



**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.**

**(Turn over)**



## **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.**

**(Turn over)**



## **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.**

**(Turn over)**

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

**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]**

<b>distillation</b>	<b>chromatography</b>	
<b>filtration</b>	<b>evaporation</b>	<b>boiling</b>

**Method B**

---

**Method D**

---

**(Turn over)**



**1 (a)(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.**

**question continues**

**(Turn over)**



**1 (b) continued**

**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

**(Turn over)**



**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]**

**(Turn over)**



2 (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 = \_\_\_\_\_

(Turn over)



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

**Boron trifluoride has the formula  $\text{BF}_3$ .**

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

**Letter \_\_\_\_\_**

**(Turn over)**



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

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

$\text{Mg}_2\text{F}$      $\text{Mg}_2\text{F}$      $\text{MgF}^2$      $\text{MgF}_2$

8

(Turn over)



**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 \_\_\_\_\_

(Turn over)



**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**

**(Turn over)**



**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** \_\_\_\_\_

**(Turn over)**



**3 (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** \_\_\_\_\_

**(Turn over)**



3 (b)(ii)

Complete the sentences by UNDERLINING 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.

(Turn over)



**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**

<b>7</b>

**(Turn over)**



**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]**



**(Turn over)**



**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 ( $20\text{ }^{\circ}\text{C}$ ). He added a 4 cm piece of magnesium ribbon to  $100\text{ cm}^3$  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]

(Turn over)



4 (b)(ii)

**UNDERLINE 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 ).**

**(Turn over)**



**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.**

**(Turn over)**



**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**

<b>10</b>

**(Turn over)**



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**TURN OVER**



- 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  $\text{Ca}^{2+}$  ion for every two  $\text{OH}^-$  ions. Write the chemical formula for calcium hydroxide. [1 mark]**
- 

**(Turn over)**















**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**

---

**(Turn over)**



**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**

**(Turn over)**



**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 = \_\_\_\_\_ %**

**(Turn over)**



**6 (a)(iv)**

**One of the ions present in copper(II) carbonate is  $\text{CO}_3^{2-}$ . [1 mark]**

**Give the formula of the other ion present.**

---

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

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

---

<b>6</b>

**(Turn over)**



## **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  $1.2\text{ g/m}^3$ .**

**BAR CHART 7.2 in the separate diagram booklet shows the densities of Group 0 gases.**

**question continues**

**(Turn over)**



**7 continued**

**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.**

**question continues**

**(Turn over)**



**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

**(Turn over)**



**7 (a)(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**

**(Turn over)**



7 (a)(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**

**(Turn over)**



**7 (a)(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**

**(Turn over)**



**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**

<b>5</b>

**(Turn over)**



**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<sup>3</sup> of soap solution was added to 25 cm<sup>3</sup> 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** \_\_\_\_\_

**(Turn over)**



**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.**

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---

**2.**

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**(Turn over)**



**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]**

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---

---



**8 (c)(ii)**

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

**Use GRAPH 8.2 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**

**(Turn over)**



**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

<b>8</b>

**(Turn over)**



**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]**

**(Turn over)**



**9 (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]**

**(Turn over)**



**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**

<b>9</b>

**(Turn over)**



**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]**

---

**(Turn over)**



**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**

---

**(Turn over)**



**10 (b)(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]**



**(Turn over)**



10 (c)

Sodium fluoride is added to some UK public water supplies to reduce tooth decay in children.

In America sodium hexafluorosilicate,  $\text{Na}_2\text{SiF}_6$ , is more commonly used. The relative formula mass of sodium hexafluorosilicate is 188.

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

$$A_r(\text{F}) = 19$$

$$M_r(\text{Na}_2\text{SiF}_6) = 188$$

Percentage = \_\_\_\_\_ %

(Turn over)



**10 (c)(ii)**

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

---

---

---

---

**(Turn over)**



**10 (c)(iii)**

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

---

<b>11</b>

**END OF PAPER**



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



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**GCSE**

**3410U10-1**

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## **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** \_\_\_\_\_

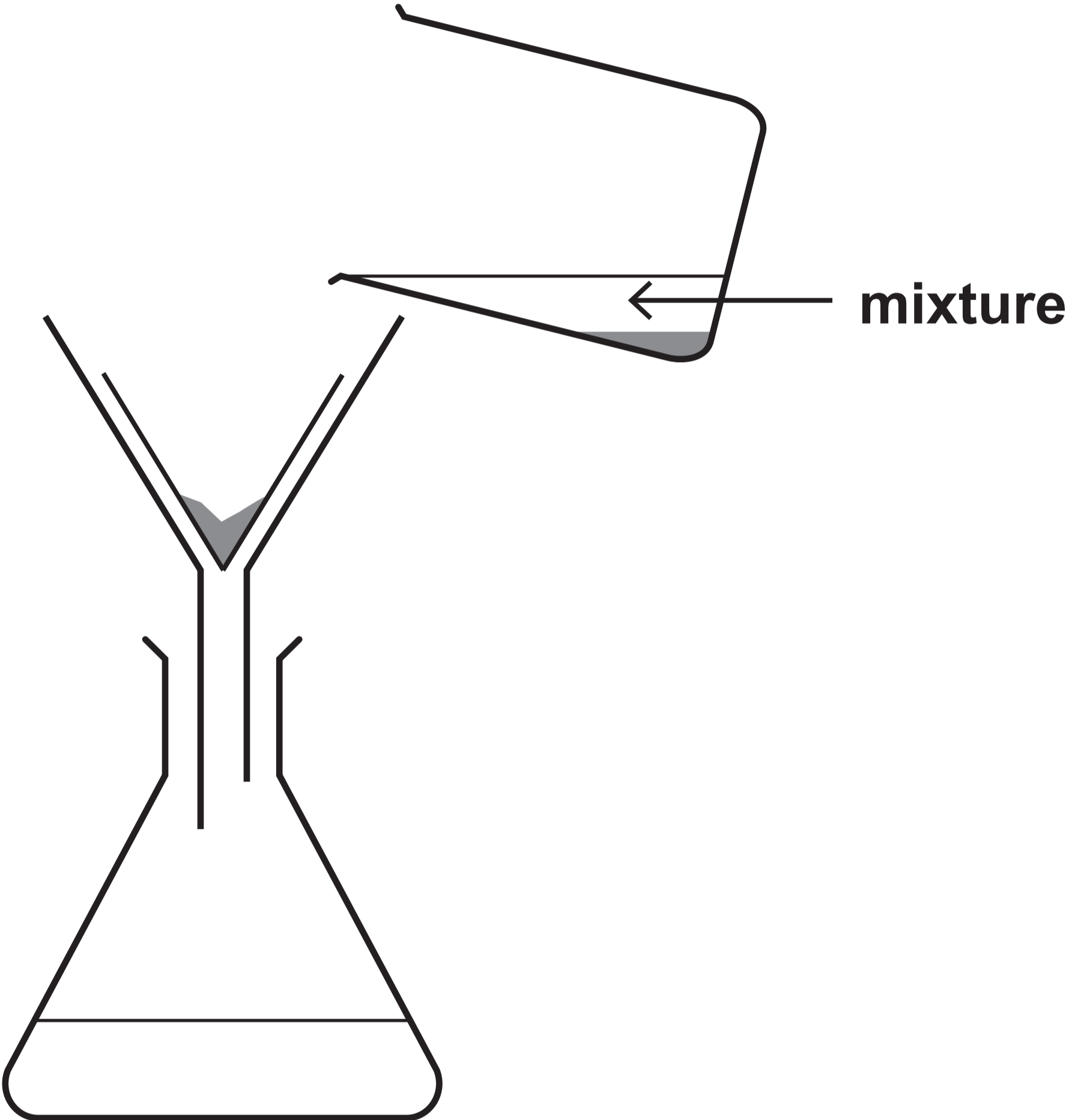
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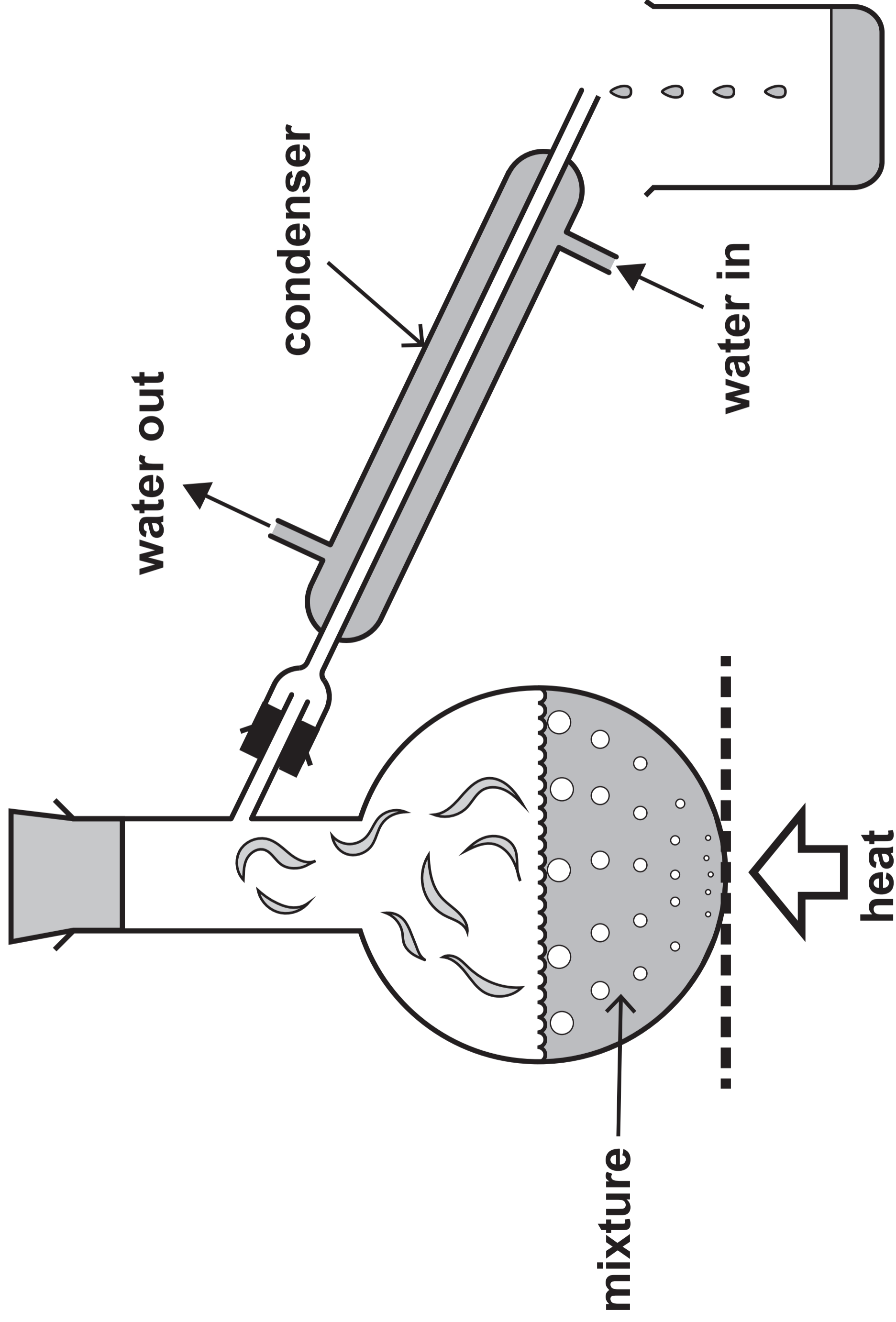
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# DIAGRAM 1.1 – Method A



**DIAGRAM 1.2 – Method B**

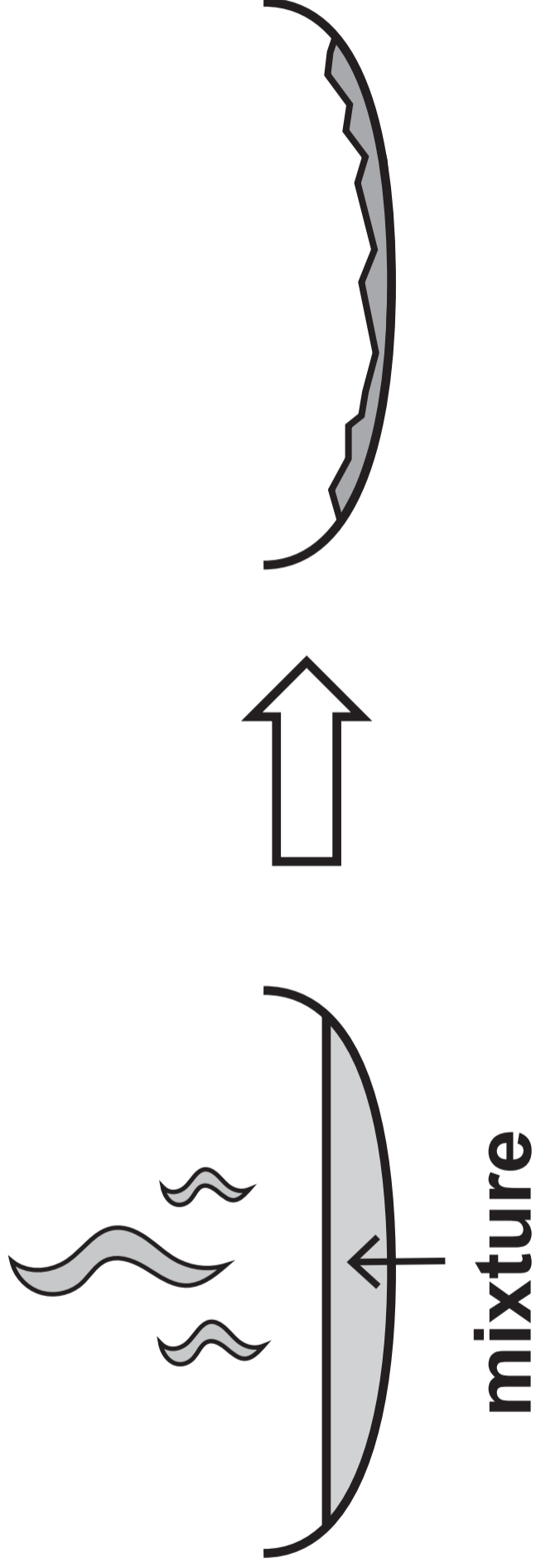




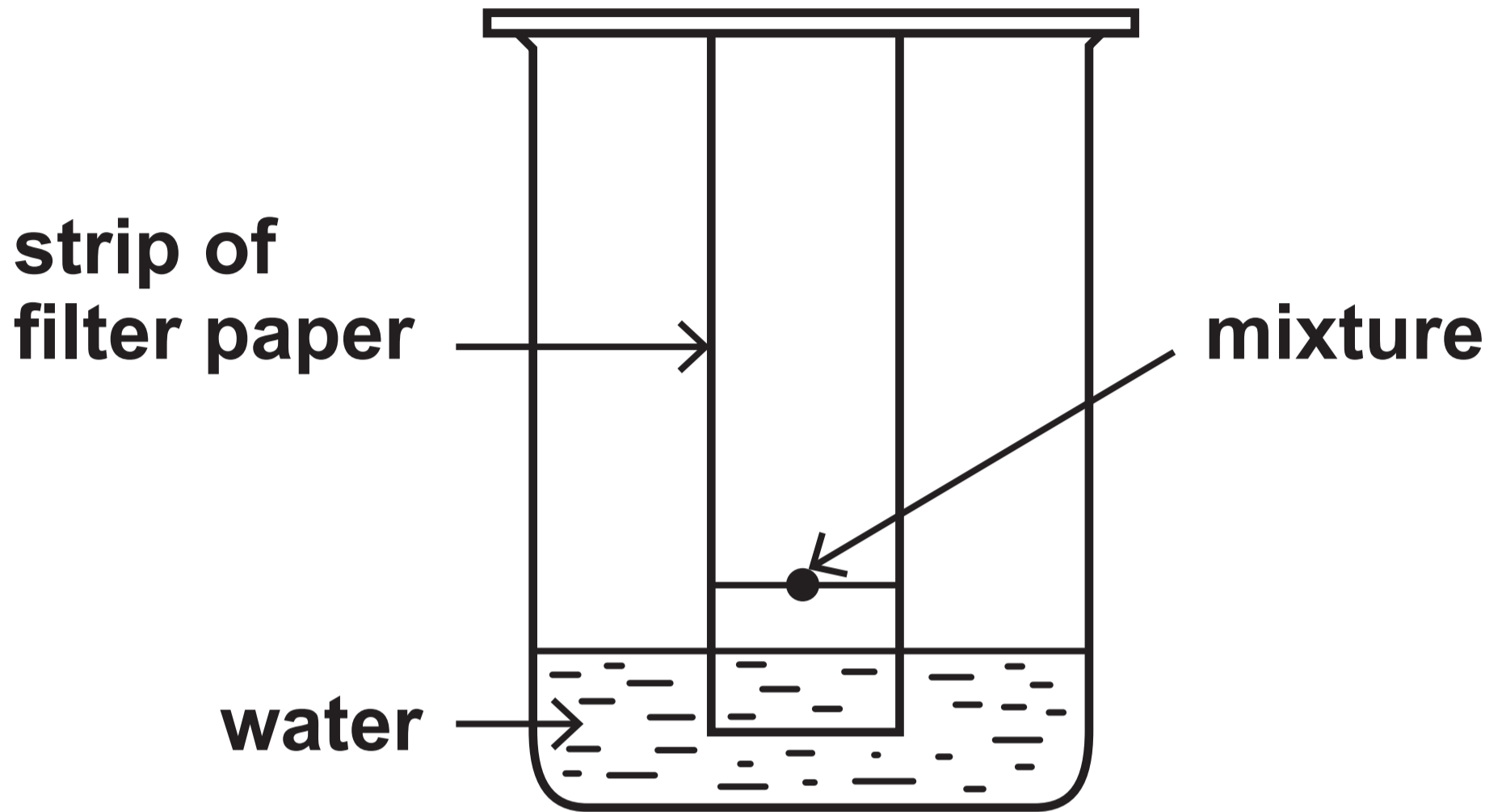
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# DIAGRAM 1.3 – Method C



# DIAGRAM 1.4 – Method D



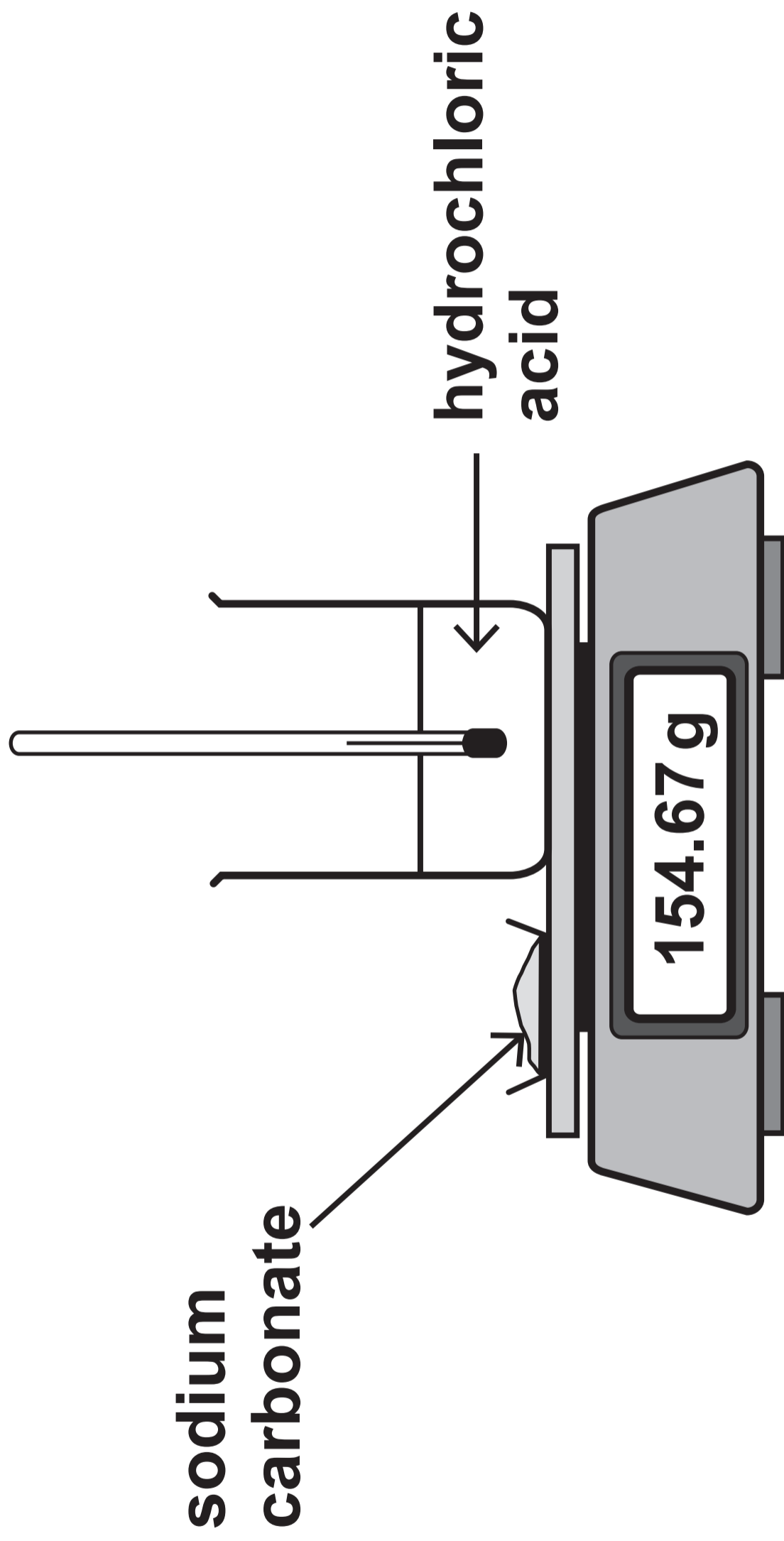


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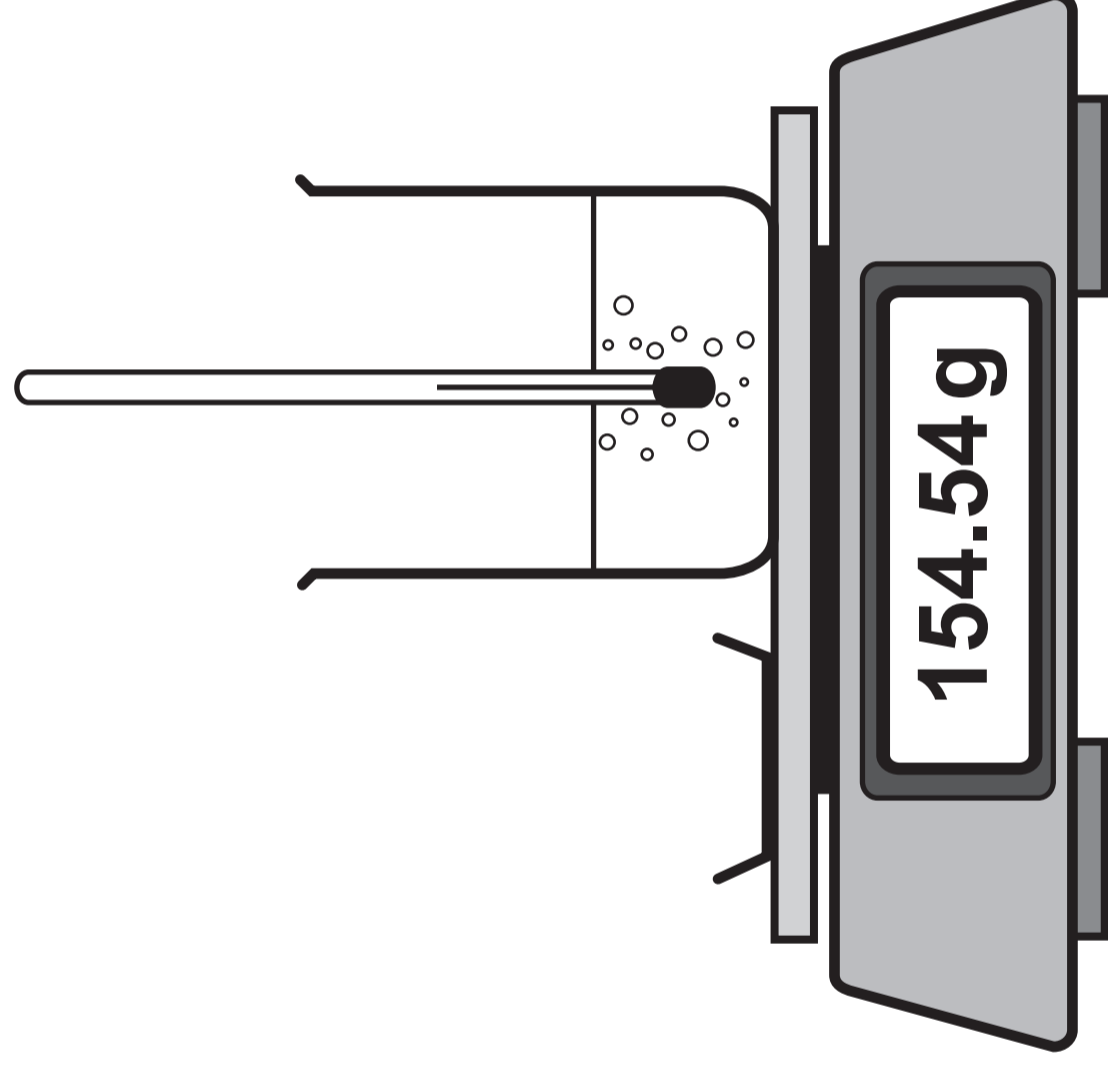
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# DIAGRAM 1.5 – BEFORE ADDING

temperature = 25°C



**DIAGRAM 1.6 – AFTER ADDING  
temperature = 30 °C**

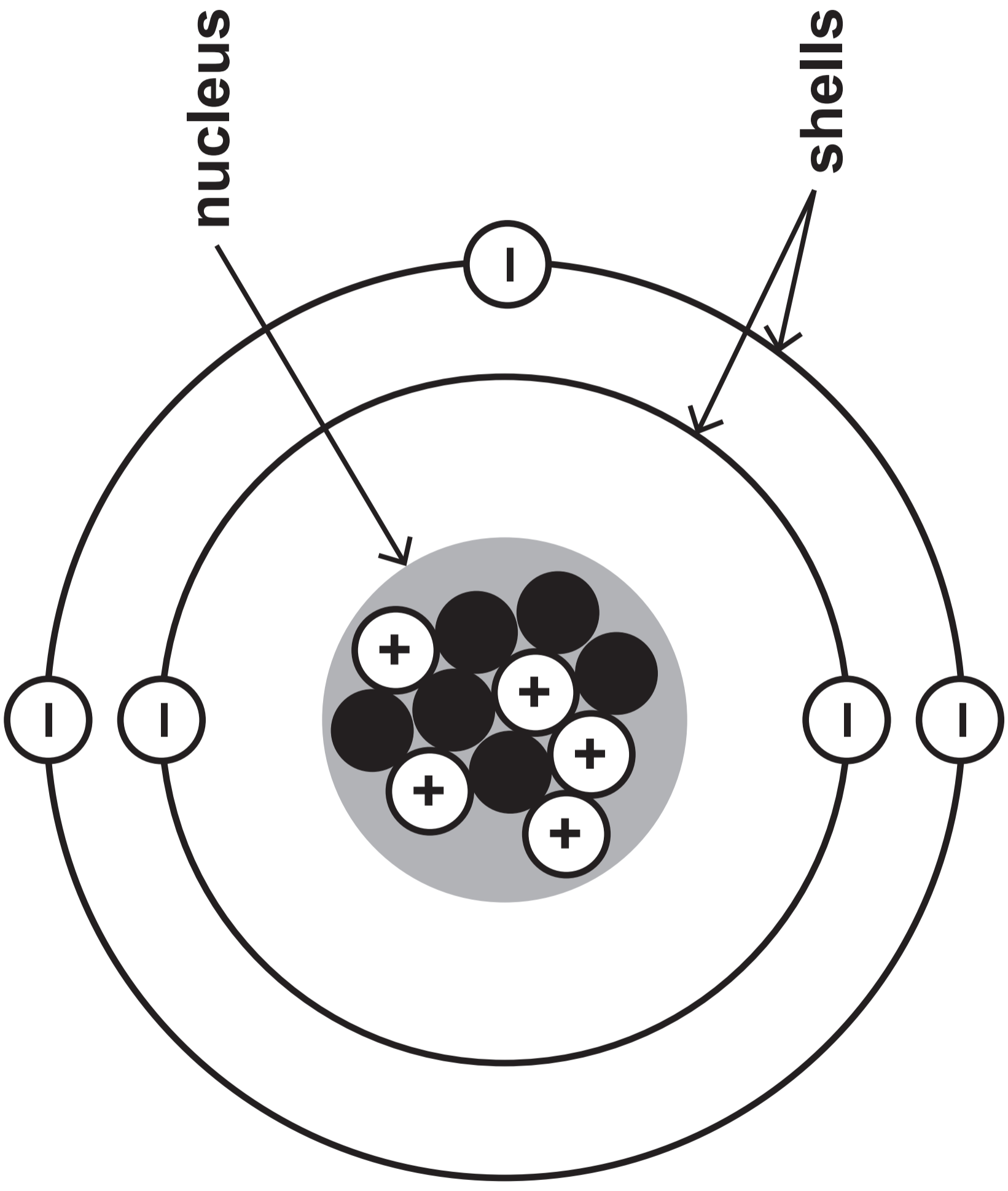




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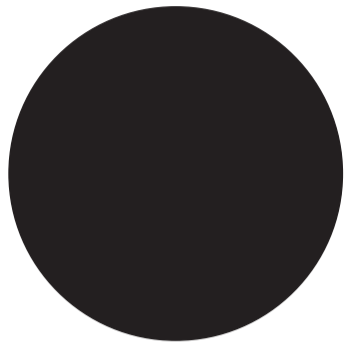
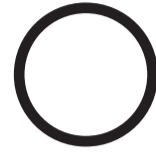
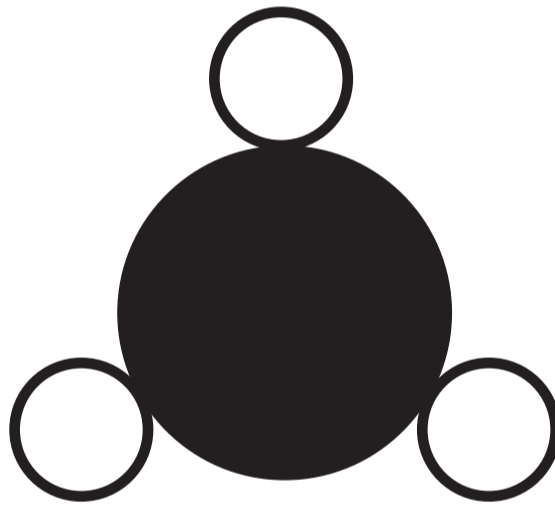
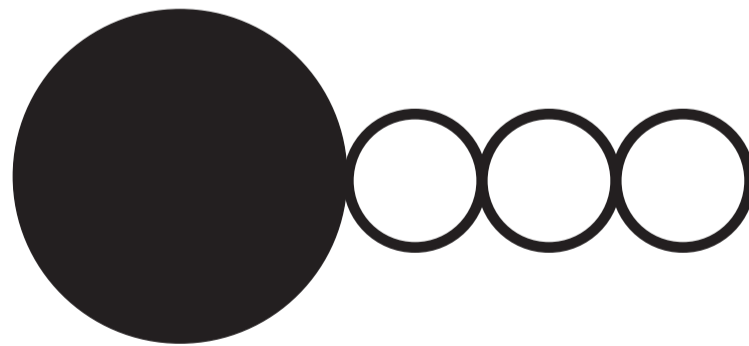
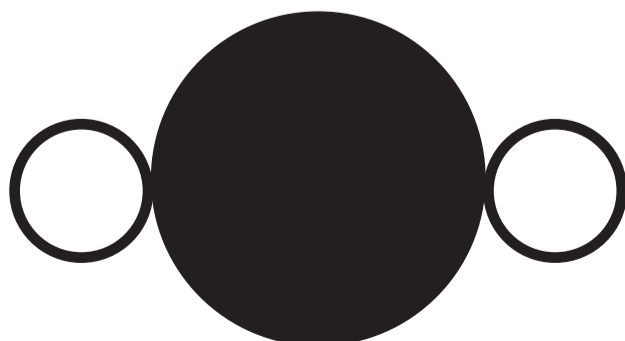
**DIAGRAM 2.1**



**TABLE 2.2**

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



**DIAGRAM 2.3****boron, B****fluorine, F****DIAGRAM 2.4****A****B****C**



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# DIAGRAM 3.1



**DIAGRAM 3.2**



**A**



**B**



**C**



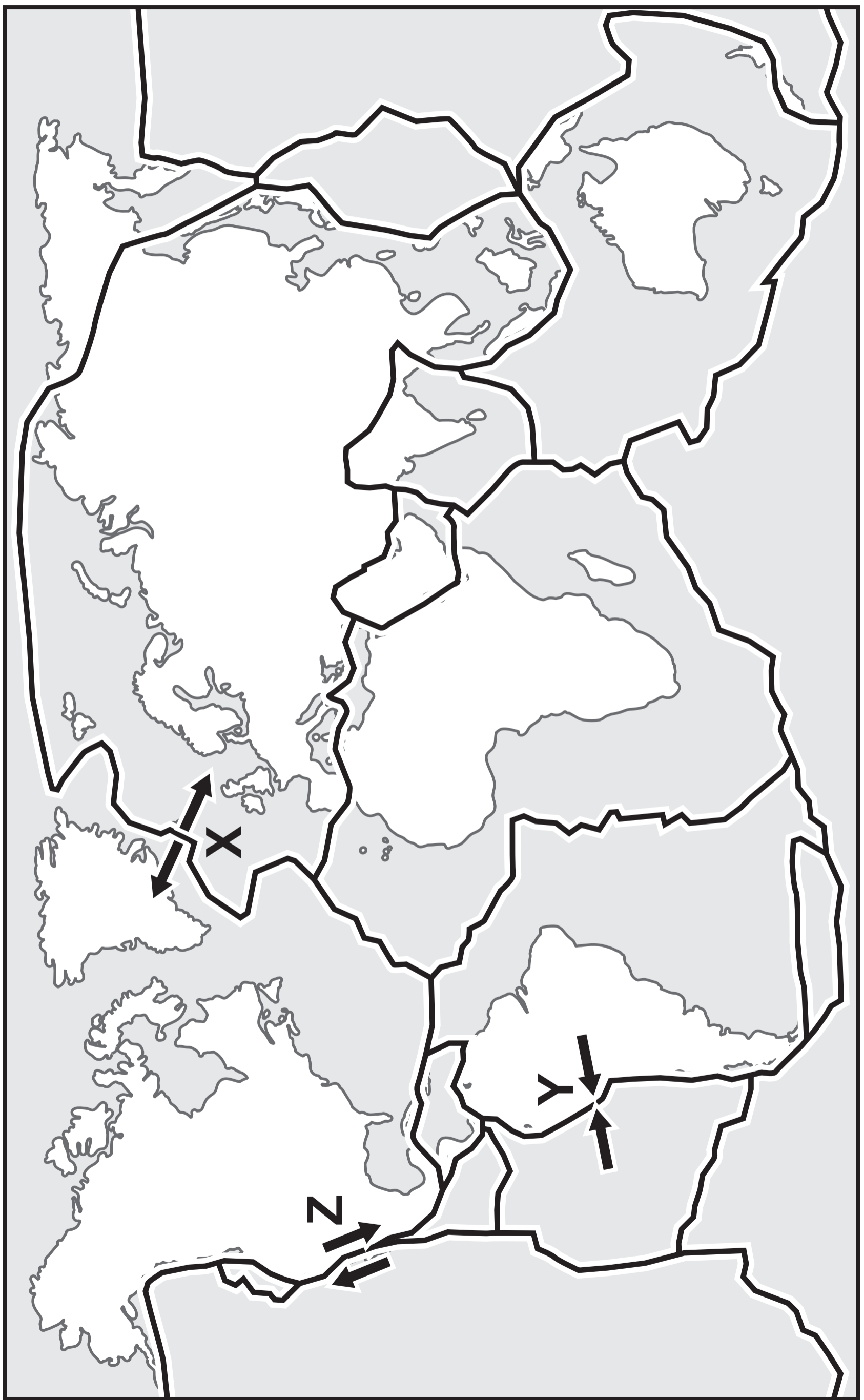
**TABLE 3.3**

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



# DIAGRAM 3.4 KEY

plate movement  
edges of tectonic plates





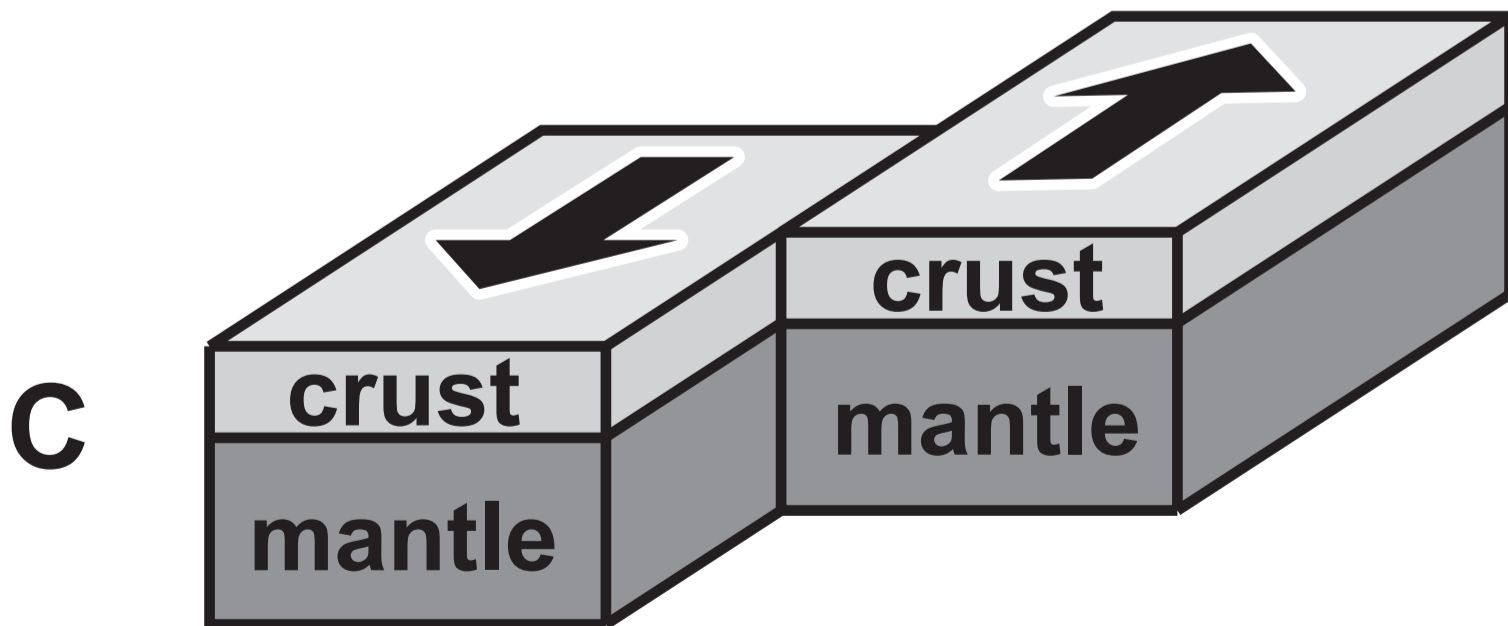
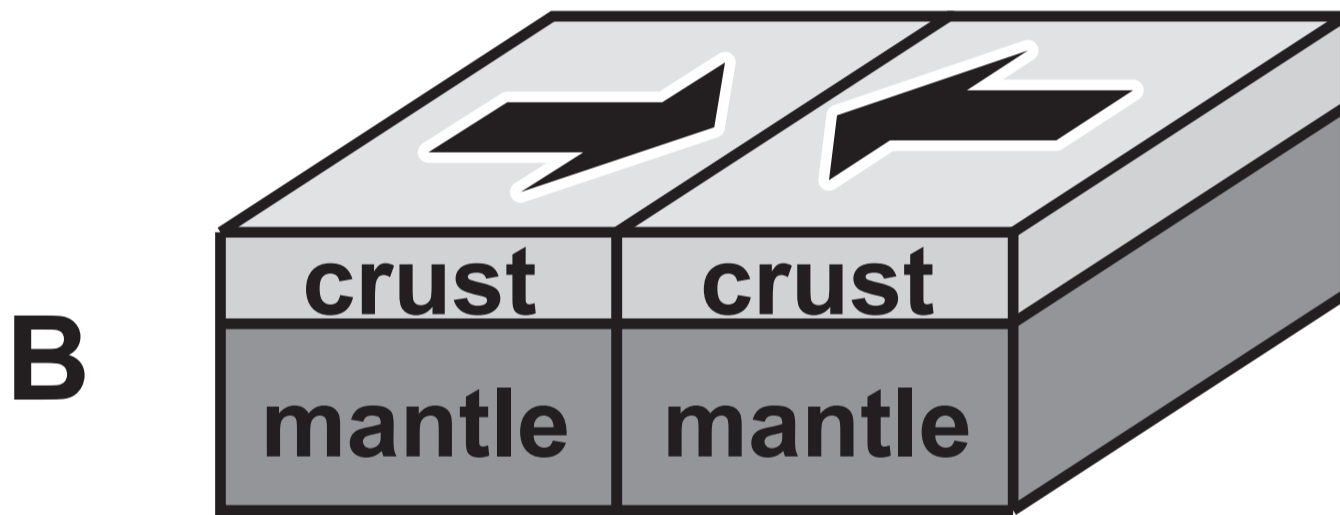
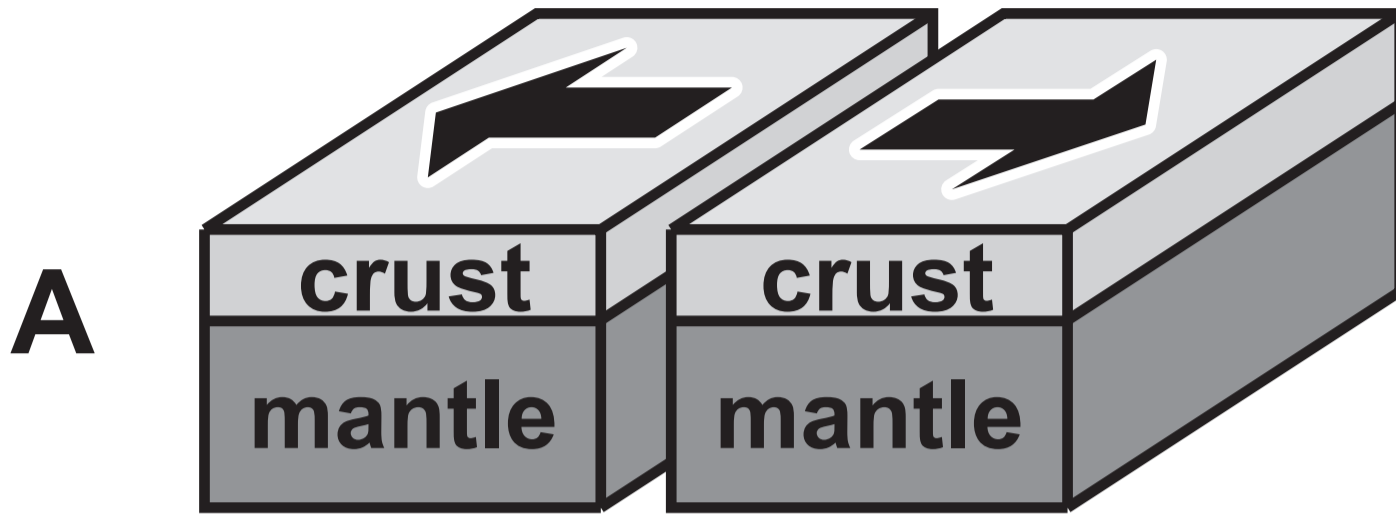
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# DIAGRAM 3.5

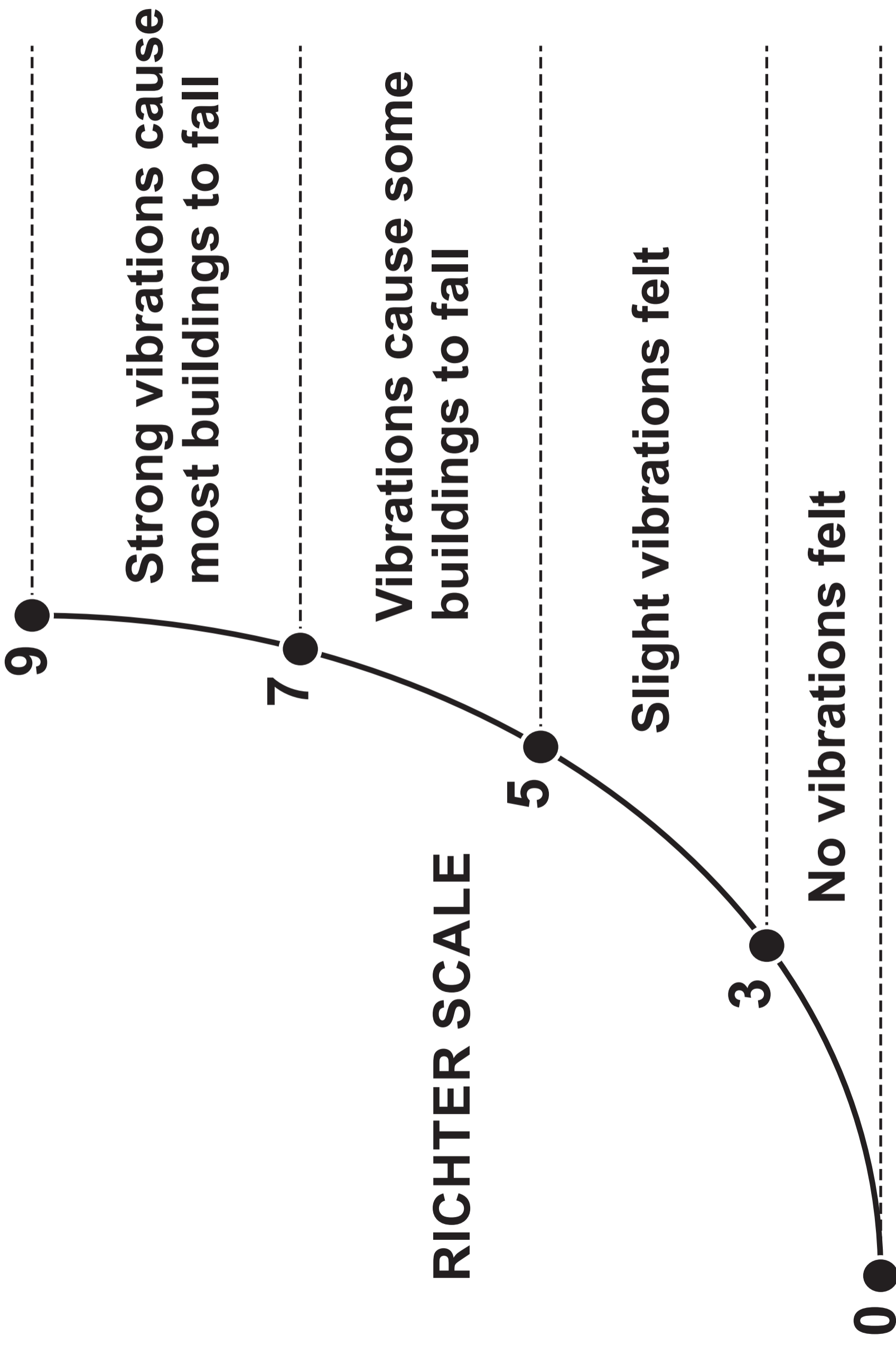


DIAGRAM 3.6



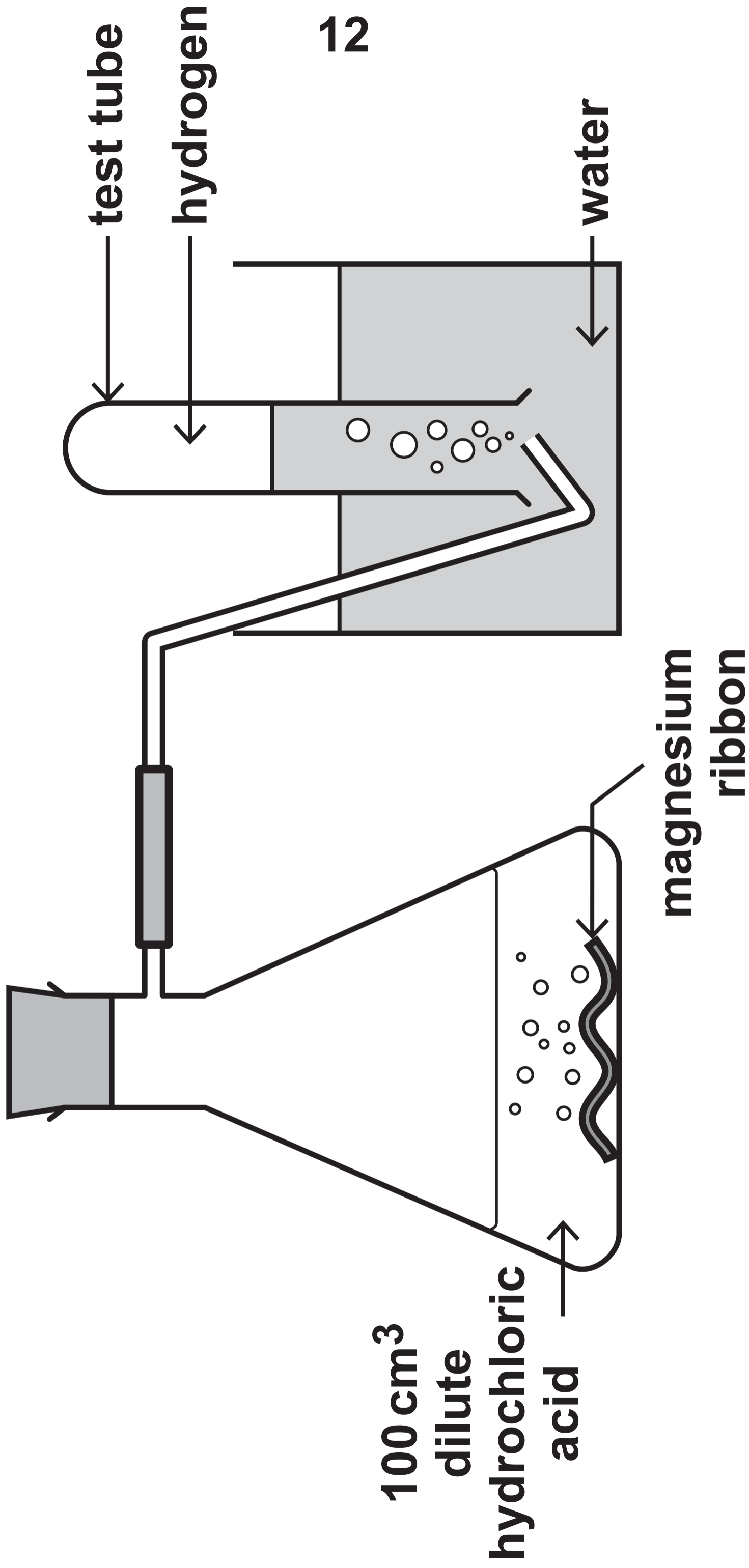


**DIAGRAM 3.7**





**DIAGRAM 4.1**





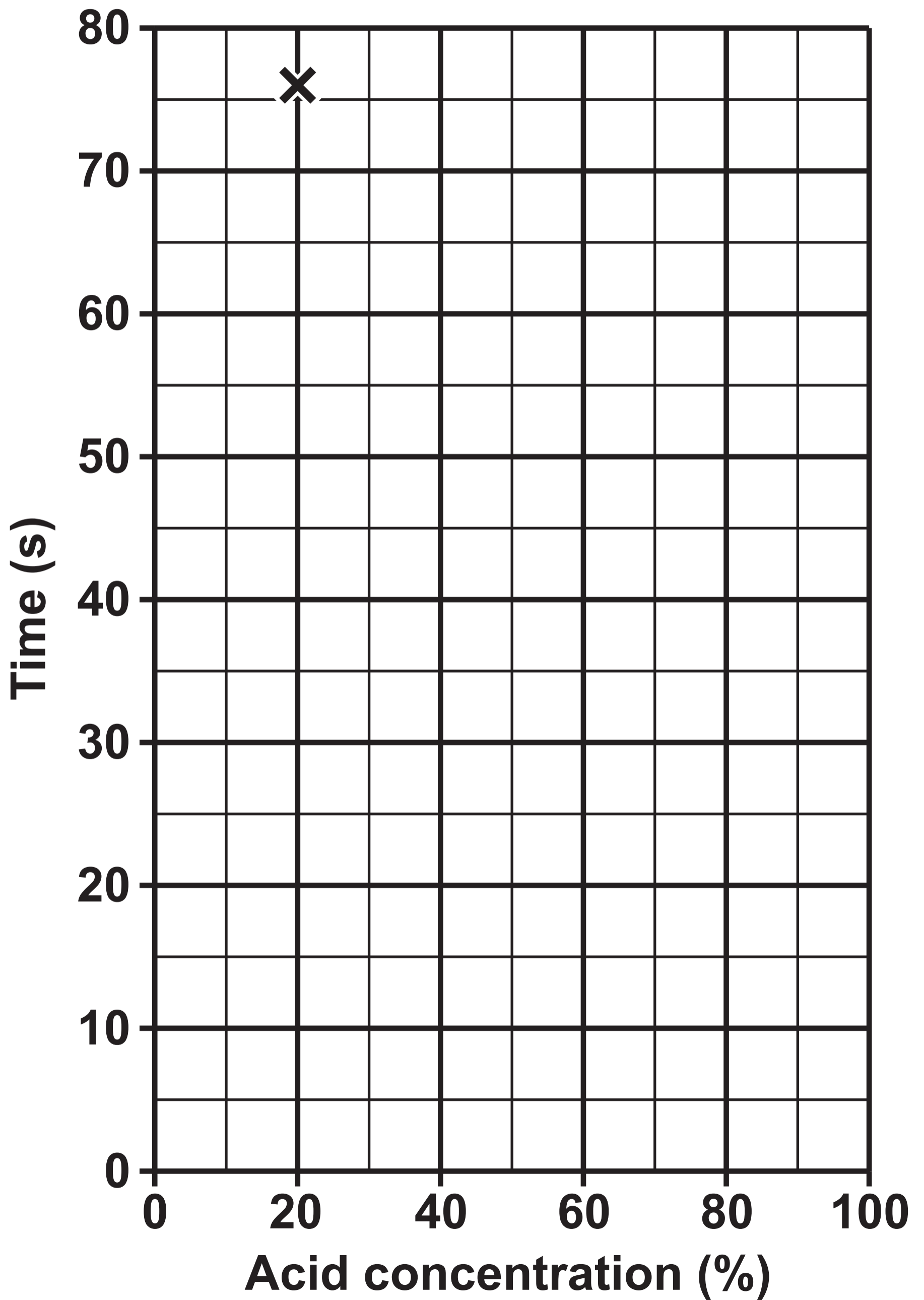
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**TABLE 4.2**

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

## GRAPH 4.3



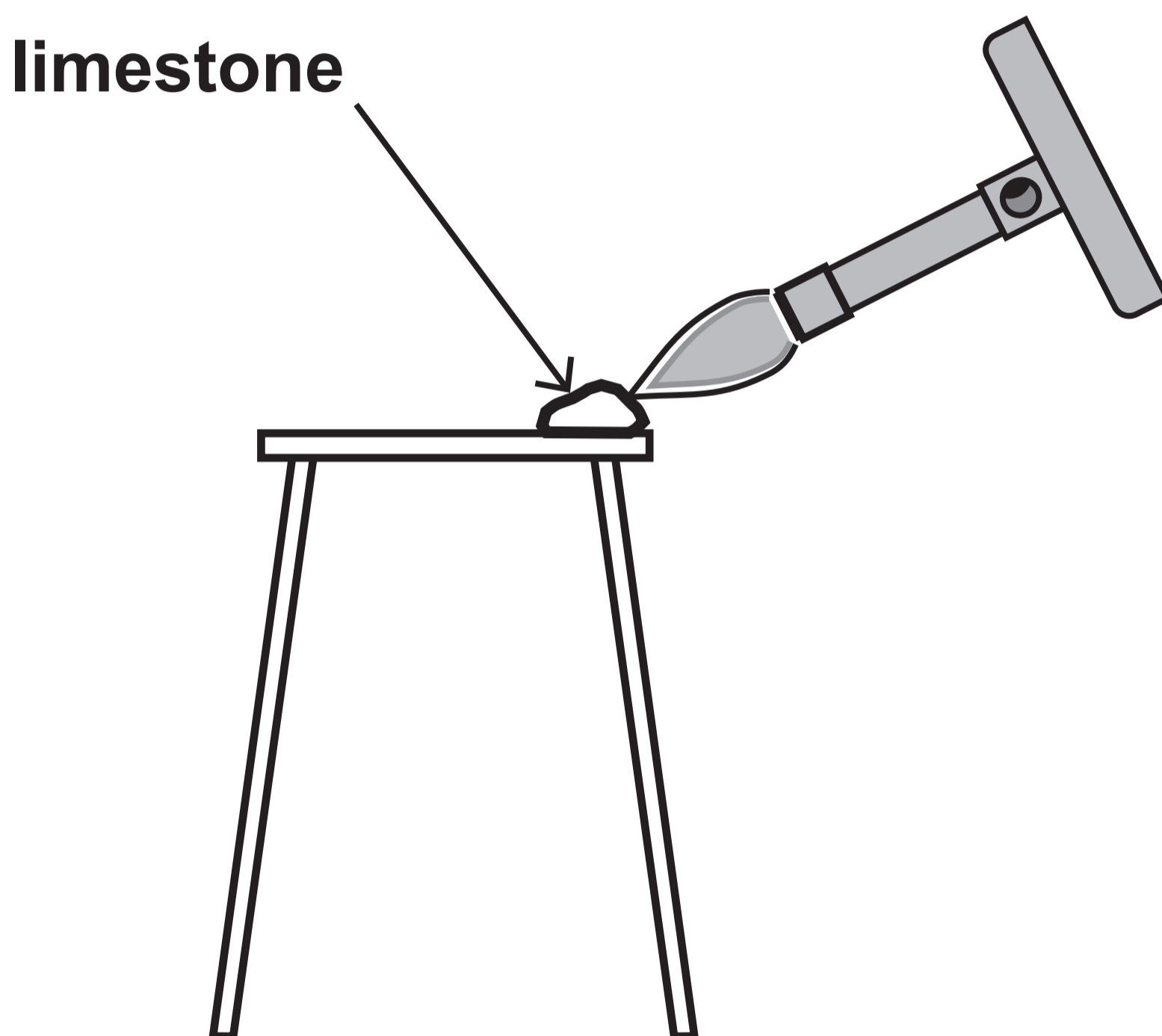


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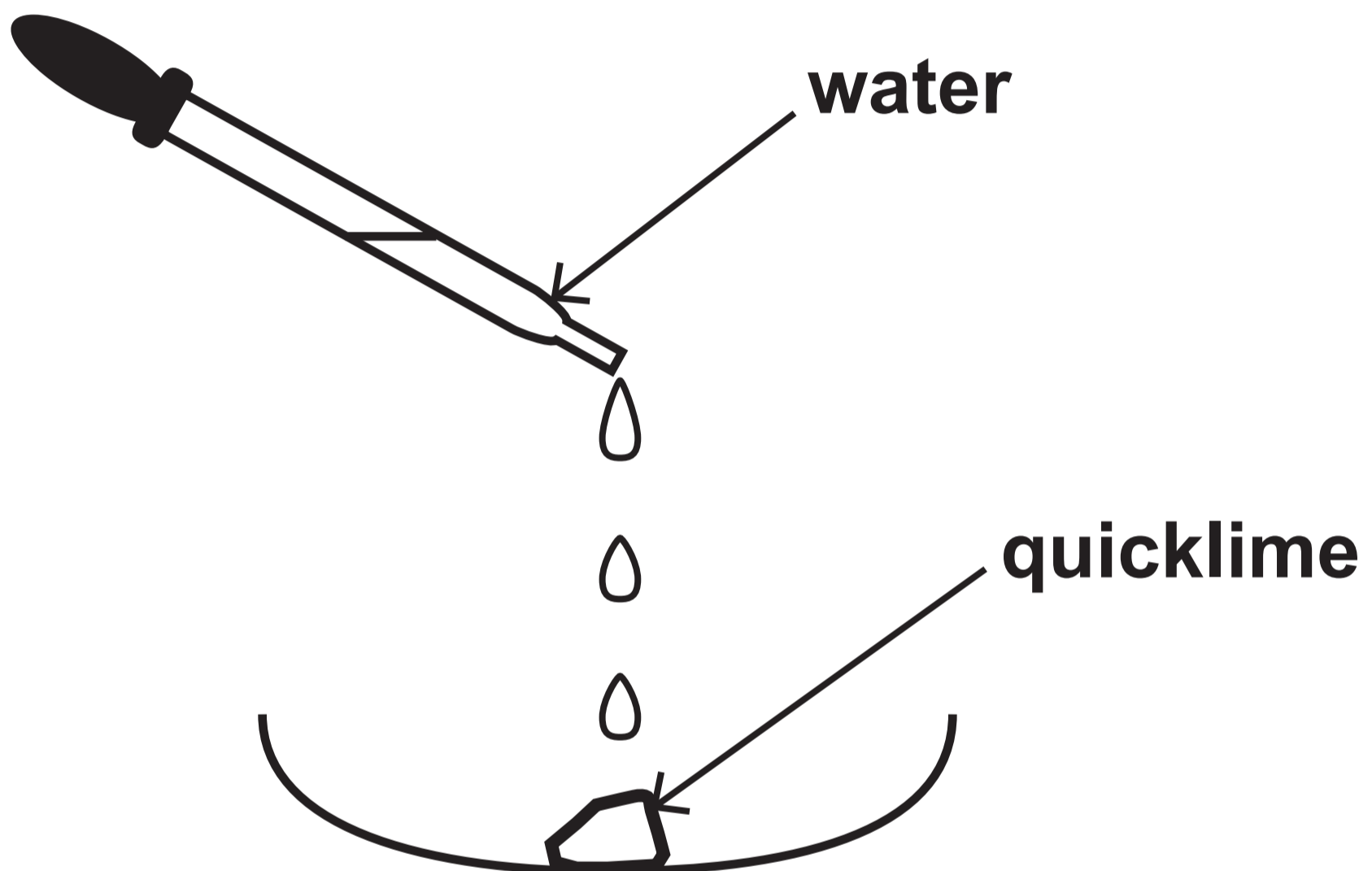
## DIAGRAM 5.1

**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



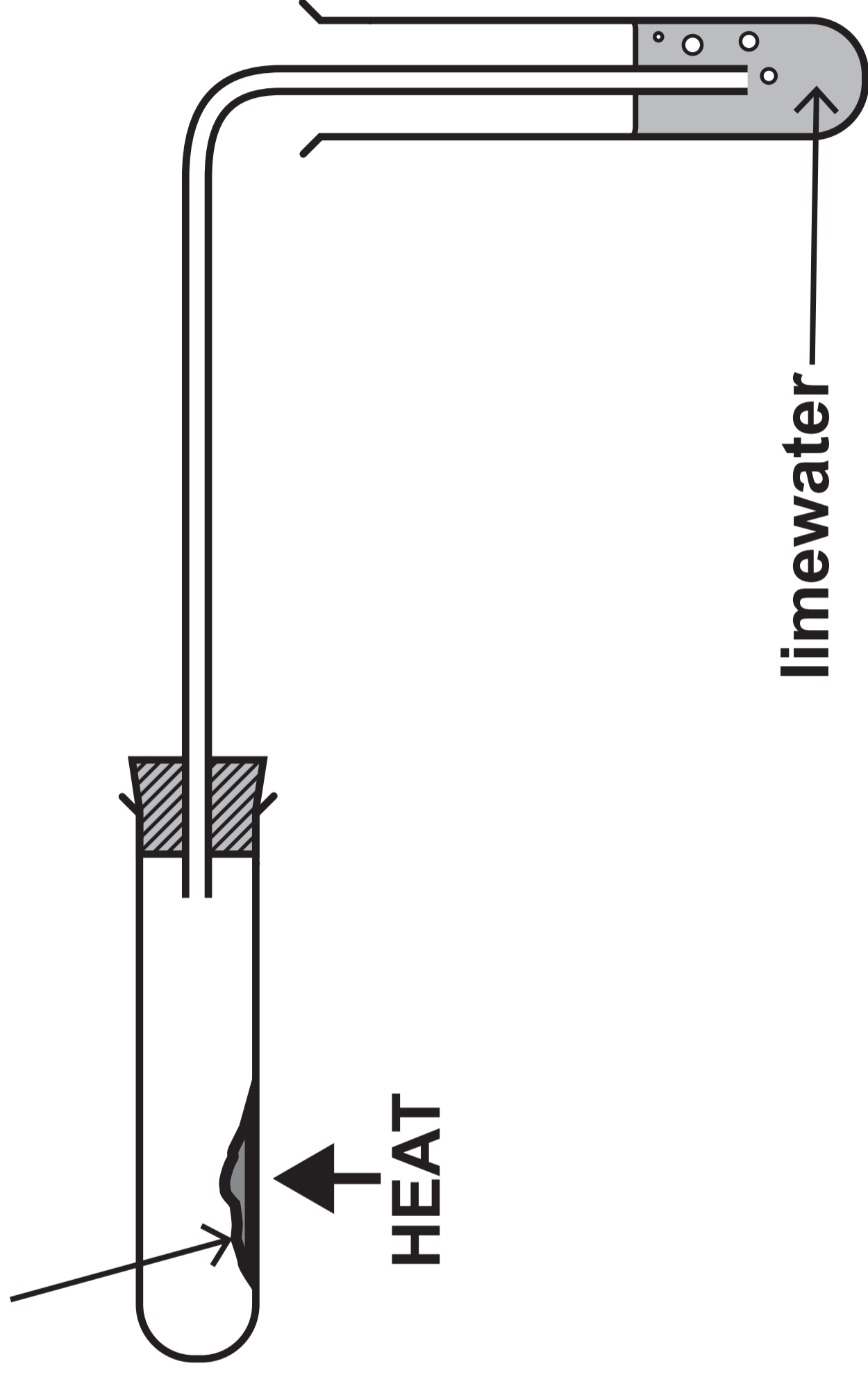


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# DIAGRAM 6.1

metal carbonate



**TABLE 6.2**

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



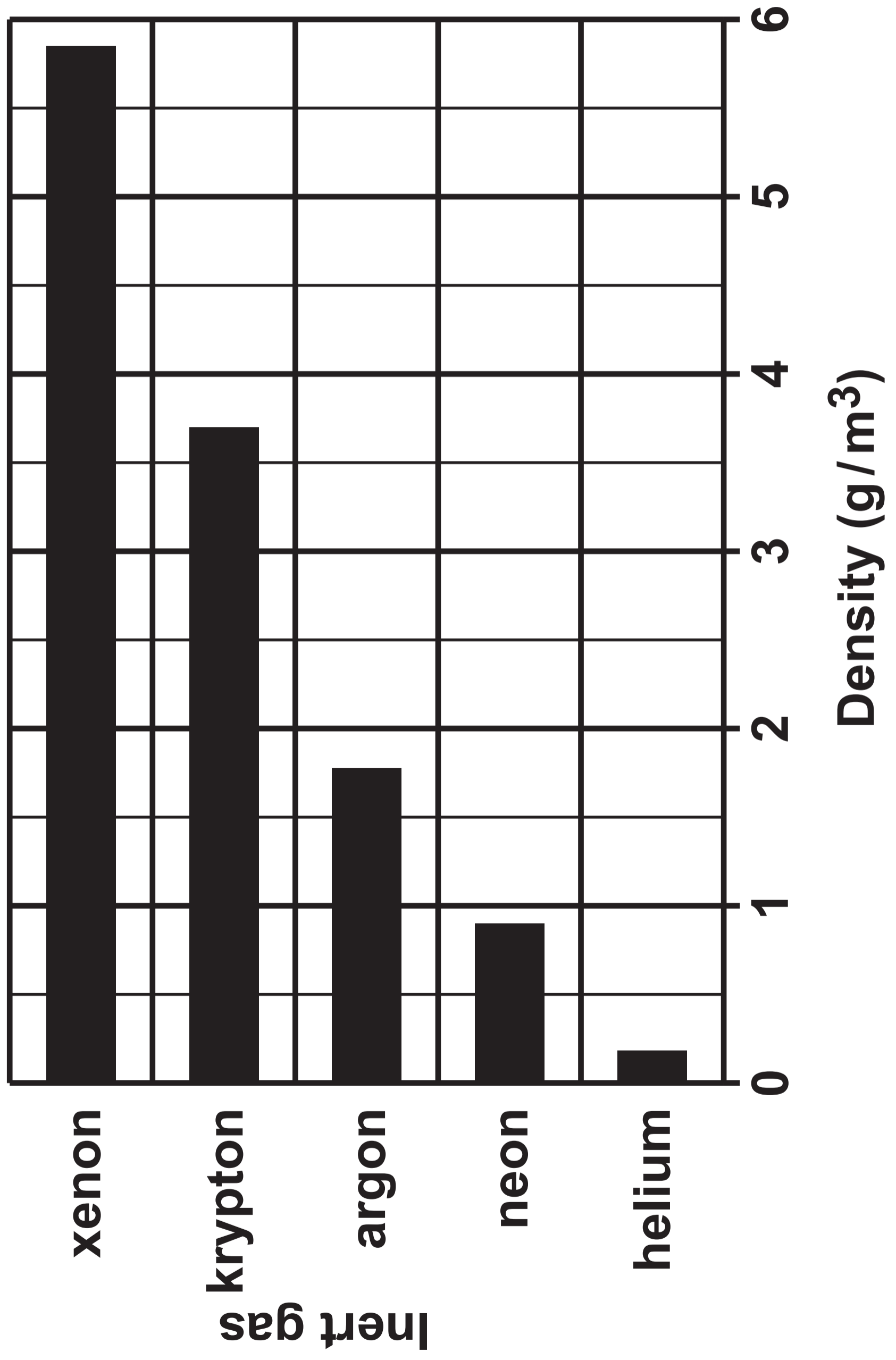
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**TABLE 7.1**

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

**BAR CHART 7.2**



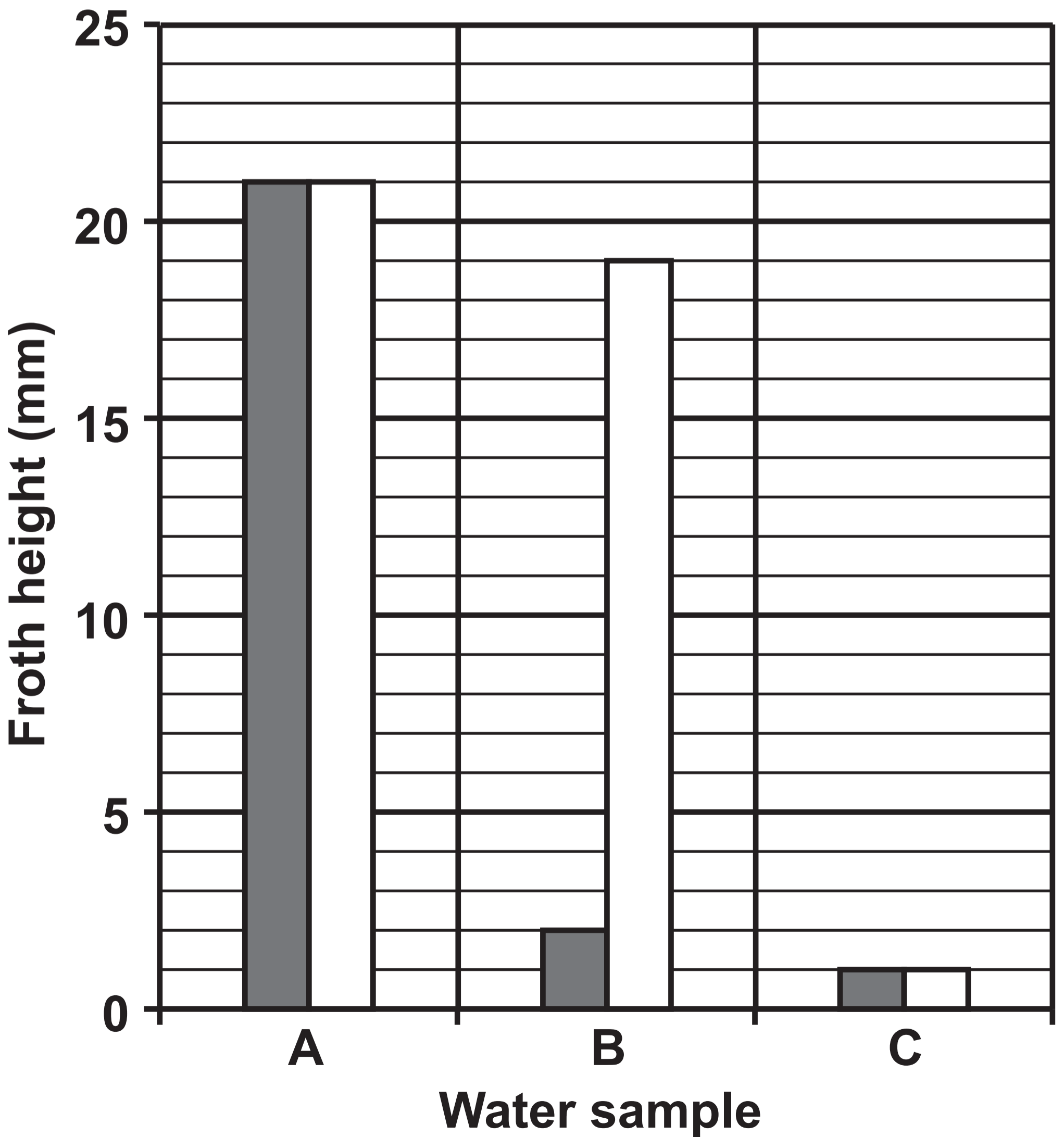
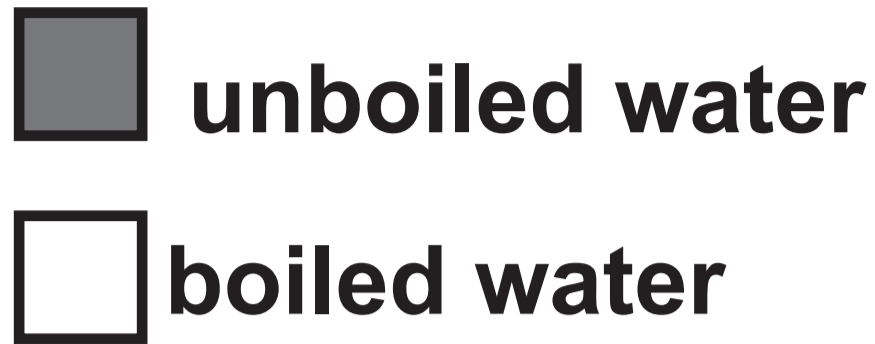


**TABLE 7.3**

<b>Group 0 element</b>	<b>Electronic structure</b>
<b>helium</b>	<b>2</b>
<b>neon</b>	<b>2,8</b>
<b>argon</b>	<b>2,8,8</b>

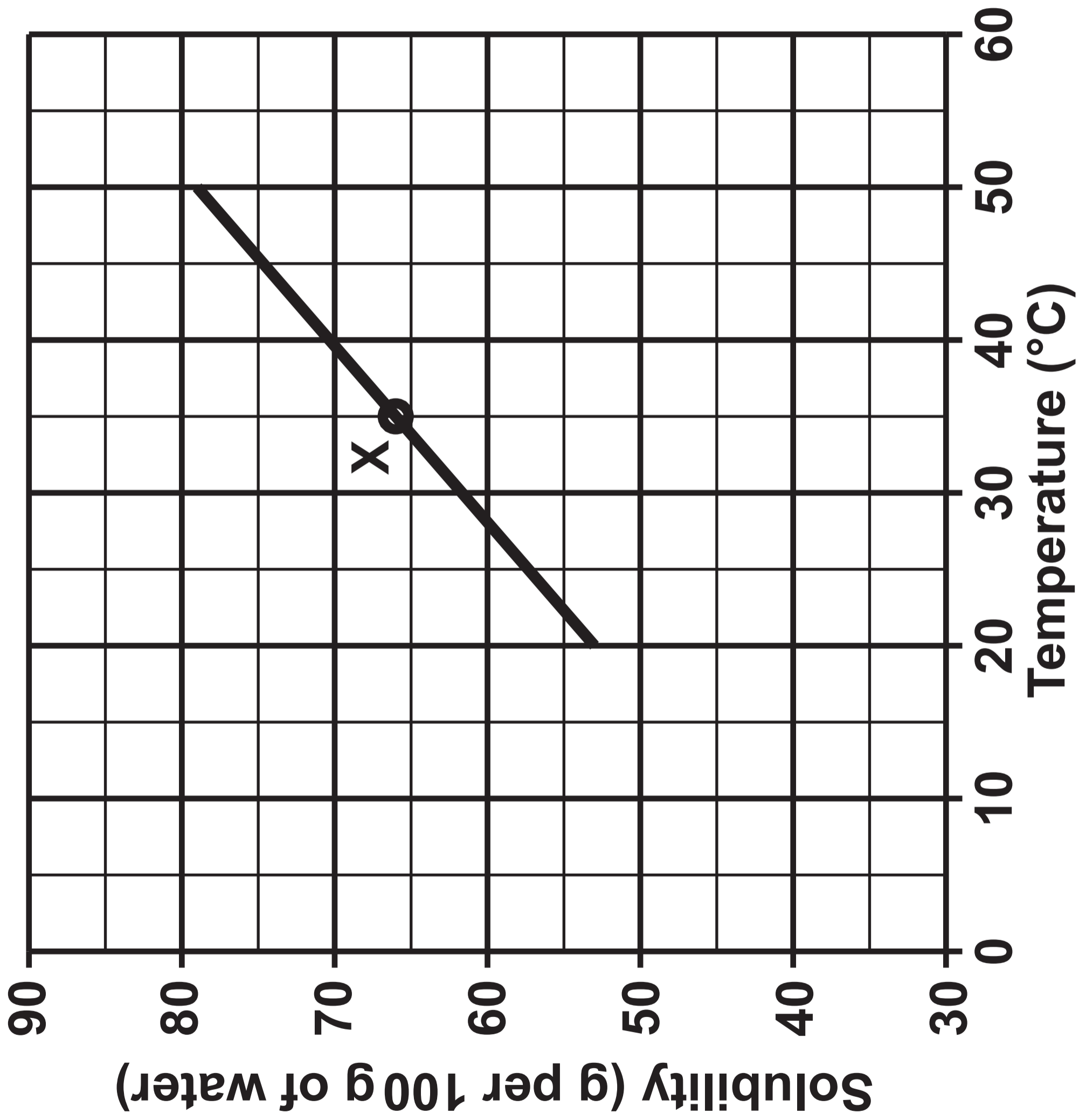


GRAPH 8.1





GRAPH 8.2





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TABLE 9.2

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



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# DIAGRAM 9.3

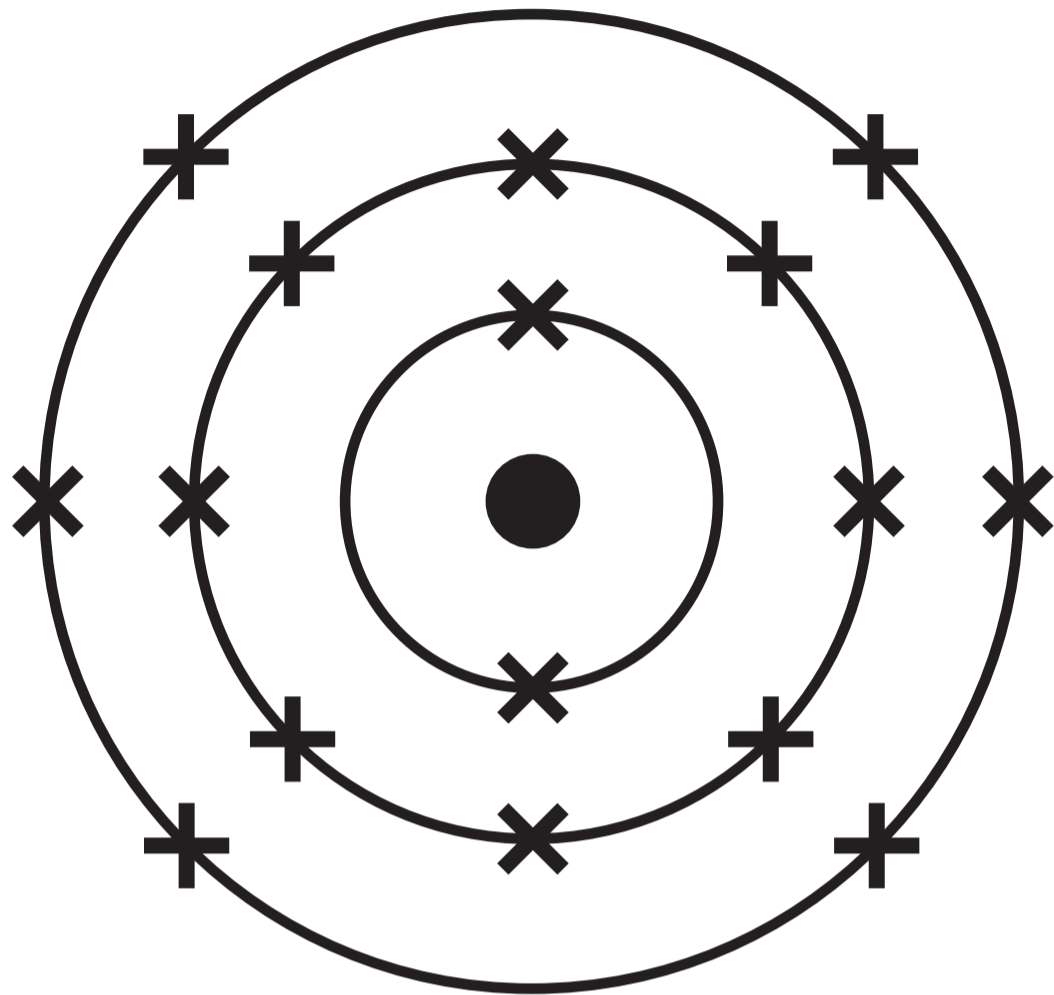


TABLE 9.4

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

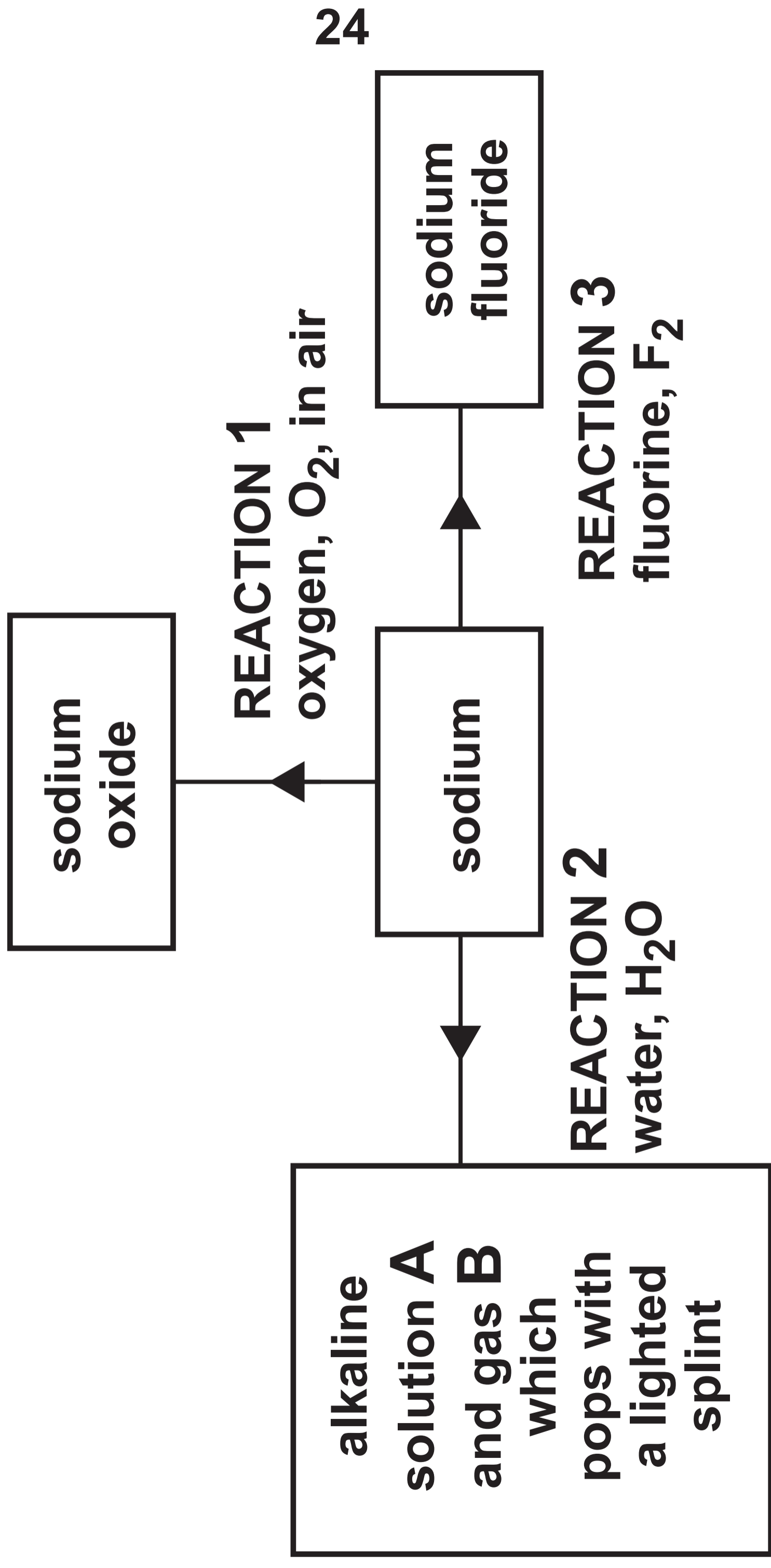


**TABLE 10.1**

<b>Element</b>	<b>Relative atomic mass</b>	<b>Number of electrons in the outer shell</b>	<b>Melting point (°C)</b>	<b>Boiling point (°C)</b>	<b>Density (g/cm<sup>3</sup>)</b>
<b>lithium</b>	<b>7</b>	<b>1</b>	<b>180</b>	<b>1342</b>	<b>0.53</b>
<b>sodium</b>	<b>23</b>	<b>1</b>	<b>98</b>	<b>883</b>	<b>0.97</b>
<b>potassium</b>	<b>39</b>	<b>1</b>	<b>63</b>	<b>759</b>	<b>0.89</b>
<b>rubidium</b>	<b>85</b>	<b>1</b>	<b>39</b>	<b>688</b>	<b>1.53</b>
<b>caesium</b>	<b>134</b>	<b>1</b>	<b>29</b>	<b>671</b>	<b>1.93</b>



**DIAGRAM 10.2**





**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

<b>POSITIVE IONS</b>	
<b>Name</b>	<b>Formula</b>
<b>aluminium</b>	<b>Al<sup>3+</sup></b>
<b>ammonium</b>	<b>NH<sub>4</sub><sup>+</sup></b>
<b>barium</b>	<b>Ba<sup>2+</sup></b>
<b>calcium</b>	<b>Ca<sup>2+</sup></b>
<b>copper(II)</b>	<b>Cu<sup>2+</sup></b>
<b>hydrogen</b>	<b>H<sup>+</sup></b>
<b>iron(II)</b>	<b>Fe<sup>2+</sup></b>
<b>iron(III)</b>	<b>Fe<sup>3+</sup></b>
<b>lithium</b>	<b>Li<sup>+</sup></b>
<b>magnesium</b>	<b>Mg<sup>2+</sup></b>
<b>nickel</b>	<b>Ni<sup>2+</sup></b>
<b>potassium</b>	<b>K<sup>+</sup></b>
<b>silver</b>	<b>Ag<sup>+</sup></b>
<b>sodium</b>	<b>Na<sup>+</sup></b>
<b>zinc</b>	<b>Zn<sup>2+</sup></b>

## NEGATIVE IONS

Name	Formula
bromide	$\text{Br}^-$
carbonate	$\text{CO}_3^{2-}$
chloride	$\text{Cl}^-$
fluoride	$\text{F}^-$
hydroxide	$\text{OH}^-$
iodide	$\text{I}^-$
nitrate	$\text{NO}_3^-$
oxide	$\text{O}^{2-}$
sulfate	$\text{SO}_4^{2-}$

# THE PERIODIC TABLE

1 2 GROUP

1 H 1
-------------

7 Li 3	9 Be 4
23 Na 11	24 Mg 12

<b>KEY</b>	
$A_r$	relative atomic mass
Sym	symbol
Z	atomic number

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
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
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
223 Fr 87	226 Ra 88	227 Ac 89						

3 4 5 6 7 0

4  
He  
2

11 B 5	12 C 6	14 N 7	16 O 8	19 F 9	20 Ne 10
27 Al 13	28 Si 14	31 P 15	32 S 16	35.5 Cl 17	40 Ar 18

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
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
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

# THE PERIODIC TABLE

## PERIODIC TABLE – KEY

### ATOMIC NUMBER – SYMBOL – NAME

<b>1</b>	<b>H – Hydrogen</b>	<b>19</b>	<b>K – Potassium</b>
<b>2</b>	<b>He – Helium</b>	<b>20</b>	<b>Ca – Calcium</b>
<b>3</b>	<b>Li – Lithium</b>	<b>21</b>	<b>Sc – Scandium</b>
<b>4</b>	<b>Be – Beryllium</b>	<b>22</b>	<b>Ti – Titanium</b>
<b>5</b>	<b>B – Boron</b>	<b>23</b>	<b>V – Vanadium</b>
<b>6</b>	<b>C – Carbon</b>	<b>24</b>	<b>Cr – Chromium</b>
<b>7</b>	<b>N – Nitrogen</b>	<b>25</b>	<b>Mn – Manganese</b>
<b>8</b>	<b>O – Oxygen</b>	<b>26</b>	<b>Fe – Iron</b>
<b>9</b>	<b>F – Fluorine</b>	<b>27</b>	<b>Co – Cobalt</b>
<b>10</b>	<b>Ne – Neon</b>	<b>28</b>	<b>Ni – Nickel</b>
<b>11</b>	<b>Na – Sodium</b>	<b>29</b>	<b>Cu – Copper</b>
<b>12</b>	<b>Mg – Magnesium</b>	<b>30</b>	<b>Zn – Zinc</b>
<b>13</b>	<b>Al – Aluminium</b>	<b>31</b>	<b>Ga – Gallium</b>
<b>14</b>	<b>Si – Silicon</b>	<b>32</b>	<b>Ge – Germanium</b>
<b>15</b>	<b>P – Phosphorus</b>	<b>33</b>	<b>As – Arsenic</b>
<b>16</b>	<b>S – Sulfur</b>	<b>34</b>	<b>Se – Selenium</b>
<b>17</b>	<b>Cl – Chlorine</b>	<b>35</b>	<b>Br – Bromine</b>
<b>18</b>	<b>Ar – Argon</b>	<b>36</b>	<b>Kr – Krypton</b>

<b>37</b>	<b>Rb – Rubidium</b>	<b>57</b>	<b>La – Lanthanum</b>
<b>38</b>	<b>Sr – Strontium</b>	<b>72</b>	<b>Hf – Hafnium</b>
<b>39</b>	<b>Y – Yttrium</b>	<b>73</b>	<b>Ta – Tantalum</b>
<b>40</b>	<b>Zr – Zirconium</b>	<b>74</b>	<b>W – Tungsten</b>
<b>41</b>	<b>Nb – Niobium</b>	<b>75</b>	<b>Re – Rhenium</b>
<b>42</b>	<b>Mo – Molybdenum</b>	<b>76</b>	<b>Os – Osmium</b>
<b>43</b>	<b>Tc – Technetium</b>	<b>77</b>	<b>Ir – Iridium</b>
<b>44</b>	<b>Ru – Ruthenium</b>	<b>78</b>	<b>Pt – Platinum</b>
<b>45</b>	<b>Rh – Rhodium</b>	<b>79</b>	<b>Au – Gold</b>
<b>46</b>	<b>Pd – Palladium</b>	<b>80</b>	<b>Hg – Mercury</b>
<b>47</b>	<b>Ag – Silver</b>	<b>81</b>	<b>Tl – Thallium</b>
<b>48</b>	<b>Cd – Cadmium</b>	<b>82</b>	<b>Pb – Lead</b>
<b>49</b>	<b>In – Indium</b>	<b>83</b>	<b>Bi – Bismuth</b>
<b>50</b>	<b>Sn – Tin</b>	<b>84</b>	<b>Po – Polonium</b>
<b>51</b>	<b>Sb – Antimony</b>	<b>85</b>	<b>At – Astatine</b>
<b>52</b>	<b>Te – Tellurium</b>	<b>86</b>	<b>Rn – Radon</b>
<b>53</b>	<b>I – Iodine</b>	<b>87</b>	<b>Fr – Francium</b>
<b>54</b>	<b>Xe – Xenon</b>	<b>88</b>	<b>Ra – Radium</b>
<b>55</b>	<b>Cs – Caesium</b>	<b>89</b>	<b>Ac – Actinium</b>
<b>56</b>	<b>Ba – Barium</b>		