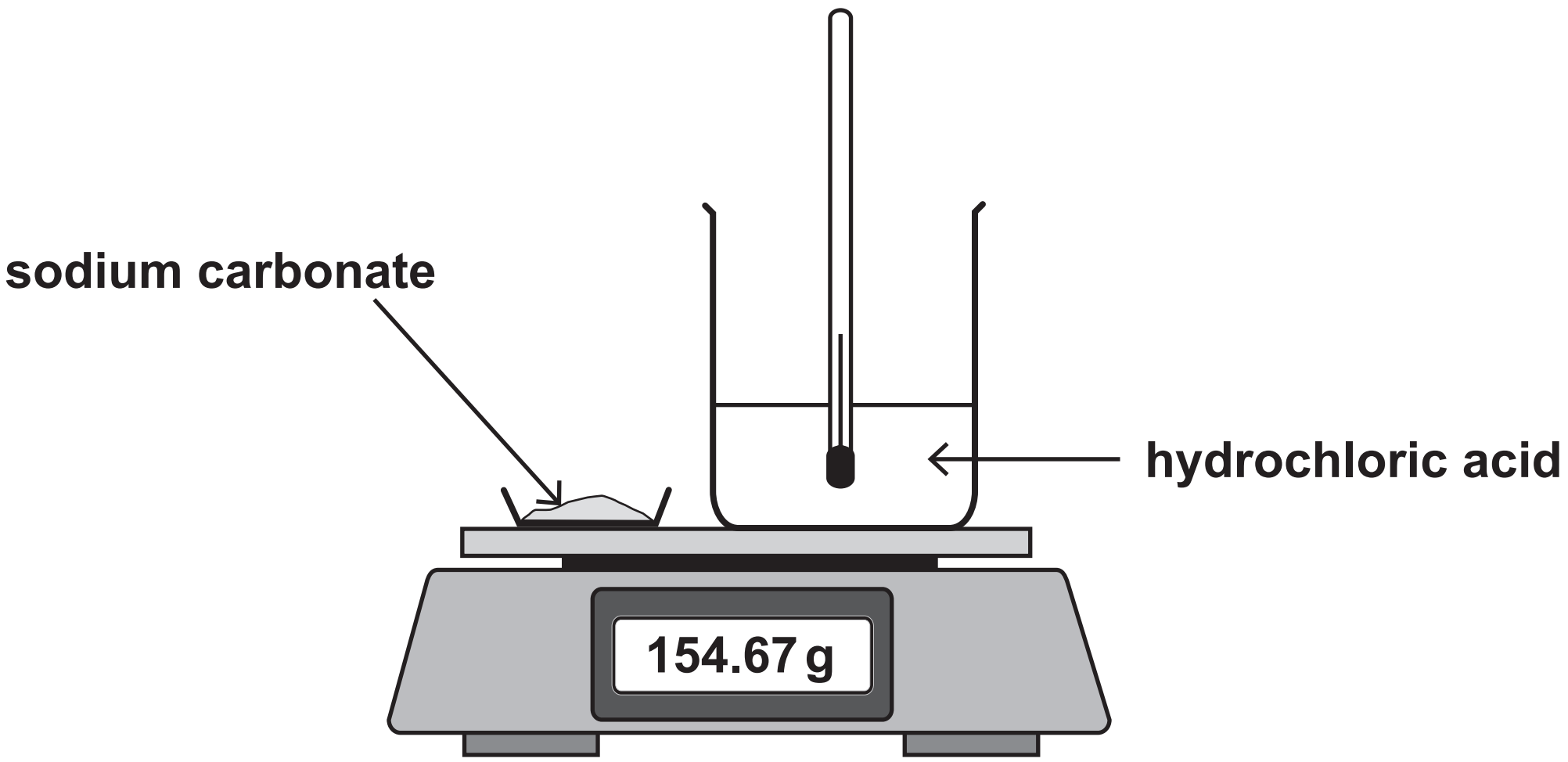

DIAGRAM 1.6 – AFTER ADDING

temperature = 30 °C

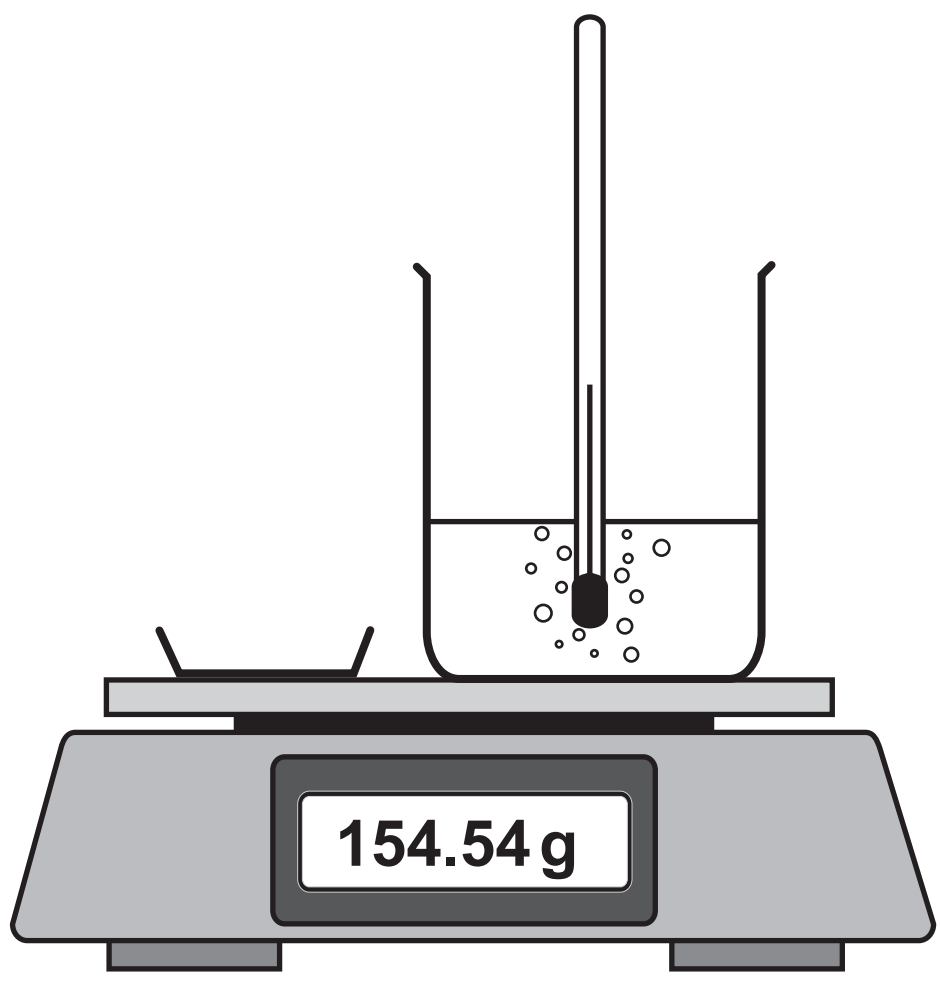

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DIAGRAM 2.1

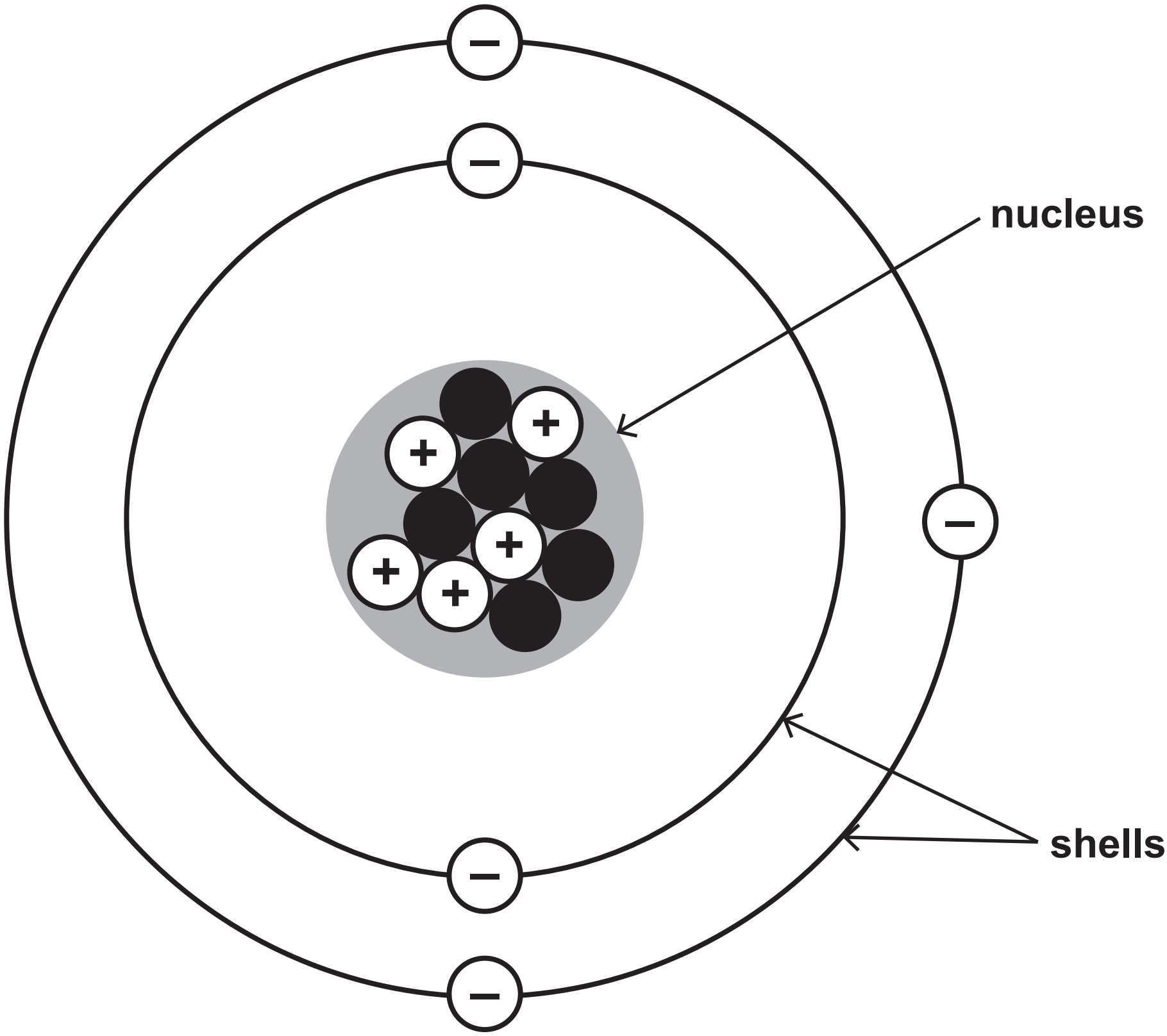
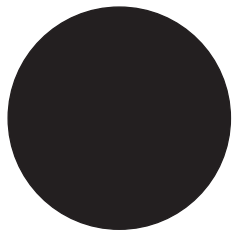


TABLE 2.2

Statement	True or false?
Boron atoms contain the same number of protons and electrons	_____
The particles found in the shells are called electrons	_____
The nucleus contains five neutrons	_____
The electronic structure of boron is 3,2	_____

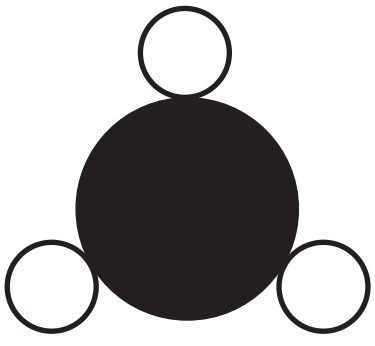
DIAGRAM 2.3



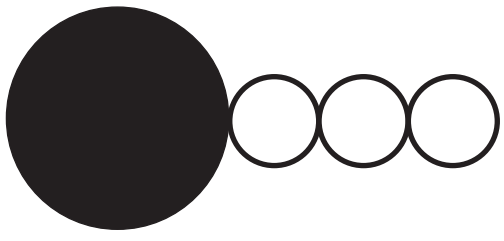
boron, B

fluorine, F

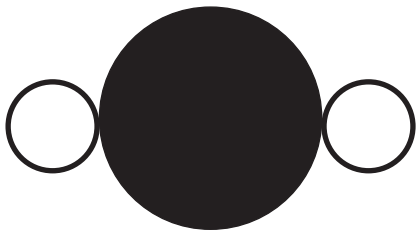
DIAGRAM 2.4



A



B



C

DIAGRAM 3.1

DIAGRAM 3.2

A

B

C

TABLE 3.3

Distance of ocean floor from plate boundary (km)	Approximate age of rock (million years)
2000	100

DIAGRAM 3.4

KEY

plate movement

edges of tectonic plates

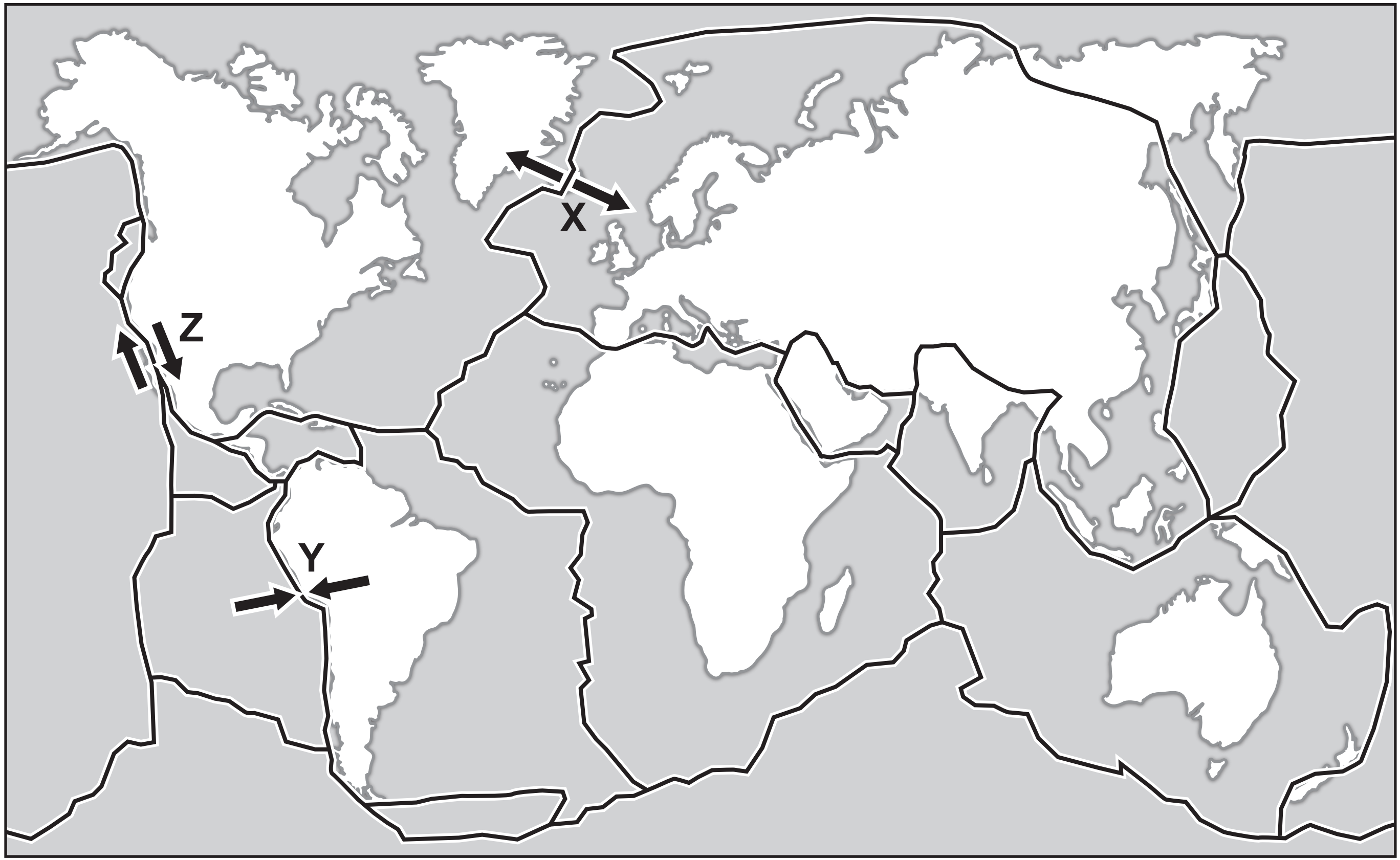
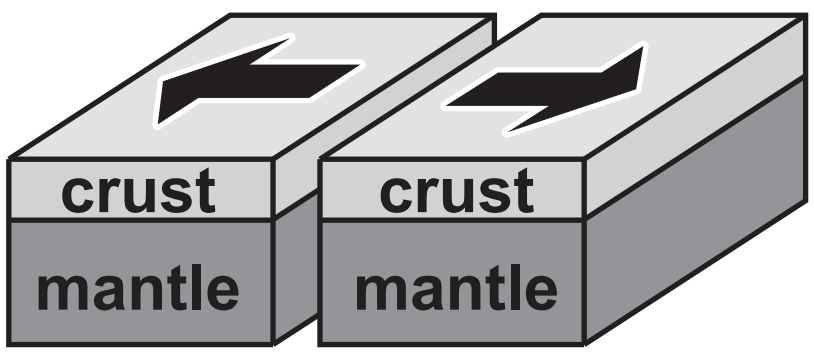


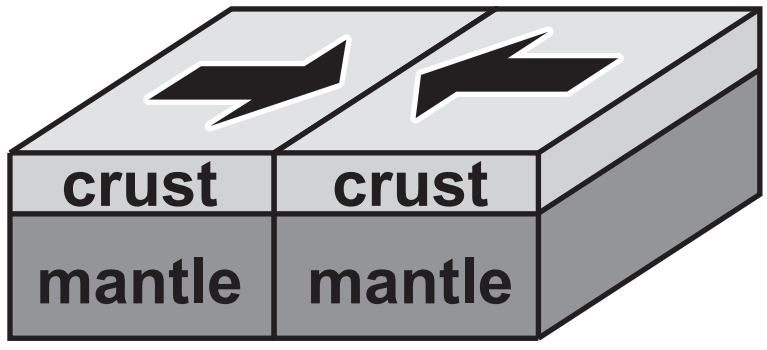
DIAGRAM 3.5

DIAGRAM 3.6

A



B



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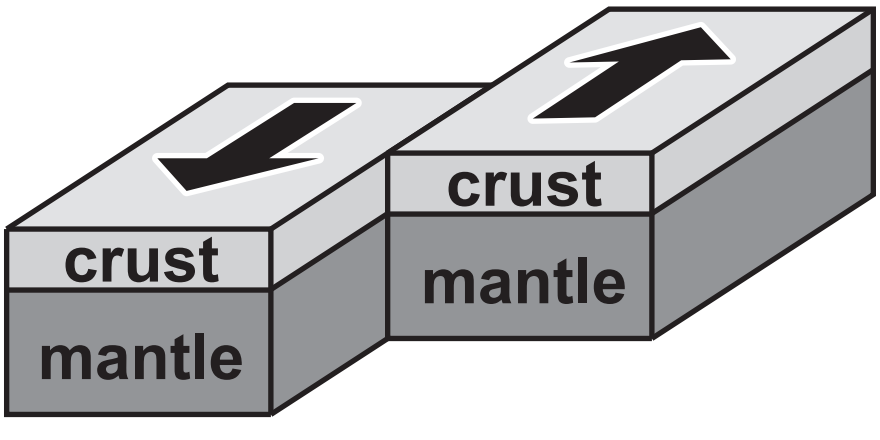

DIAGRAM 3.7

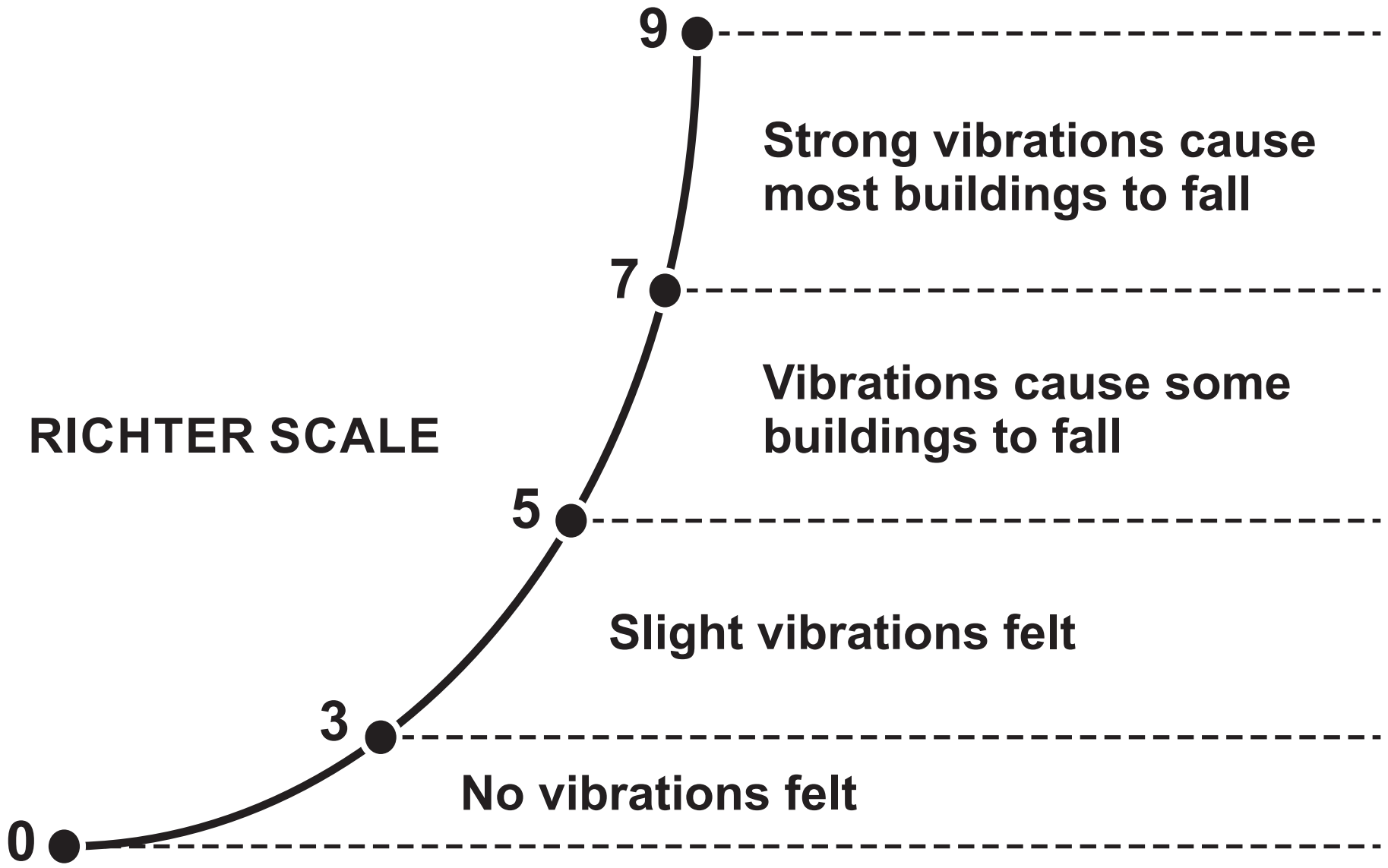
RICHTER SCALE
9
Strong vibrations cause most buildings to fall
7
Vibrations cause some buildings to fall
5
Slight vibrations felt
3
No vibrations felt
0

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DIAGRAM 4.1

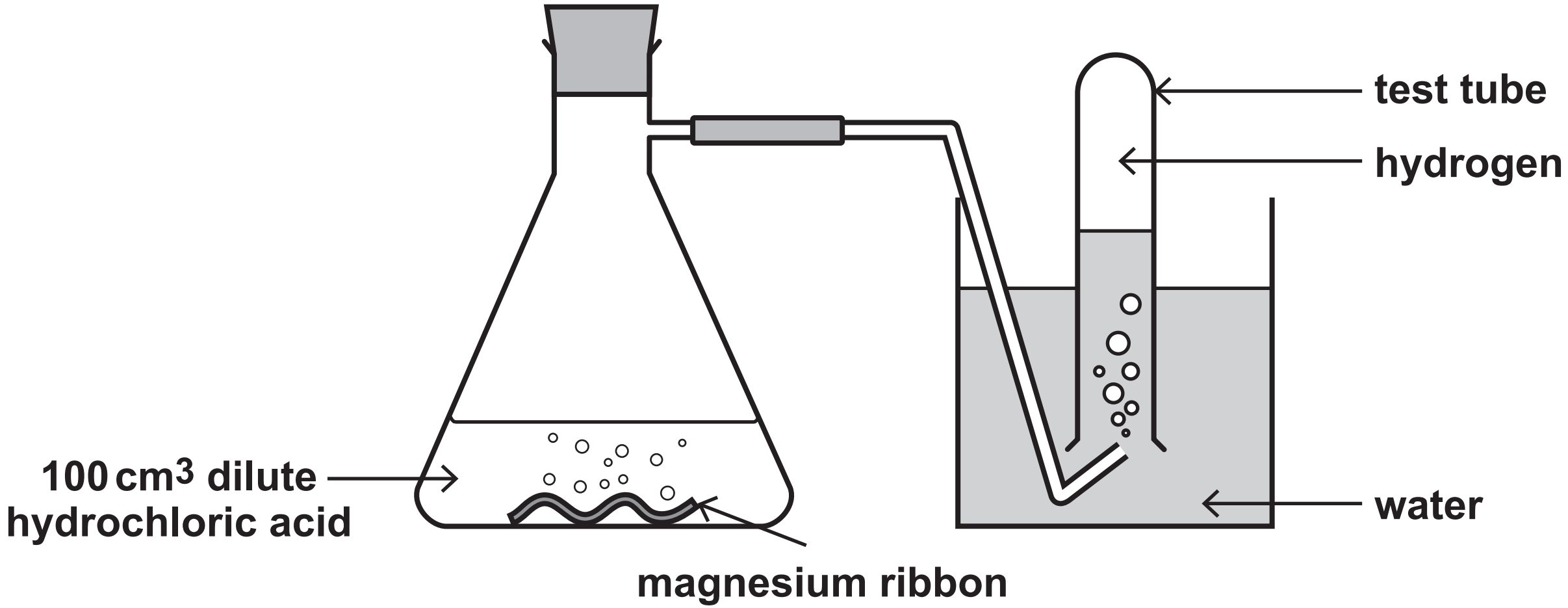

TABLE 4.2

Experiment	Acid concentration (%)	Time (s)
1	100	12
2	80	14
3	60	20
4	40	36
5	20	76

GRAPH 4.3

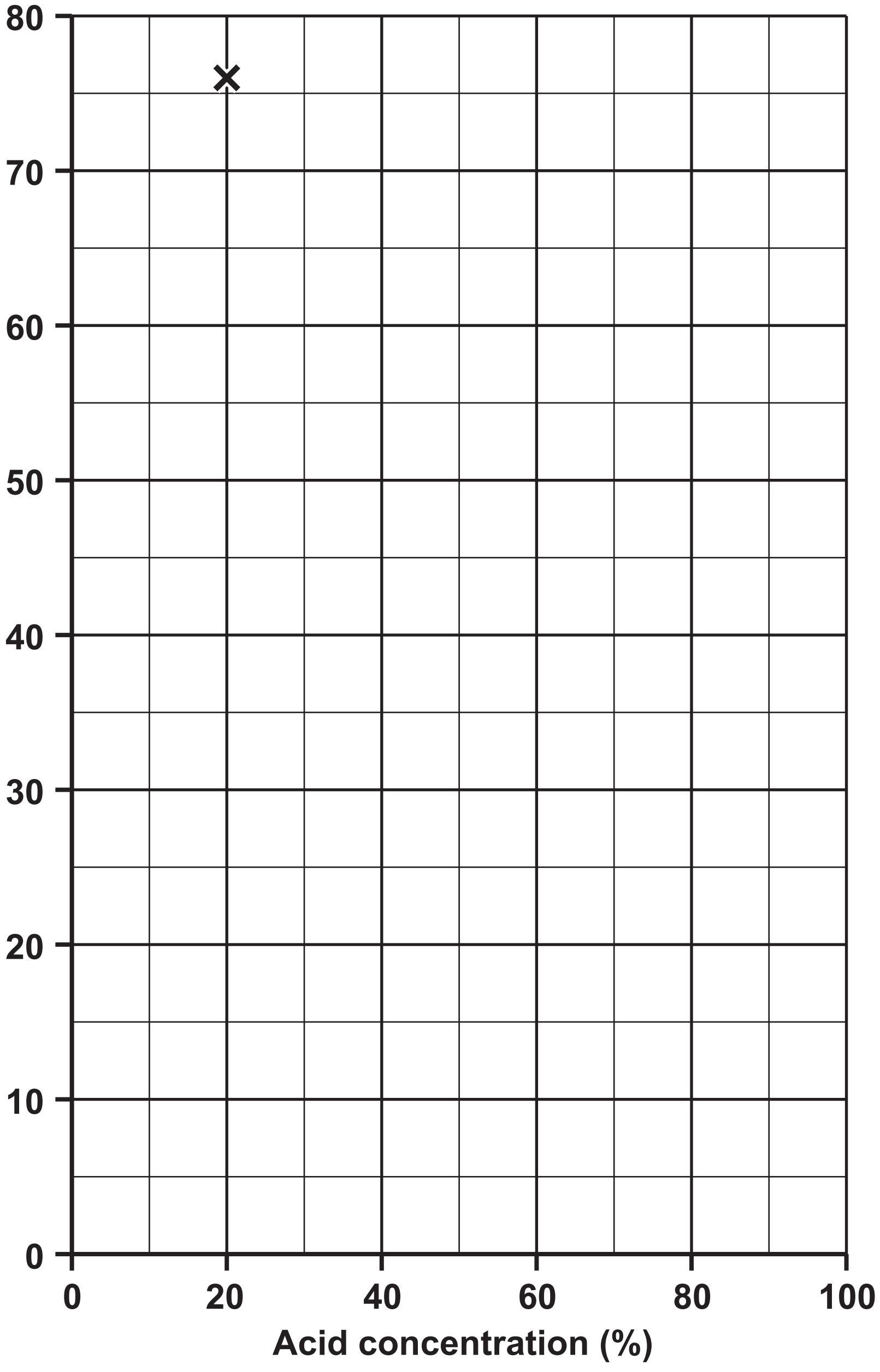
Time (s)
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
Acid concentration (%)

DIAGRAM 5.1

Stage 1: Limestone (calcium carbonate) decomposes into quicklime (calcium oxide) and carbon dioxide

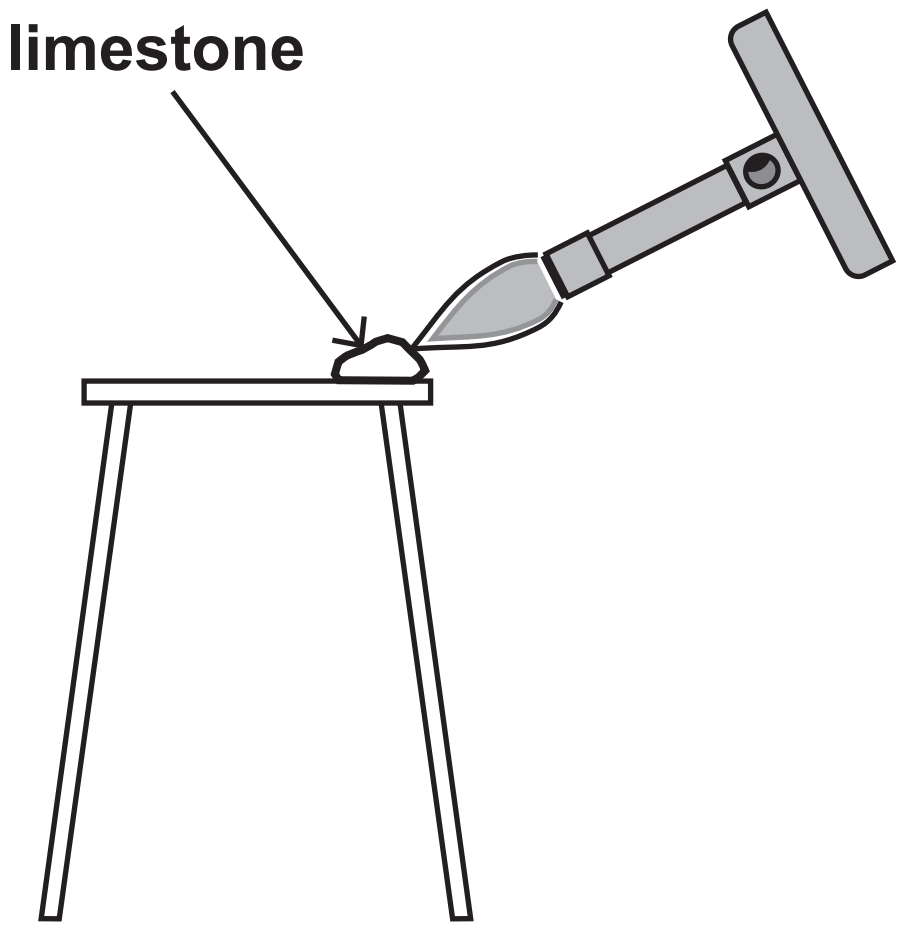

DIAGRAM 5.2

Stage 2: Quicklime (calcium oxide) reacts with water forming slaked lime (calcium hydroxide)

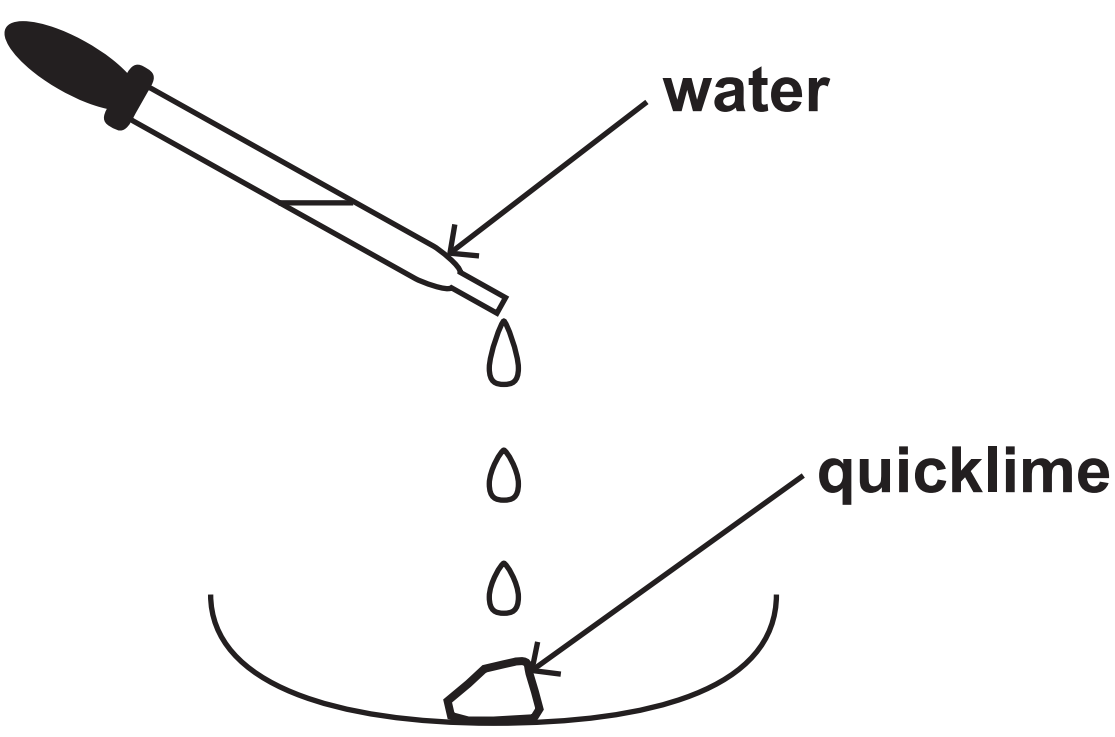

DIAGRAM 5.3

DIAGRAM 6.1

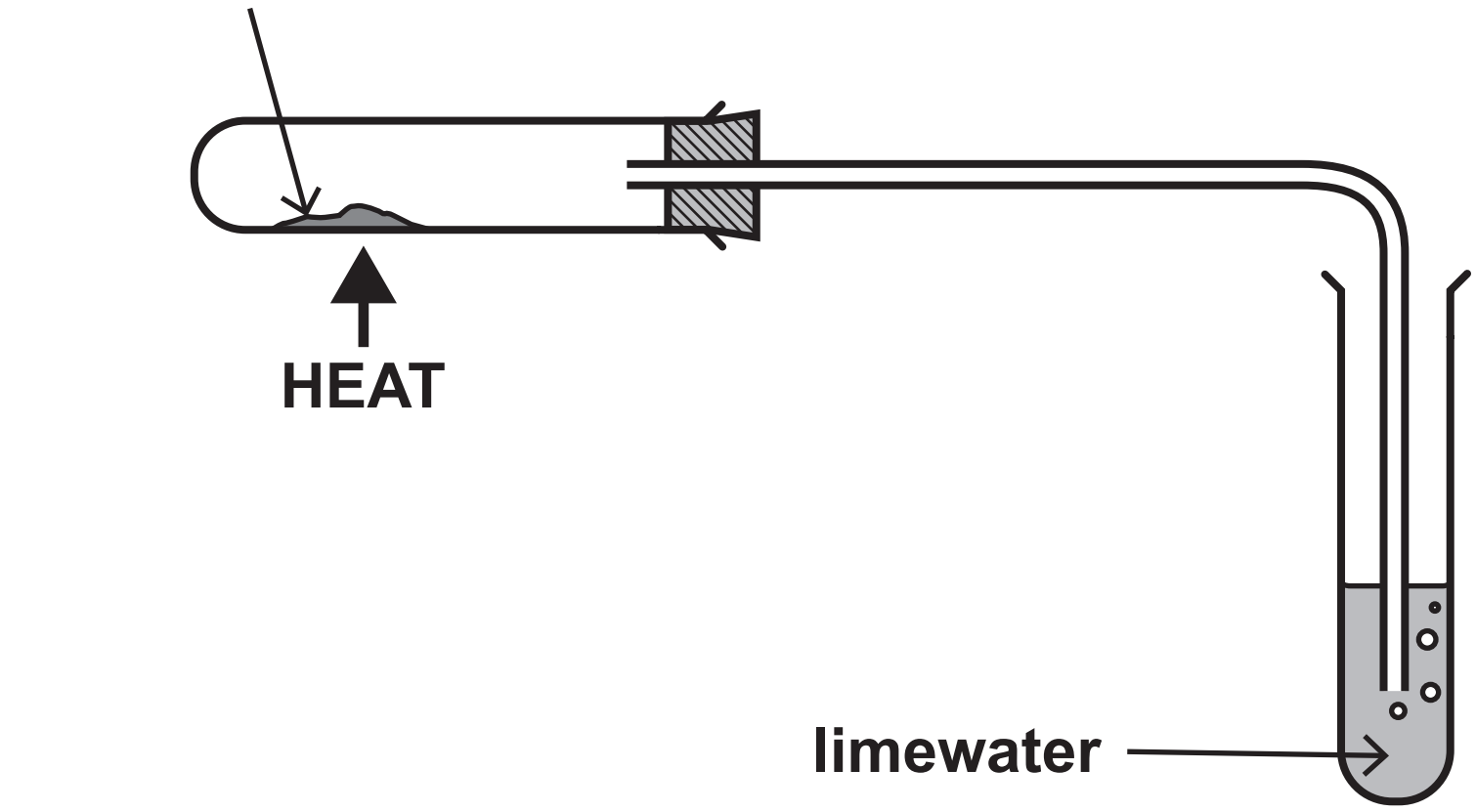

TABLE 6.2

Metal carbonate	Time taken for limewater to turn milky (s)
copper(II) carbonate	18
zinc carbonate	27
lead carbonate	11

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TURN OVER

TABLE 7.1

Inert gas	Percentage in the atmosphere (%)	Melting point (°C)	Boiling point (°C)
helium	0.00052	−272	−269
neon	0.0018	−246	−246
argon	0.93	−186	−186
krypton	0.0001	−152	−152
xenon	0.000009	−111	−106

BAR CHART 7.2

Inert gas

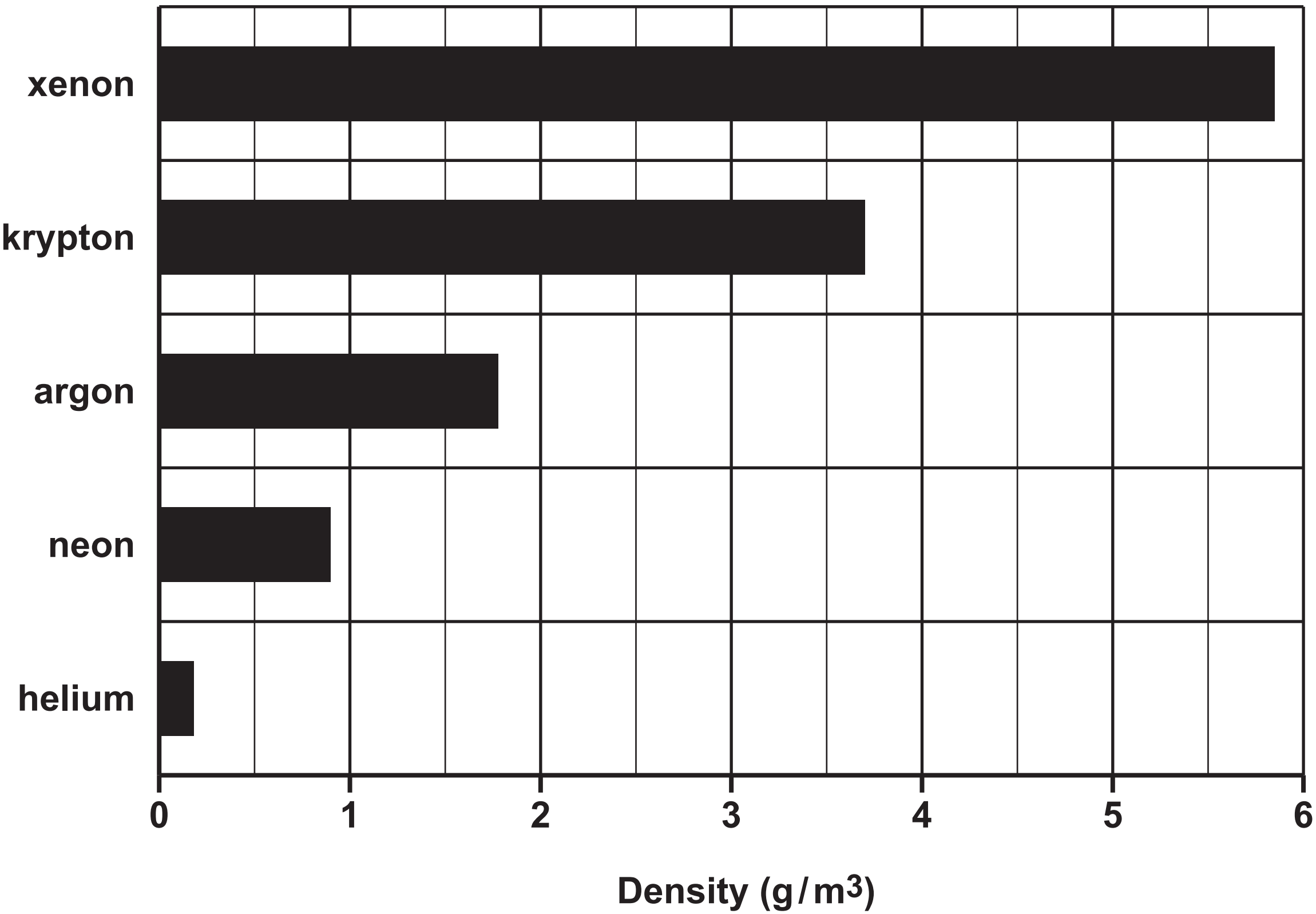
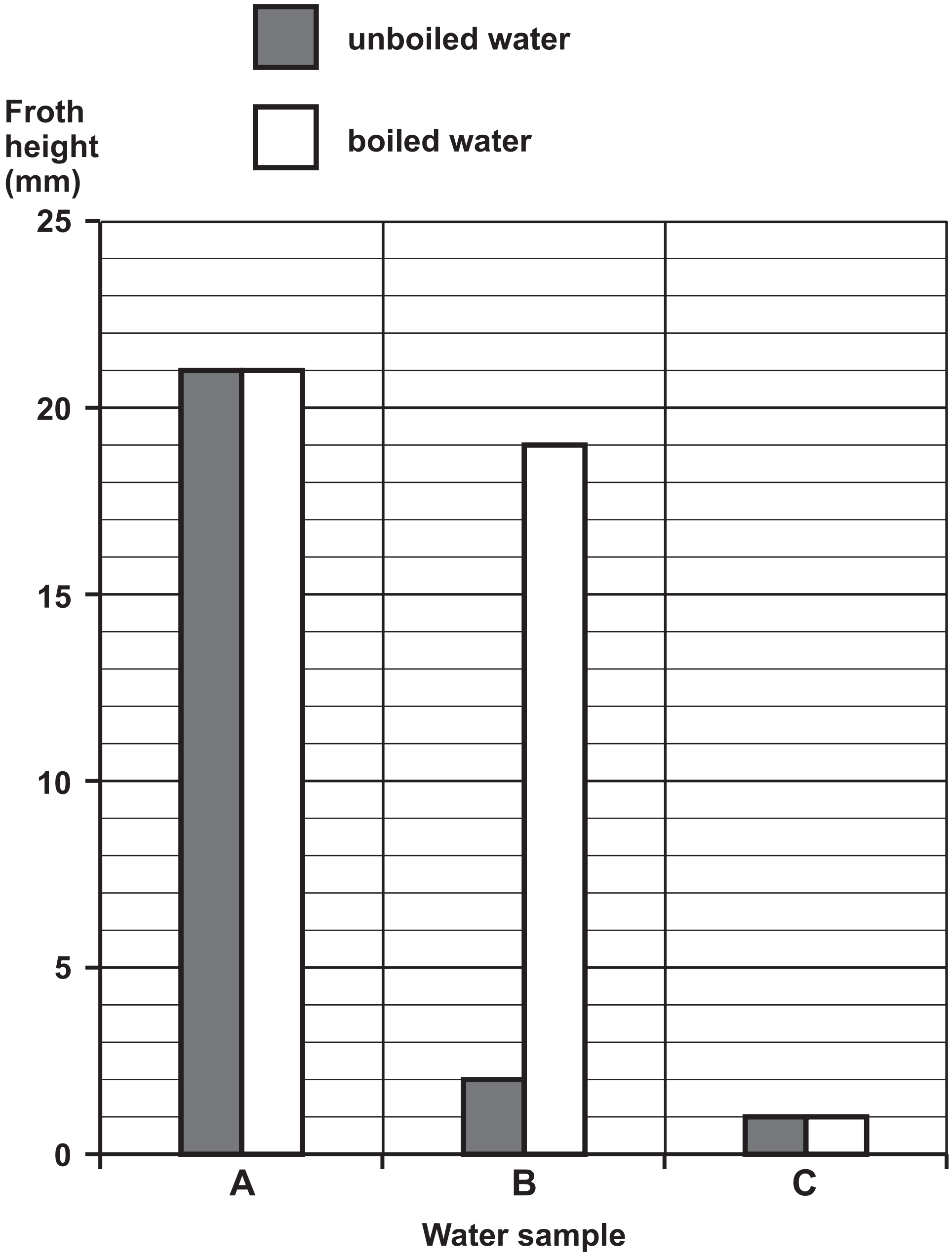


TABLE 7.3

Group 0 element	Electronic structure
helium	2
neon	2,8
argon	2,8,8

GRAPH 8.1


unboiled water
boiled water
Froth height (mm)
25
20
15
10
5
0
A
B
C
Water sample

GRAPH 8.2

Solubility (g per 100 g of water)

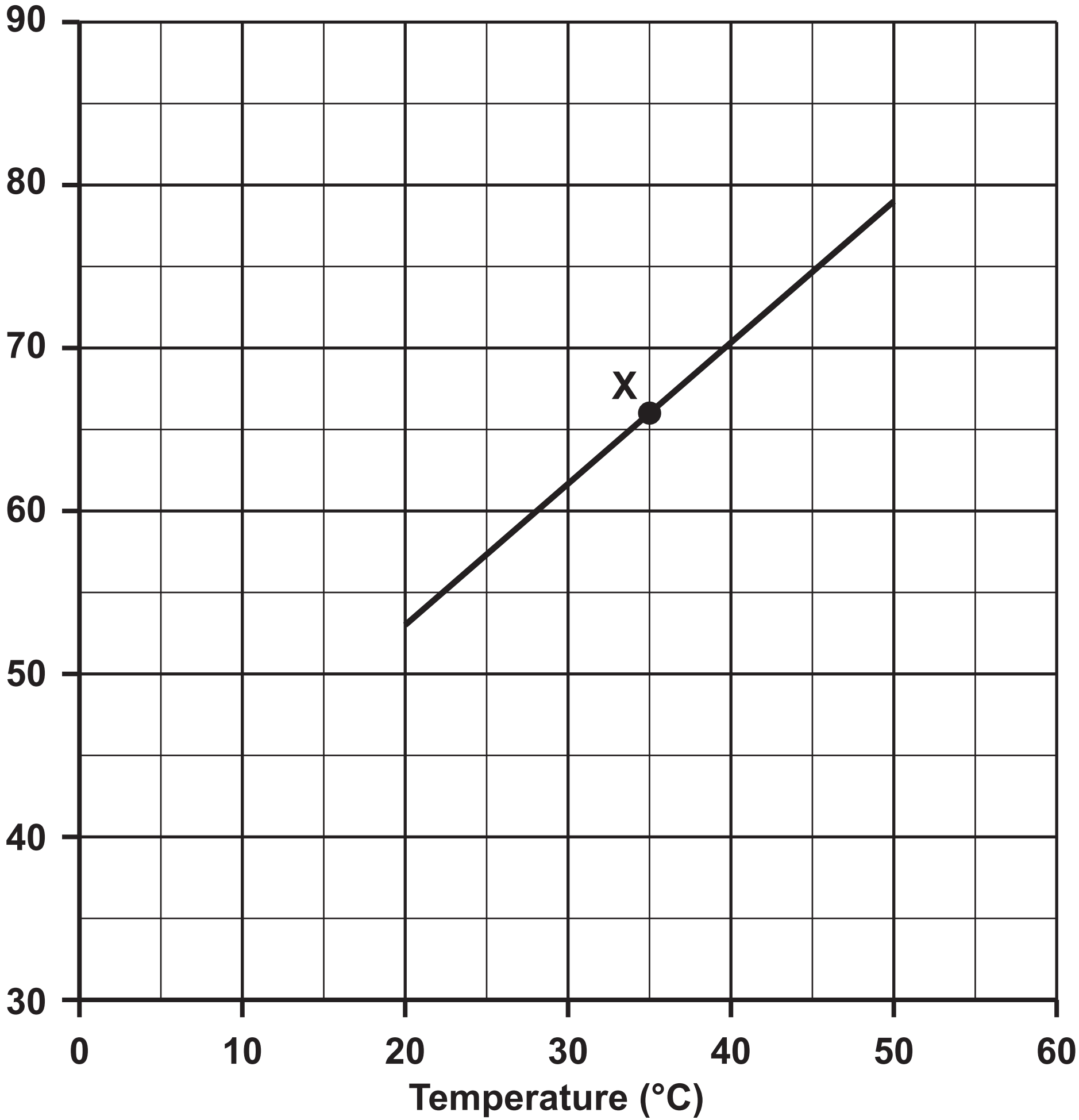


DIAGRAM 9.1

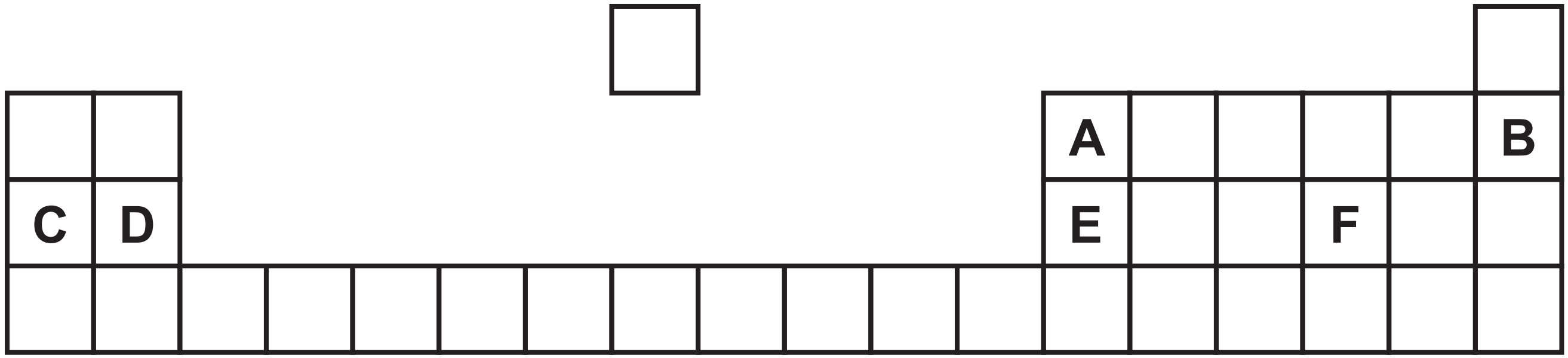


TABLE 9.2

	Letter
The element in Group 3 and Period 2	_____
The element which has 10 protons in its nucleus	_____
The element with the electronic structure 2,8,6	_____
The element which forms a 2+ ion	_____

DIAGRAM 9.3

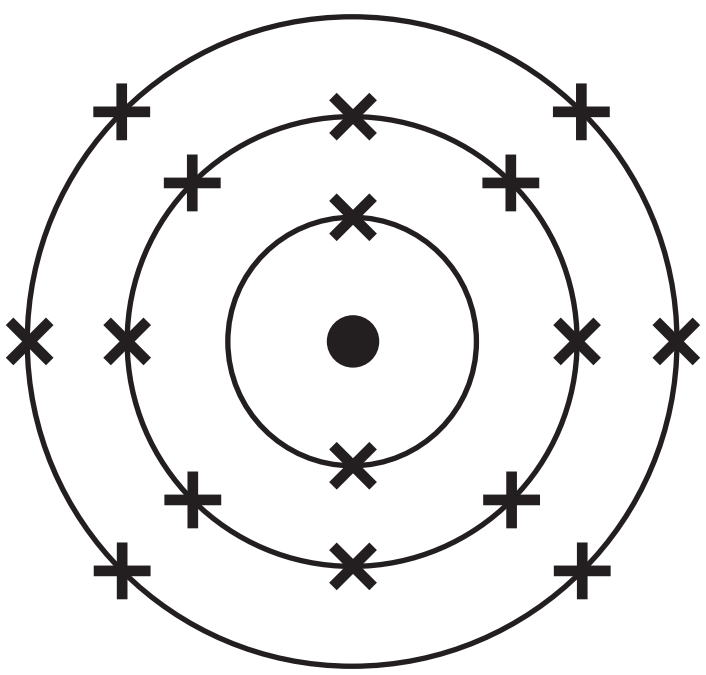


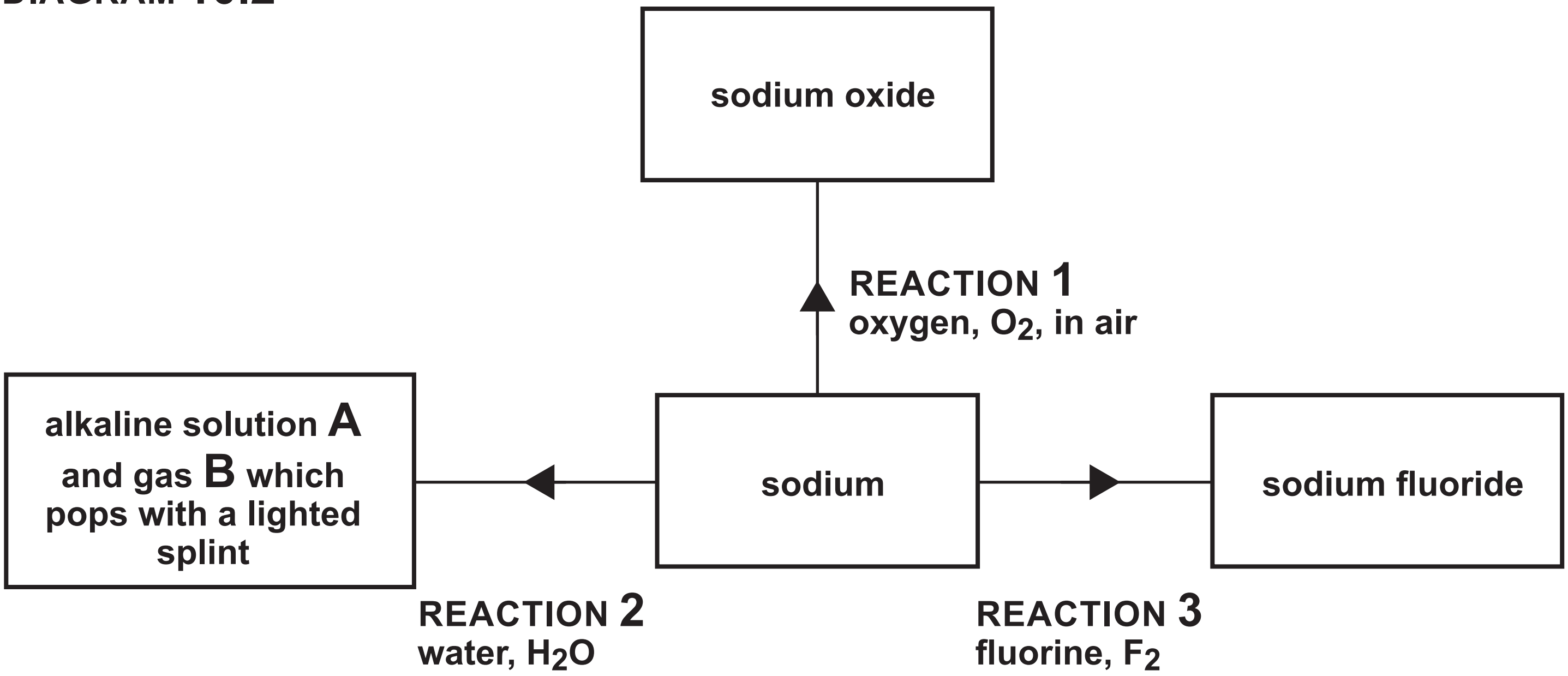
TABLE 9.4

Atom	Symbol	Number of protons	Number of neutrons	Number of electrons
X	$^{31}_{15}X$	_____	16	15
Y	$^{39}_{19}Y$	19	_____	19
Z	$^{40}_{19}Z$	19	21	_____

TABLE 10.1

Element	Relative atomic mass	Number of electrons in the outer shell	Melting point (°C)	Boiling point (°C)	Density (g/cm^3)
lithium	7	1	180	1 342	0.53
sodium	23	1	98	883	0.97
potassium	39	1	63	759	0.89
rubidium	85	1	39	688	1.53
caesium	134	1	29	671	1.93

DIAGRAM 10.2


sodium oxide
REACTION 1
oxygen, O_2, in air
alkaline solution A and gas B which pops with a lighted splint
sodium
sodium fluoride
REACTION 2
water, H_2O
REACTION 3
fluorine, F_2

GCSE

3410U10-1

FRIDAY, 16 JUNE 2023 – MORNING

CHEMISTRY – Unit 1:

Chemical Substances, Reactions and Essential Resources
FOUNDATION TIER

Data Booklet

FORMULAE FOR SOME COMMON IONS

POSITIVE IONS	
Name	Formula
aluminium	Al^{3+}
ammonium	NH_4^+
barium	Ba^{2+}
calcium	Ca^{2+}
copper(II)	Cu^{2+}
hydrogen	H^+
iron(II)	Fe^{2+}
iron(III)	Fe^{3+}
lithium	Li^+
magnesium	Mg^{2+}
nickel	Ni^{2+}
potassium	K^+
silver	Ag^+
sodium	Na^+
zinc	Zn^{2+}

NEGATIVE IONS	
Name	Formula
bromide	Br^-
carbonate	CO_3^{2-}
chloride	Cl^-
fluoride	F^-
hydroxide	OH^-
iodide	I^-
nitrate	NO_3^-
oxide	O^{2-}
sulfate	SO_4^{2-}

THE PERIODIC TABLE

KEY

A_r	relative atomic mass
Sym	symbol
Z	atomic number

1	2	GROUP										3	4	5	6	7	0
								1 H 1									4 He 2
7 Li 3	9 Be 4											11 B 5	12 C 6	14 N 7	16 O 8	19 F 9	20 Ne 10
23 Na 11	24 Mg 12											27 Al 13	28 Si 14	31 P 15	32 S 16	35.5 Cl 17	40 Ar 18
39 K 19	40 Ca 20	45 Sc 21	48 Ti 22	51 V 23	52 Cr 24	55 Mn 25	56 Fe 26	59 Co 27	59 Ni 28	63.5 Cu 29	65 Zn 30	70 Ga 31	73 Ge 32	75 As 33	79 Se 34	80 Br 35	84 Kr 36
86 Rb 37	88 Sr 38	89 Y 39	91 Zr 40	93 Nb 41	96 Mo 42	99 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
133 Cs 55	137 Ba 56	139 La 57	179 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	210 Po 84	210 At 85	222 Rn 86
223 Fr 87	226 Ra 88	227 Ac 89															

THE PERIODIC TABLE

PERIODIC TABLE – KEY
ATOMIC NUMBER – SYMBOL – NAME

1	H – Hydrogen
2	He – Helium
3	Li – Lithium
4	Be – Beryllium
5	B – Boron
6	C – Carbon
7	N – Nitrogen
8	O – Oxygen
9	F – Fluorine
10	Ne – Neon
11	Na – Sodium
12	Mg – Magnesium
13	Al – Aluminium
14	Si – Silicon
15	P – Phosphorus
16	S – Sulfur
17	Cl – Chlorine
18	Ar – Argon
19	K – Potassium
20	Ca – Calcium
21	Sc – Scandium
22	Ti – Titanium
23	V – Vanadium
24	Cr – Chromium
25	Mn – Manganese
26	Fe – Iron
27	Co – Cobalt
28	Ni – Nickel
29	Cu – Copper
30	Zn – Zinc
31	Ga – Gallium
32	Ge – Germanium
33	As – Arsenic

34	Se – Selenium
35	Br – Bromine
36	Kr – Krypton
37	Rb – Rubidium
38	Sr – Strontium
39	Y – Yttrium
40	Zr – Zirconium
41	Nb – Niobium
42	Mo – Molybdenum
43	Tc – Technetium
44	Ru – Ruthenium
45	Rh – Rhodium
46	Pd – Palladium
47	Ag – Silver
48	Cd – Cadmium
49	In – Indium
50	Sn – Tin
51	Sb – Antimony
52	Te – Tellurium
53	I – Iodine
54	Xe – Xenon
55	Cs – Caesium
56	Ba – Barium
57	La – Lanthanum
72	Hf – Hafnium
73	Ta – Tantalum
74	W – Tungsten
75	Re – Rhenium
76	Os – Osmium
77	Ir – Iridium
78	Pt – Platinum
79	Au – Gold
80	Hg – Mercury

81	Tl – Thallium
82	Pb – Lead
83	Bi – Bismuth
84	Po – Polonium
85	At – Astatine
86	Rn – Radon
87	Fr – Francium
88	Ra – Radium
89	Ac – Actinium