



GCSE

3410U10-1

WEDNESDAY, 12 JUNE 2019 – MORNING

CHEMISTRY – Unit 1:

**Chemical Substances, Reactions and
Essential Resources**

FOUNDATION TIER

1 hour 45 minutes plus your additional time allowance

Surname

Other Names

Centre Number

Candidate Number

0

ADDITIONAL MATERIALS

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

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 on the previous page.

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.

Question 7(a) is a quality of extended response (QER) question where your writing skills will be assessed.

The Periodic Table and the formulae for some common ions are printed as a separate insert.

Answer ALL questions.

1 (a) The diagrams opposite show the atoms of four elements, A-D.

These letters are NOT the chemical symbols for the elements.

(i) Use the letters A-D to complete the following sentences. [2]

Two atoms found in the same group are

_____ and _____ .

The atom found in Group 1 is _____ .

(ii) I Give the electronic structure of atom B.

_____ [1]

II Give the atomic number of atom B.

_____ [1]

1 (b) The diagram opposite shows an atom of lithium.

(i) Complete the following sentences. [2]

Particle X is an _____ .

Particle Y found in the nucleus is a

_____ .

(ii) Use the diagram to explain why lithium has a mass number of 7. [1]

7

2 (a) Study the diagram opposite.

A teacher carried out an experiment to show how to separate a mixture of ethanol and water.

(i) Choose from the box the name of the method used. [1]

<p>CHROMATOGRAPHY</p> <p>FILTRATION</p> <p>DISTILLATION</p> <p>EVAPORATION</p>
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Method _____

2 (a)(ii)

The following sentences show the steps involved in this method of separation.

- A Ethanol vapour cools and condenses**
- B Ethanol boils and evaporates**
- C The mixture of water and ethanol is heated**
- D Ethanol is collected**

Put the steps in the correct order. Use the letters A-D. [1]

2 (a)(iii)

Tick (✓) the box below that explains why it is the water that is left in the flask. [1]

the boiling point of ethanol is equal to the boiling point of water

the boiling point of ethanol is lower than the boiling point of water

the boiling point of ethanol is higher than the boiling point of water

2 (b) A student carried out an investigation to find out whether pigments E, F and G are present in a blue felt pen. The results are shown opposite.

(i) State what the results tell you about the blue ink.

[2]

2 (b)(ii)

Calculate the R_f value of pigment F using the equation given. [2]

$$R_f = \frac{\text{distance moved by pigment}}{\text{distance moved by solvent}}$$

$$R_f = \underline{\hspace{15cm}}$$

7

3 (a) The diagrams opposite represent five substances, A-E.

(i) State which diagram, A-E, represents an element. Give a reason for your answer. [2]

Element _____

Reason _____

(ii) State which diagram, A-E, represents carbon dioxide, CO₂. [1]

(iii) Give the formula of the substance represented by diagram C. [1]

3 (b) When copper(II) sulfate solution reacts with sodium hydroxide, it forms copper(II) hydroxide, $\text{Cu}(\text{OH})_2$, and sodium sulfate, Na_2SO_4 .

(i) Write a WORD equation for the reaction taking place. [1]

(ii) Give the number of atoms of sulfur found in the formula Na_2SO_4 . [1]

(iii) Give the TOTAL number of atoms in the formula $\text{Cu}(\text{OH})_2$. [1]

3 (c)

Iron(III) sulfate reacts with sodium hydroxide to produce iron(III) hydroxide.

Write the formula of iron(III) hydroxide. [1]

8

- 4 The surface of the Earth is divided into a number of tectonic plates. These plates are constantly moving.

Plate boundaries can be classified according to the direction of movement of the plates. The three main types of boundary are shown opposite.

<p style="text-align: center;">CONSERVATIVE</p> <p style="text-align: center;">DESTRUCTIVE</p> <p style="text-align: center;">CONSTRUCTIVE</p>

- (a) Choose the name of each type of boundary from the box. [2]

A _____

B _____

C _____

4 (b) Describe what happens as a result of the movement shown at boundary A. [2]

(c) Explain what happens at boundary C as a result of the plate movement shown. [2]

6

5 (a) The chart opposite shows the melting points and boiling points of some Group 4 elements.

(i) Describe the trend in melting point going down Group 4. [1]

(ii) Name the element which has the greatest DIFFERENCE between its melting point and boiling point. [1]

5 (b)(i)

Name an element in Group 4 that is considered to be a semi-metal (metalloid). [1]

(ii) Tick (✓) the box below that describes where semi-metals are found in the Periodic Table. [1]

some are found in all groups

they are all found in Group 4

some are found in Group 1 and Group 2

they are all found between metals and non-metals

**5 (c) Carbon is the main element found in coal.
When carbon burns it forms carbon dioxide.**

**(i) Write a WORD equation to show the reaction
taking place. [1]**

**(ii) Name ONE environmental problem caused by
increased levels of carbon dioxide in the
atmosphere. [1]**

6

- 6 This question is about the development of the Periodic Table.**

In 1890, not all the elements had been discovered. A Russian scientist named Dmitri Mendeleev used the reactions of the known elements and their relative atomic masses to arrange them in the table opposite.

continued on the following page

Study the table opposite.

Based on the properties of the known elements, he predicted that new elements would be discovered and left gaps for these in his table. He even predicted what the properties of these undiscovered elements would be. He gave the name ekasilicon to one of them. The element that fits into this gap was eventually discovered and named germanium.

The modern day Periodic Table is based on Mendeleev's original table.

6 (a)(i)

Put a tick (✓) in the correct column to show whether the statements opposite apply to Mendeleev's table only, today's table only or to both tables. [2]

- 6 (ii) Tick (✓) the TWO statements that best describe why germanium was confirmed to be the element ekasilicon predicted by Mendeleev.

[1]

germanium has exactly the same atomic mass as that predicted for ekasilicon

germanium has a different colour to that predicted for ekasilicon

germanium has a similar density to that predicted for ekasilicon

germanium oxide has the same ratio of atoms as that predicted for ekasilicon oxide

germanium oxide and germanium chloride have the same ratio of atoms

6 (b)(i)

Calculate the percentage of oxygen present in the formula of germanium oxide, GeO_2 . [2]

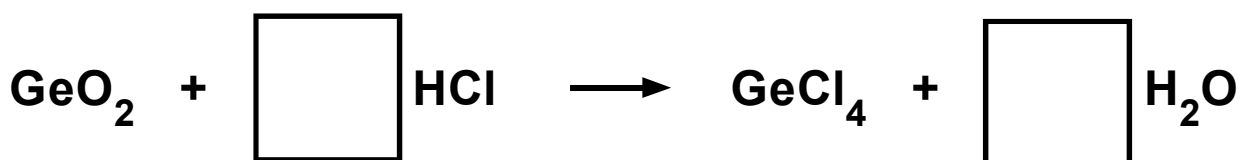
$$A_r(\text{Ge}) = 73$$

$$A_r(\text{O}) = 16$$

Percentage = _____ %

(ii) When germanium oxide reacts with hydrochloric acid it produces germanium chloride and water.

Balance the following equation for the reaction that takes place. [1]



6

7 (b) Fluoride is sometimes added to water supplies.

State why fluoride is added and give ONE reason why some people oppose the addition of fluoride to water. [2]

Reason for adding fluoride

Reason why some people oppose its addition

- 7 (c) The advert opposite was published to encourage people to save water by taking a shower instead of a bath.

Use the data in the advert to calculate the percentage of water **SAVED** by taking a shower for 8 minutes rather than running a full bath.

[2]

Percentage of water saved = _____ %

10

8 (a) A student was investigating how the concentration of sodium thiosulfate solution affects its reaction with hydrochloric acid.

(i) The reaction taking place can be represented by the equation opposite, which is NOT balanced.

Write the number 2 in ONE OF THE BOXES on the right hand side in order to balance the equation. [1]

(ii) During the reaction, the solution becomes cloudy due to the formation of a precipitate. State the meaning of the term precipitate. [1]

8 (a)(iii)

The time taken for the cross to disappear was measured as shown opposite the previous page.

The results are shown in the table.

Concentration of sodium thiosulfate solution (mol/dm ³)	Time taken for cross to disappear (s)
1.0	42
0.9	46
0.8	53
0.7	66
0.6	87
0.5	110

Plot the results from the table on the grid opposite.

Draw a suitable line. [3]

8 (a)(iv)

State how concentration affects the TIME TAKEN for the cross to disappear. [1]

(v) What conclusion can be drawn about the effect of concentration on the RATE of this reaction? [1]

8 (b) Study the diagram opposite.

A second student used a light sensor to investigate the effect of temperature on the rate of this reaction.

He obtained the results shown opposite.

8 (b)(i) Give ONE conclusion that can be drawn from these results. State how this is shown by the graph. [2]

(ii) Slightly less light passed through the tube at the start of the experiment at 20 °C than in the others. Suggest a possible practical reason for this. [1]

10

9 (a) The table opposite shows some information about Group 1 elements.

(i) Describe the trend in density going down the group. [1]

(ii) Explain the difference in reactivity down the group in terms of electronic structure. [2]

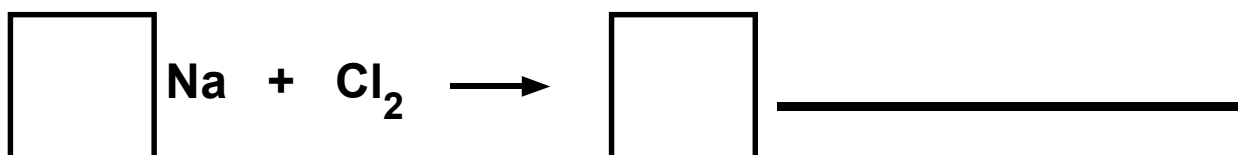
9 (b) The apparatus opposite can be used to demonstrate the reaction between sodium and chlorine.

(i) Apart from the use of safety goggles, state ONE safety precaution that needs to be followed when using EACH of these elements. [2]

Element	Safety precaution
sodium	<hr/>
chlorine	<hr/>

9 (b)(ii)

Complete and balance the symbol equation for the reaction that takes place between sodium and chlorine. [2]



7

10 The diagram opposite shows how limestone, CaCO_3 , can be converted into useful products.

(a) When a piece of limestone is heated strongly its mass decreases.

State the type of reaction taking place. [1]

(b)(i) Describe what is SEEN when limestone is heated and converted into quicklime. [1]

(ii) Write a balanced symbol equation for the reaction taking place. [2]

10 (c)(i)

Describe what is observed when quicklime is converted into slaked lime. [1]

(ii) Write a balanced symbol equation for the reaction taking place. [2]

7

11 (a) Enzymes are biological catalysts. State what is meant by the term catalyst. [2]

11 (b) The graphs opposite show how the activity of two enzymes, A and B, varies with pH.

(i) Use the graphs to compare the activities of the two enzymes. [2]

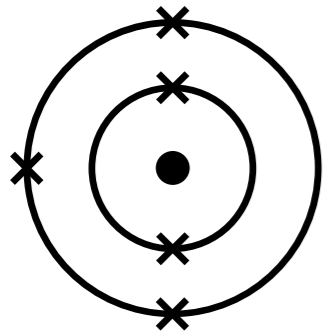
(ii) Enzyme C is found in saliva. It works between pH 5 and pH 9 but is best at a neutral pH.

SKETCH ON THE GRID opposite how the activity varies with pH. [2]

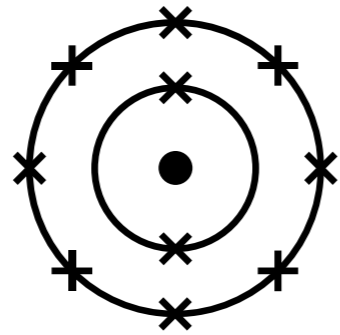
6

END OF PAPER

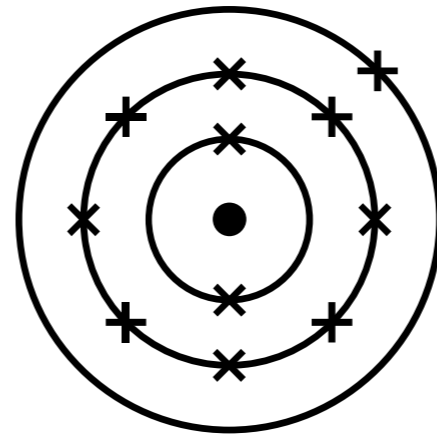
A



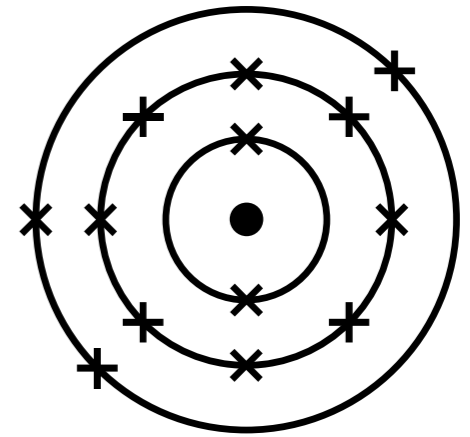
B

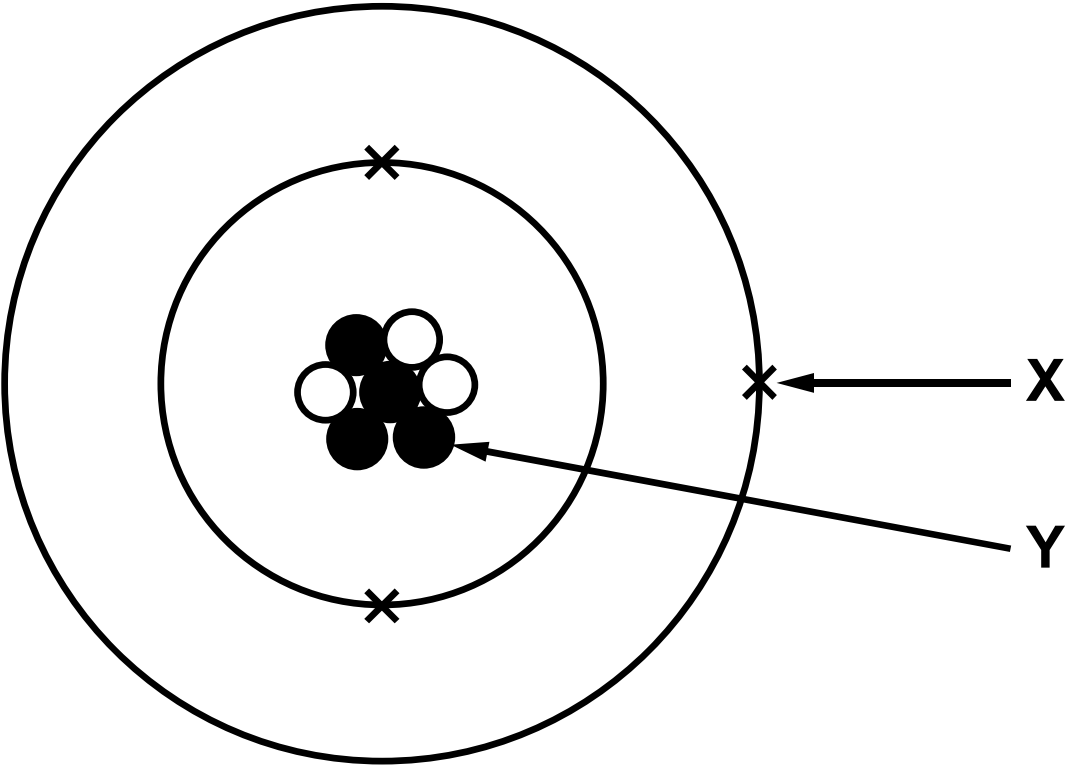


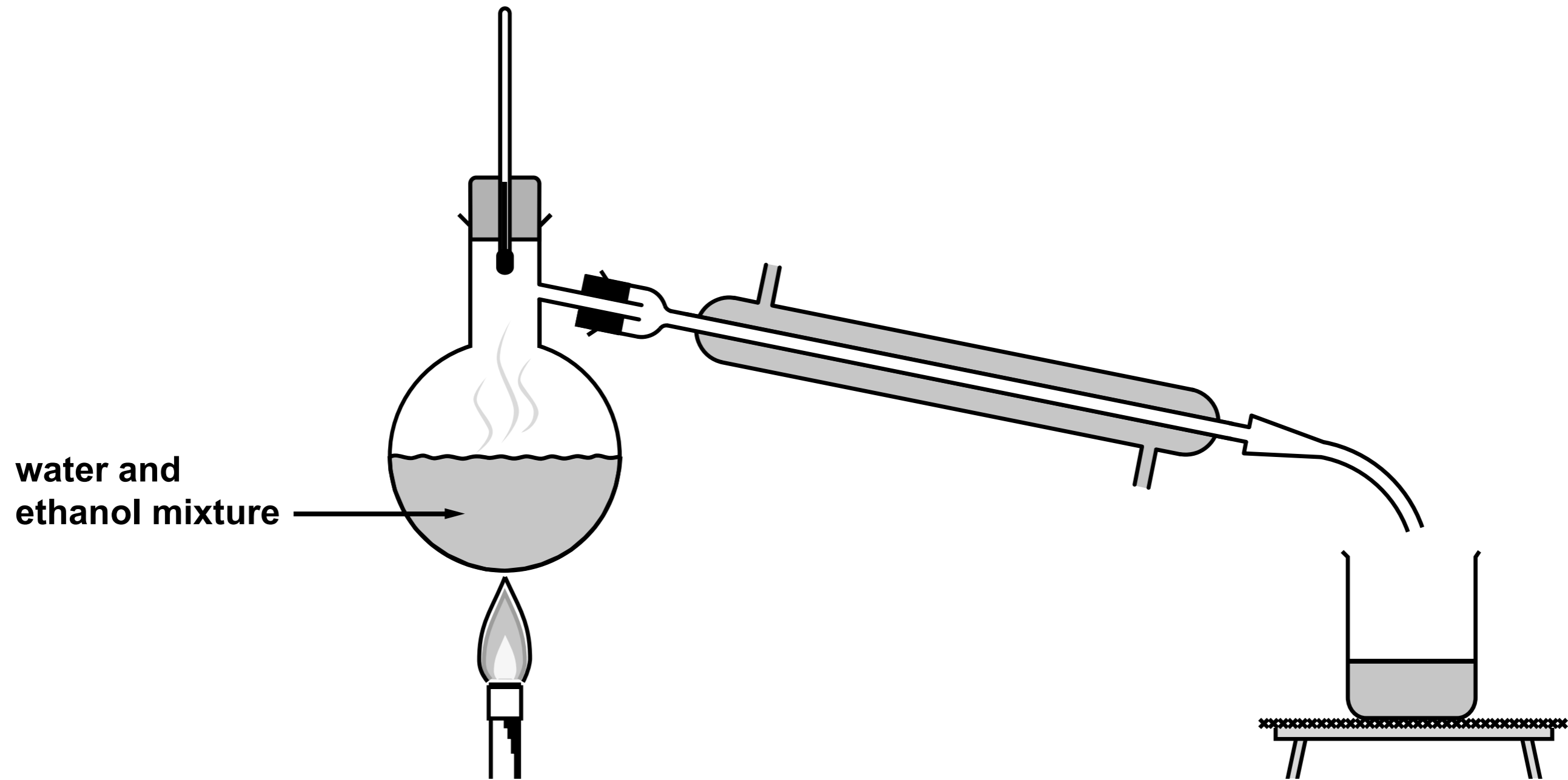
C

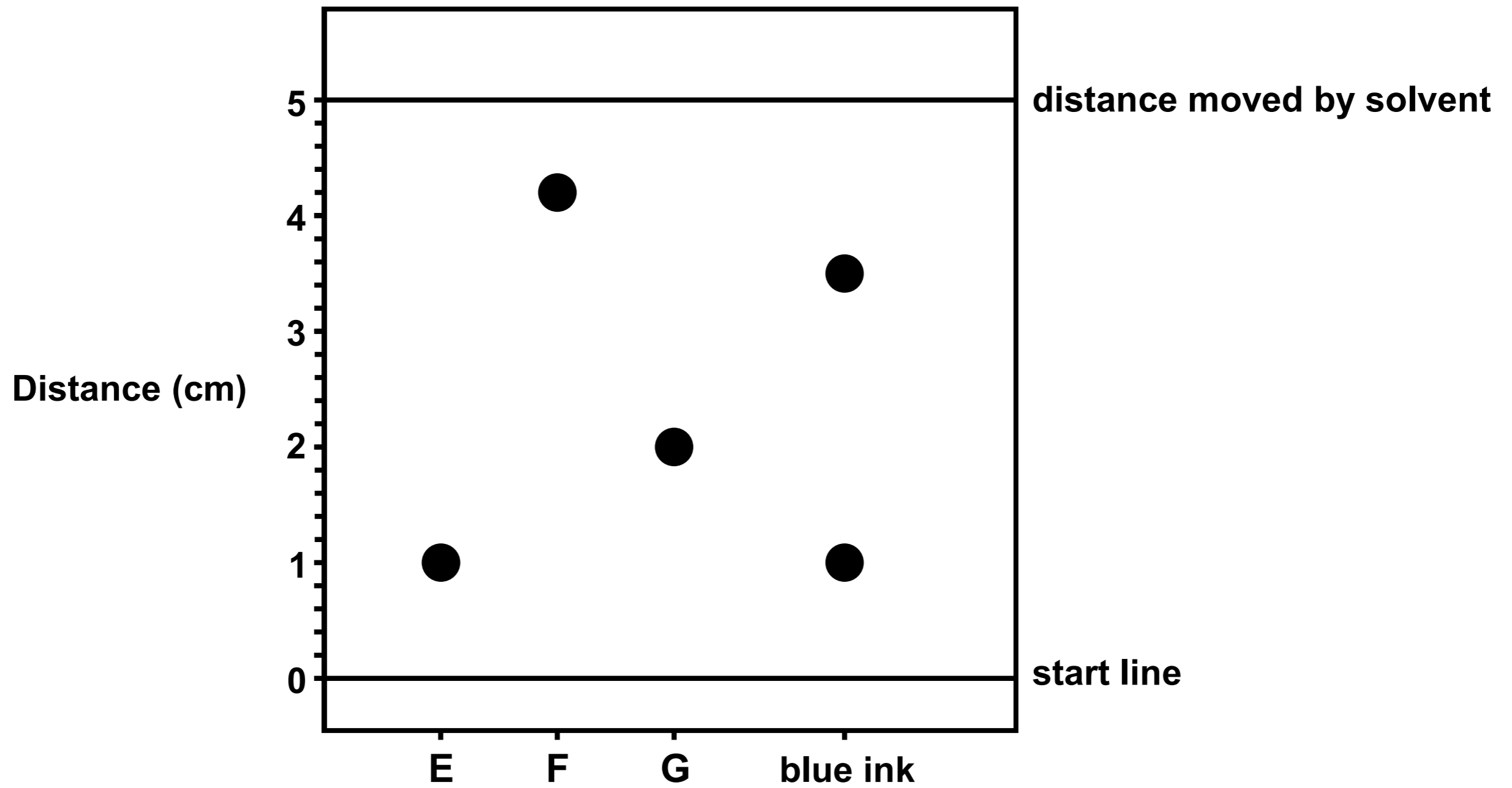


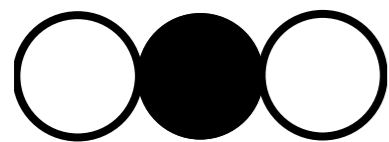
D



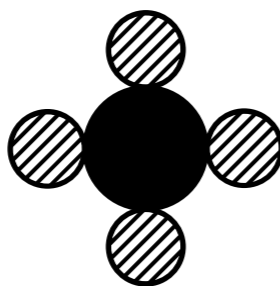




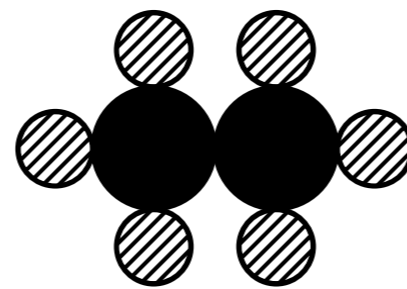




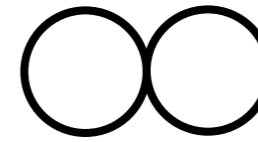
A



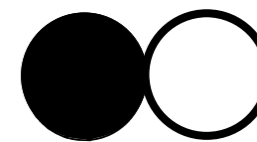
B



C

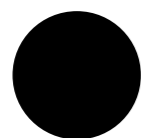


D



E

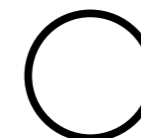
Key



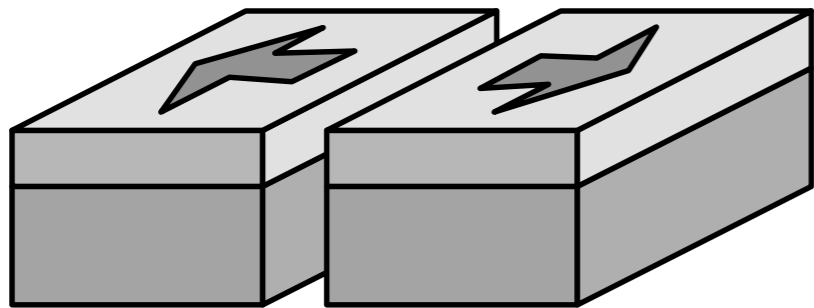
carbon



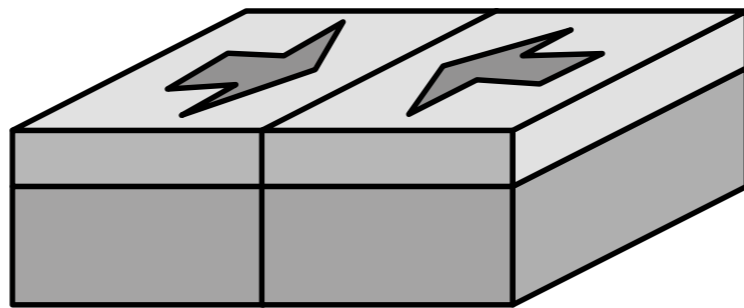
hydrogen



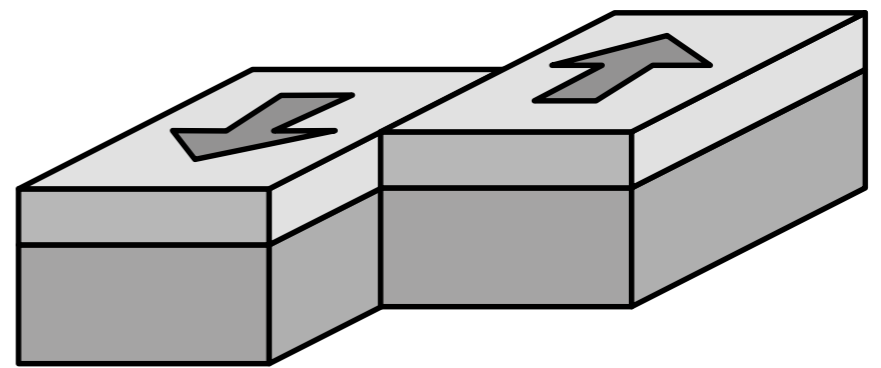
oxygen



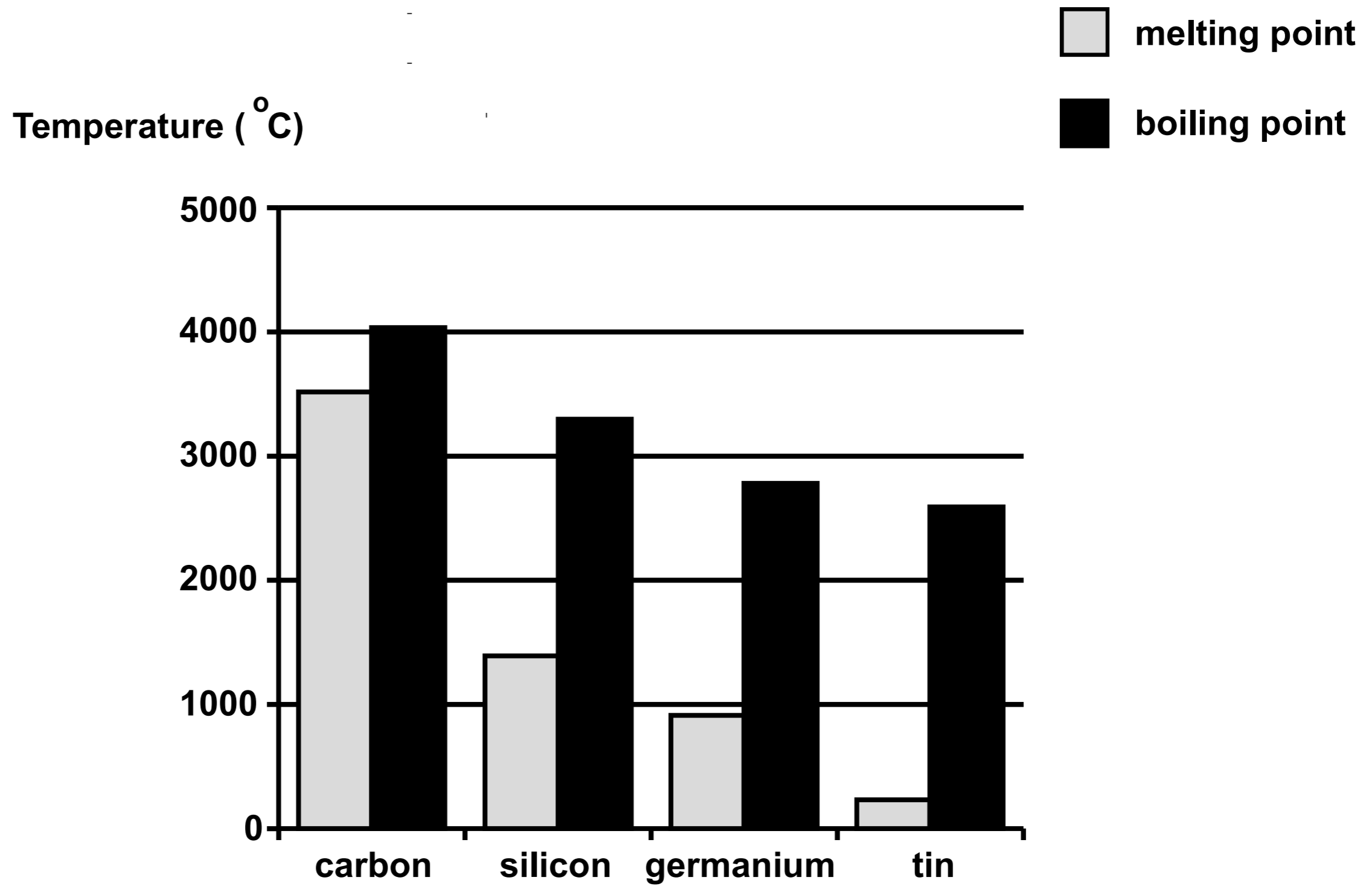
A



B



C



MENDELEEV'S TABLE

I	II	III	IV	V	VI	VII	VIII		
H 1.01									
Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0			
Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5			
K 39.1	Ca 40.1		Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7
Cu 63.5	Zn 65.4			As 74.9	Se 79.0	Br 79.9			
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9		Ru 101	Rh 103	Pd 106
Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127			
Ce 133	Ba 137	La 139		Ta 181	W 184		Os 194	Ir 192	Pt 195
Au 197	Hg 201	Tl 204	Pb 207	Bi 209					
			Th 232		U 238				

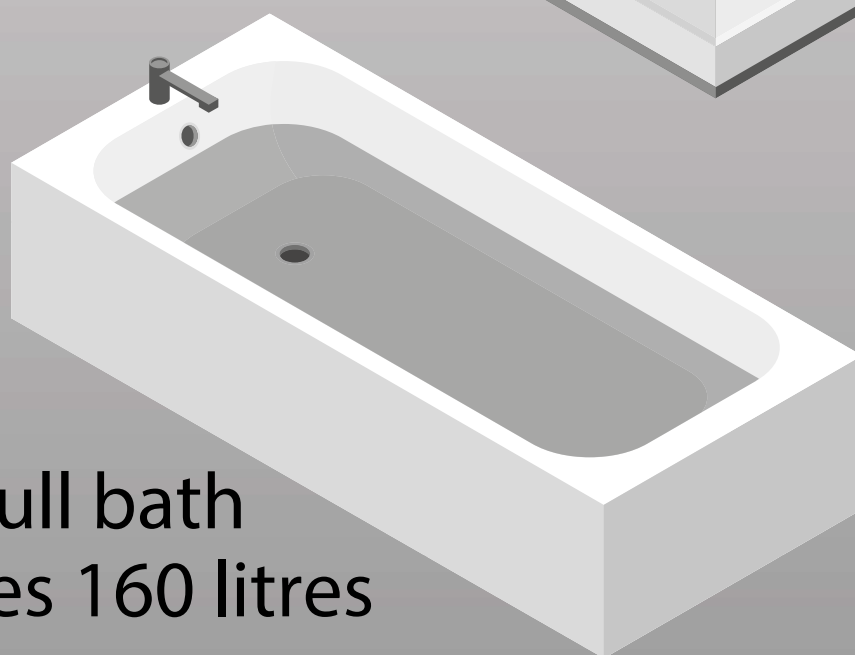
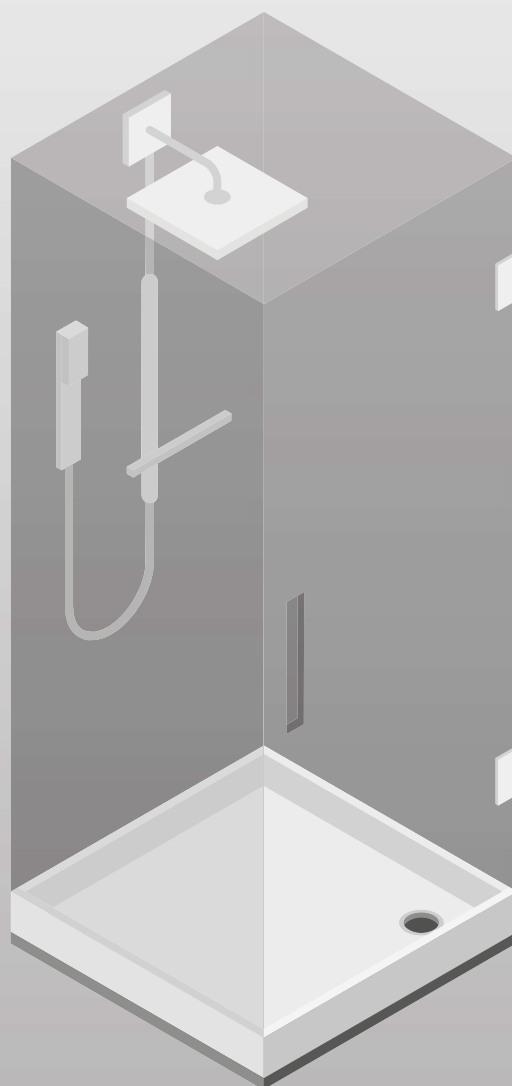
	Mendeleev only	Today only	Both tables
the table is organised into groups			
copper and potassium are in the same group			
there are gaps in the table			
fluorine and chlorine are in the same group			

COMPARISON OF THE PROPERTIES OF EKASILICON AND GERMANIUM

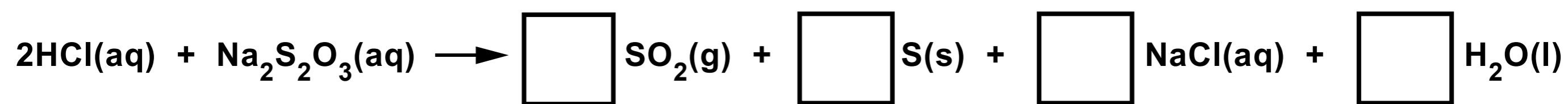
	Predicted properties of ekasilicon (Ek)	Actual properties of germanium (Ge)
Atomic mass	72	72.59
Density (g/cm ³)	5.5	5.35
Melting point	high	937.4 °C
Colour of metal	grey	grey-white
Formula of oxide	EkO ₂	GeO ₂
Formula of chloride	EkCl ₄	GeCl ₄

To
Shower
or to
Bathe?

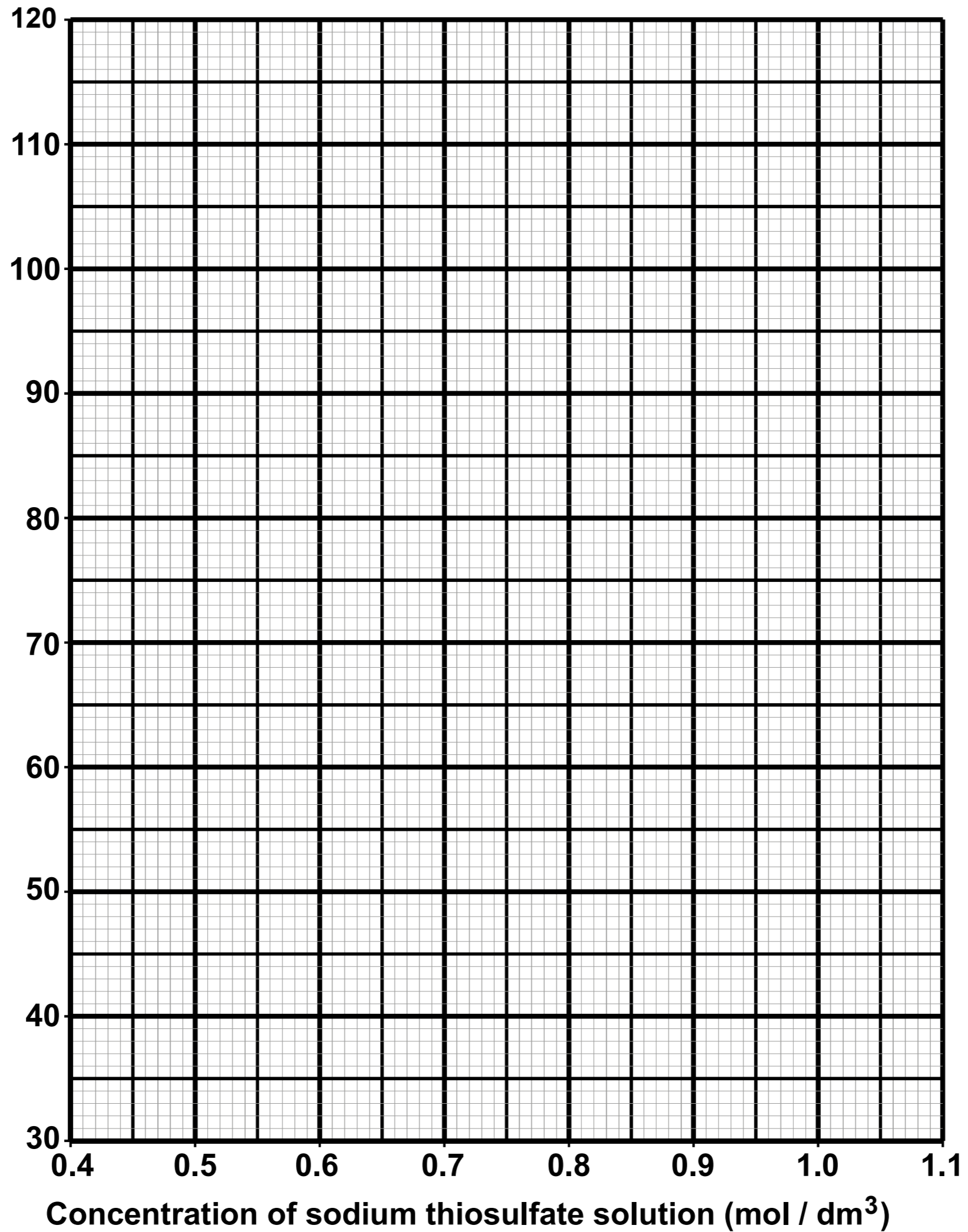
A shower for
8 minutes
uses 76 litres

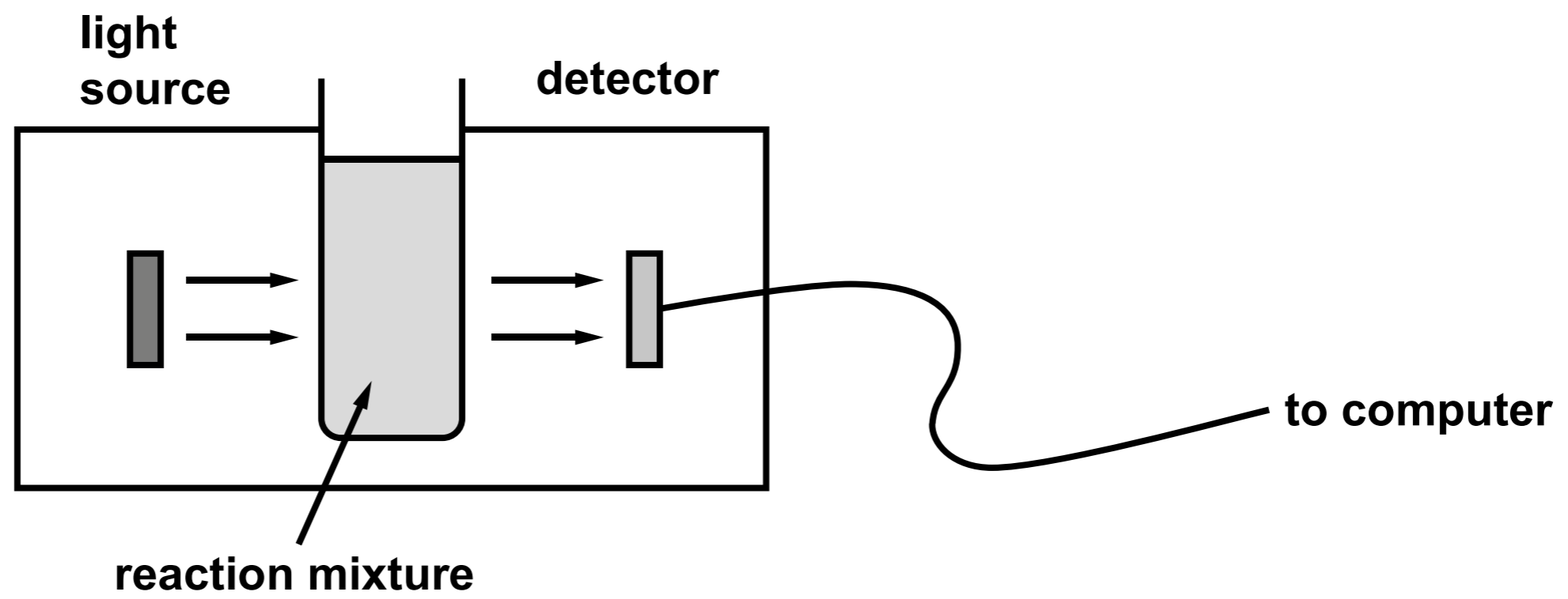


A full bath
uses 160 litres



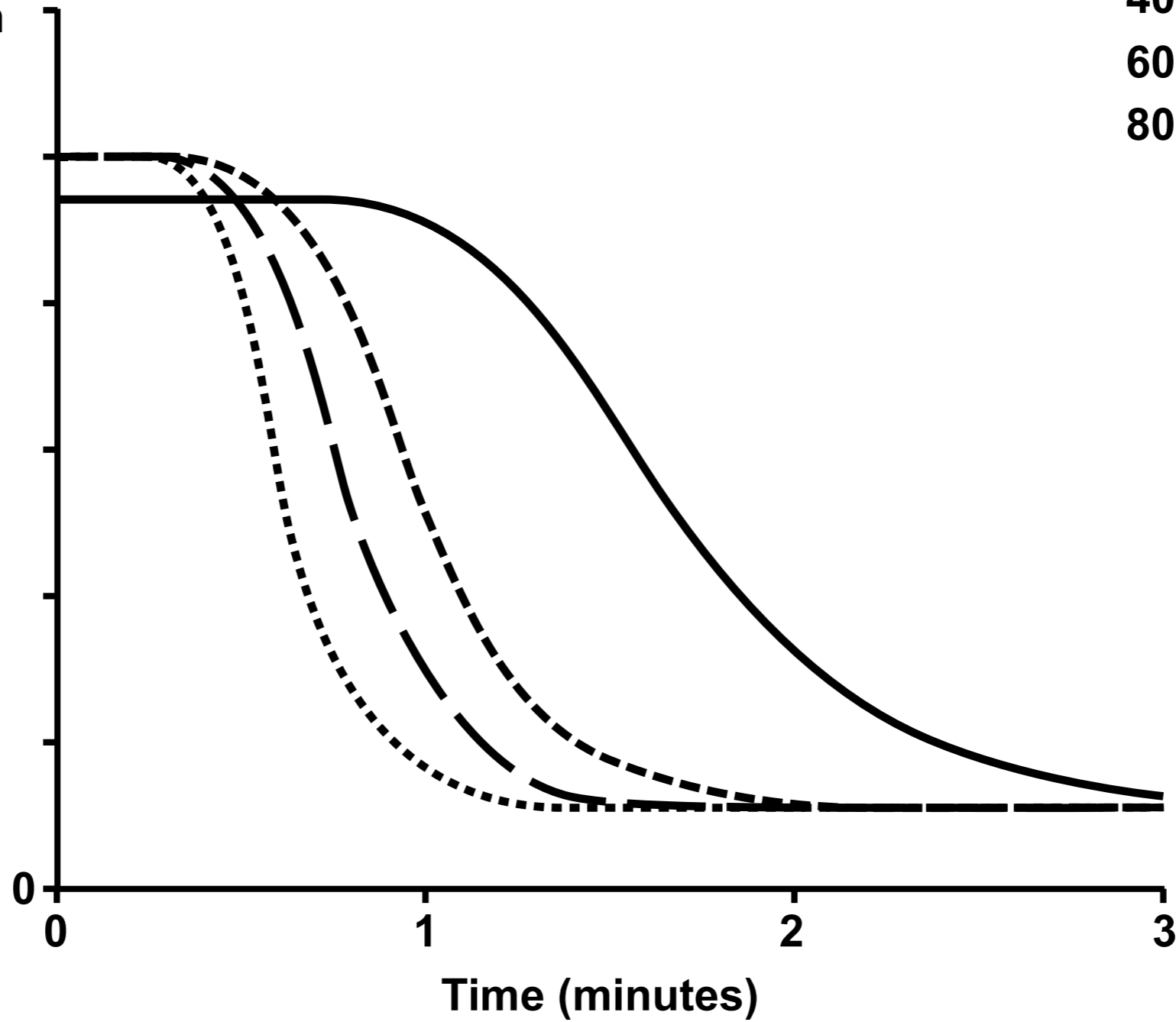
Time taken for cross to disappear (s)



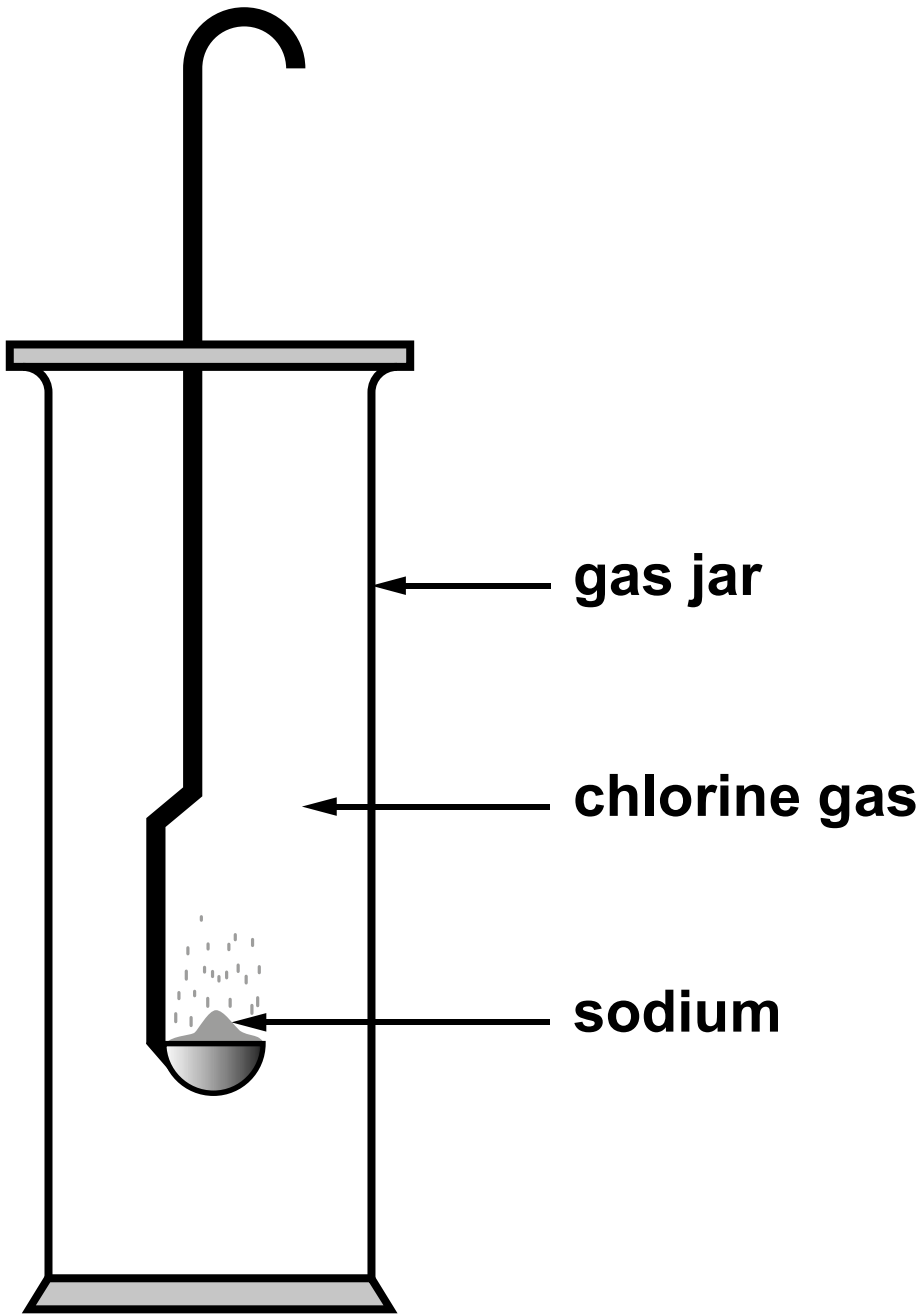


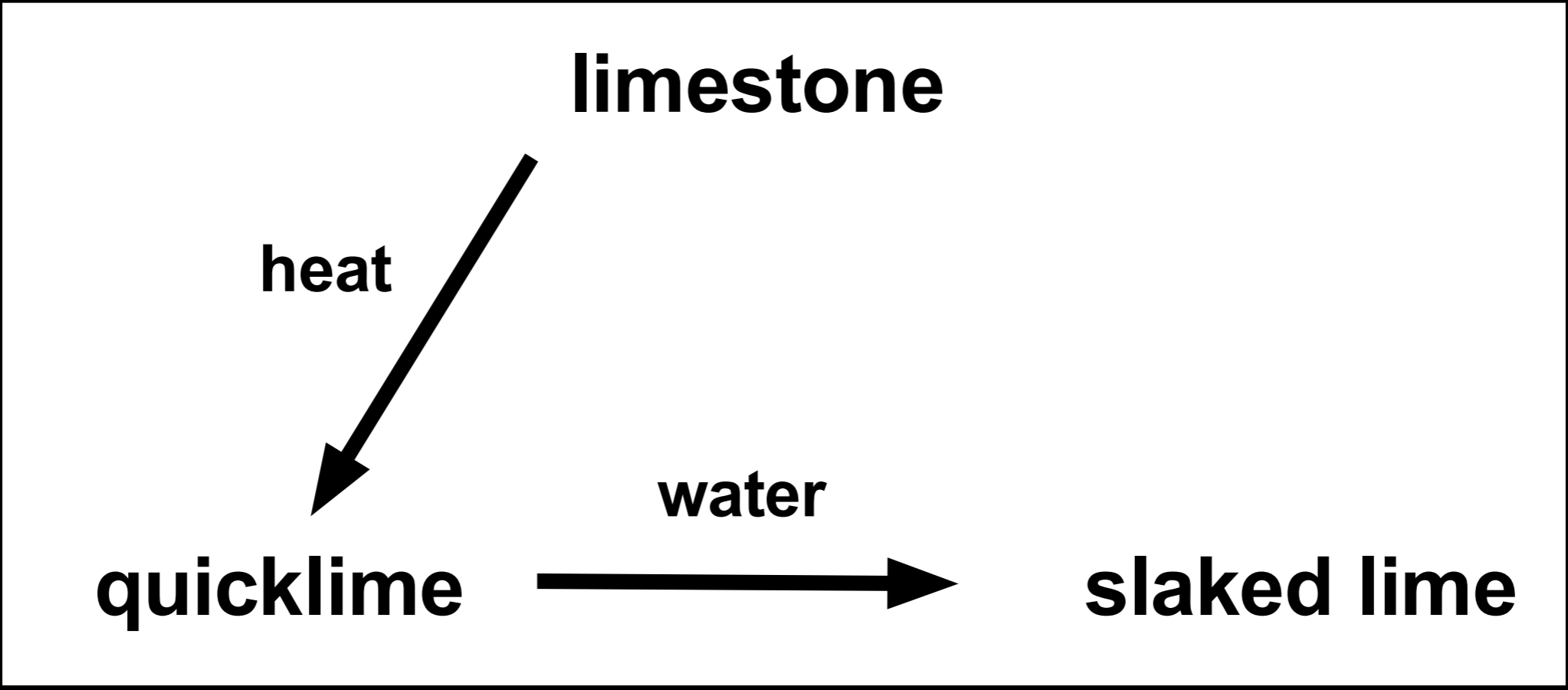
Percentage of light
passing through

20°C ———
40°C - - - -
60°C - - - -
80°C ·····

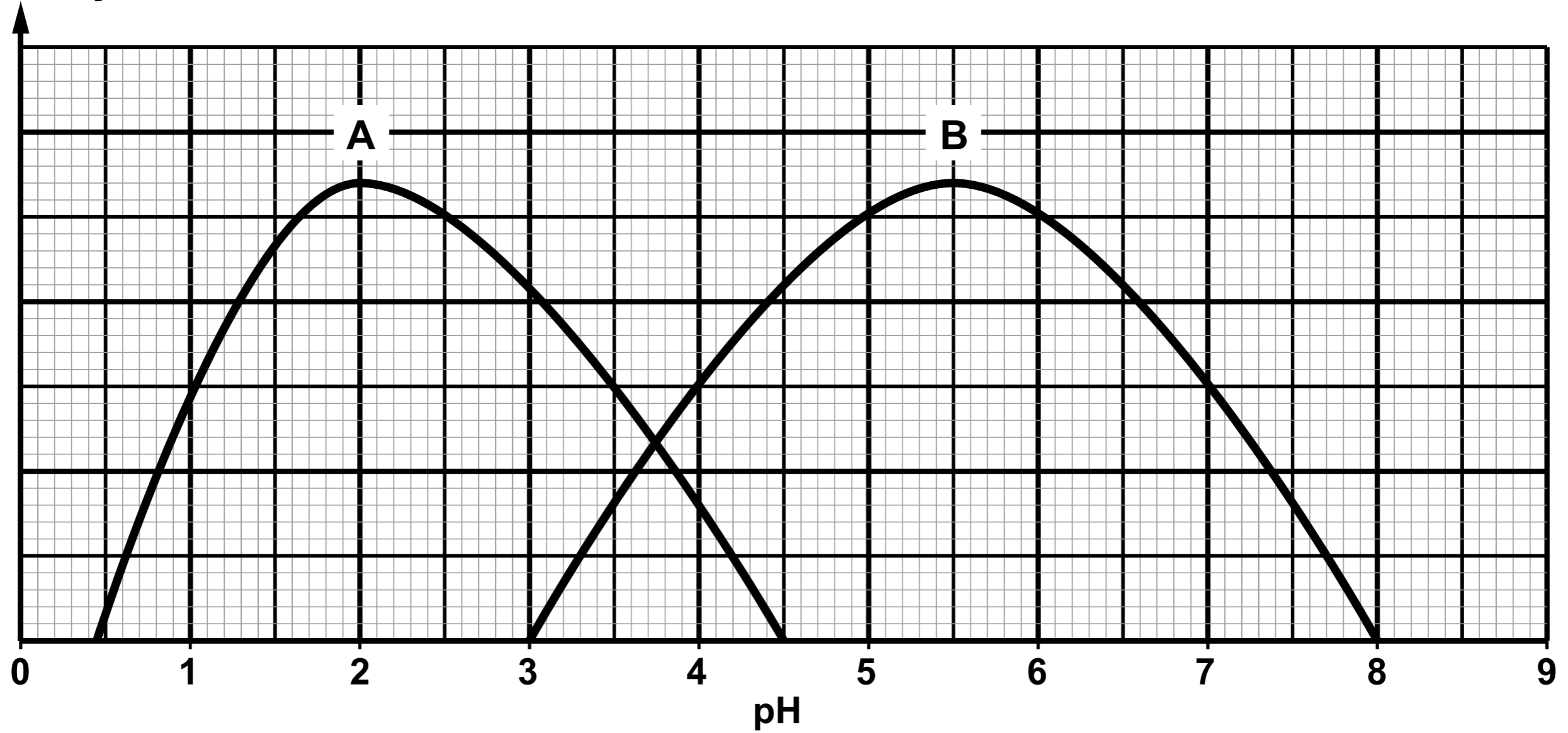


Metal	Melting point (°C)	Boiling point (°C)	Density (g/ cm³)	Reaction with chlorine
lithium	180	1342	0.54	reacts slowly to make a white salt
sodium	97	883	0.97	burns vigorously with a yellow flame to make a white salt
potassium	63	759	0.88	reacts violently to make a white salt
rubidium	39	688	1.53	explosive reaction
caesium	28	671	1.93	explosive reaction





Enzyme activity





GCSE

3410U10-1

WEDNESDAY, 12 JUNE 2019 – MORNING

CHEMISTRY – Unit 1:

**Chemical Substances, Reactions and
Essential Resources**

FOUNDATION TIER

INSERT

PERIODIC TABLE - KEY
ATOMIC NUMBER - SYMBOL - NAME

1 H - Hydrogen	32 Ge - Germanium	77 Ir - Iridium
2 He - Helium	33 As - Arsenic	78 Pt - Platinum
3 Li - Lithium	34 Se - Selenium	79 Au - Gold
4 Be - Beryllium	35 Br - Bromine	80 Hg - Mercury
5 B - Boron	36 Kr - Krypton	81 Tl - Thallium
6 C - Carbon	37 Rb - Rubidium	82 Pb - Lead
7 N - Nitrogen	38 Sr - Strontium	83 Bi - Bismuth
8 O - Oxygen	39 Y - Yttrium	84 Po - Polonium
9 F - Fluorine	40 Zr - Zirconium	85 At - Astatine
10 Ne - Neon	41 Nb - Niobium	86 Rn - Radon
11 Na - Sodium	42 Mo - Molybdenum	87 Fr - Francium
12 Mg - Magnesium	43 Tc - Technetium	88 Ra - Radium
13 Al - Aluminium	44 Ru - Ruthenium	89 Ac - Actinium
14 Si - Silicon	45 Rh - Rhodium	
15 P - Phosphorus	46 Pd - Palladium	
16 S - Sulfur	47 Ag - Silver	
17 Cl - Chlorine	48 Cd - Cadmium	
18 Ar - Argon	49 In - Indium	
19 K - Potassium	50 Sn - Tin	
20 Ca - Calcium	51 Sb - Antimony	
21 Sc - Scandium	52 Te - Tellurium	
22 Ti - Titanium	53 I - Iodine	
23 V - Vanadium	54 Xe - Xenon	
24 Cr - Chromium	55 Cs - Caesium	
25 Mn - Manganese	56 Ba - Barium	
26 Fe - Iron	57 La - Lanthanum	
27 Co - Cobalt	72 Hf - Hafnium	
28 Ni - Nickel	73 Ta - Tantalum	
29 Cu - Copper	74 W - Tungsten	
30 Zn - Zinc	75 Re - Rhenium	
31 Ga - Gallium	76 Os - Osmium	

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+}		