GCSE

3410U20-1

FRIDAY, 17 MAY 2024 – MORNING

CHEMISTRY – Unit 2:
Chemical Bonding, Application of Chemical Reactions and Organic Chemistry

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 Diagram Booklet.

A separate Data 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.

Question 8(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 in the separate Data Booklet.

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

Answer ALL questions.

1 (a) A student carried out an experiment to prepare magnesium chloride crystals.

A, B and C in DIAGRAM 1.1 in the separate diagram booklet show the stages of the experiment she carried out. The stages are NOT in the correct order.

(i) I. Give the LETTER that shows the FIRST stage of the experiment. [1 mark]

Letter _____

II. Give the LETTER of the stage that shows filtration. [1 mark]

Letter _____

(ii) The gas formed in the reaction pops with a lighted splint.

UNDERLINE the name of this gas. [1 mark]

oxygen hydrogen carbon dioxide

1 (a)(iii)

Magnesium chloride contains Mg^{2+} and Cl^{-} ions.

Tick (✓) the box next to the formula of magnesium chloride. [1 mark]

☐ $MgCl_2$

☐ Mg_2Cl

☐ $MgCl$

☐ Mg_2Cl_2

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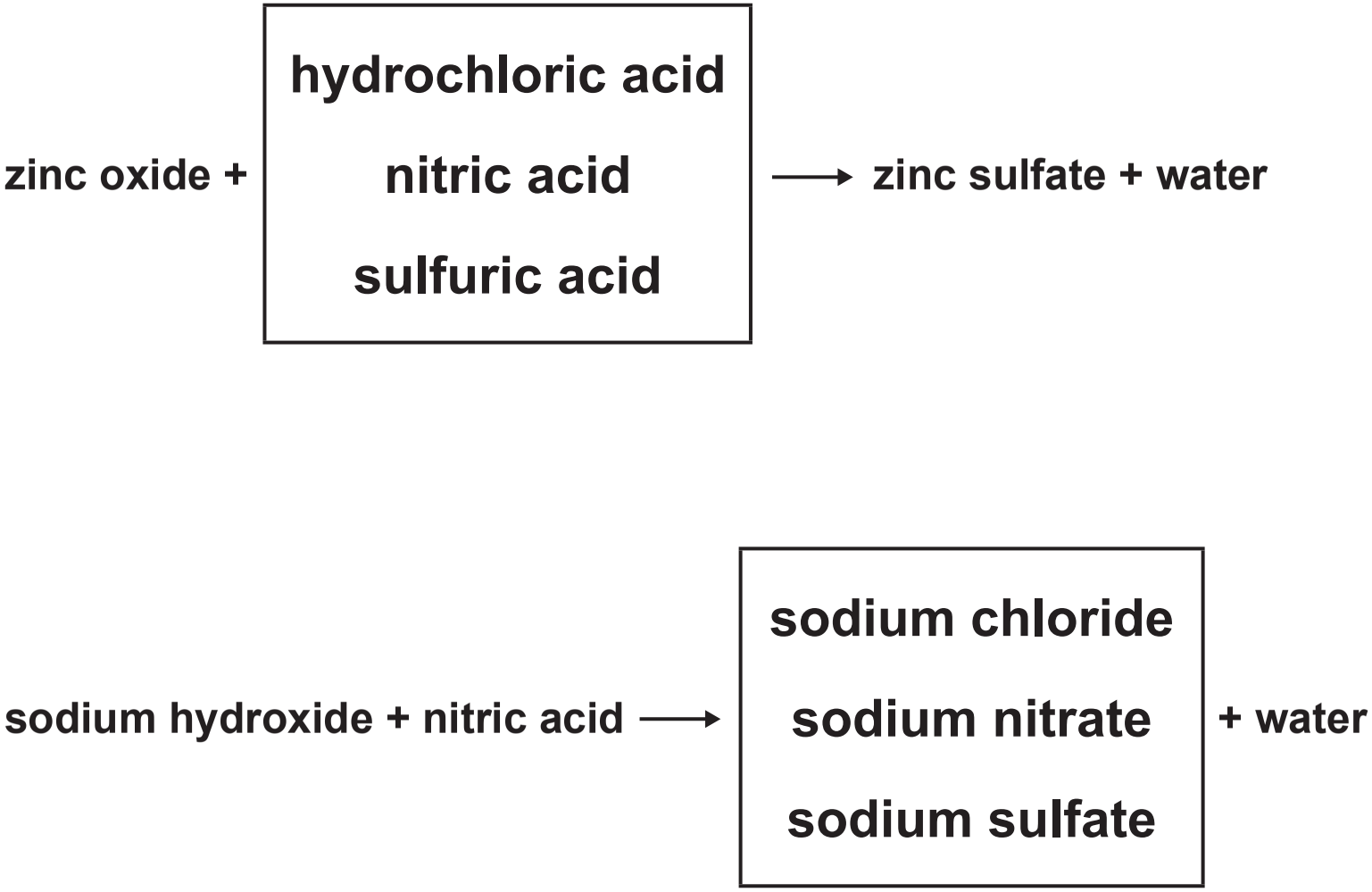
zinc oxide +
hydrochloric acid
nitric acid
sulfuric acid
zinc sulfate + water
sodium hydroxide + nitric acid
sodium chloride
sodium nitrate
sodium sulfate
+ water

1 (b) **The word equations on the opposite page show reactions of acids.**

<u>UNDERLINE</u> the substance in each box that correctly completes the equation. [2 marks]

6

2 (a) DIAGRAM 2.1 in the separate diagram booklet shows a cell used in the extraction of aluminium from aluminium oxide.

(i) <u>UNDERLINE</u> the correct word in the brackets to complete each sentence. [3 marks]

The process of extracting aluminium from aluminium oxide is called

(corrosion / electrolysis / cracking).

Aluminium ions, Al^{3+}, move towards the negative electrode because (opposite / similar / neutral) charges attract.

Aluminium leaves the cell as a (gas / solid / liquid).

(ii) Balance the SYMBOL equation that shows the overall reaction. [1 mark]

$$2Al_2O_3 \longrightarrow \square\ Al + 3O_2$$

2 (b) **Tick (✓) the box next to the TWO properties of aluminium that makes it suitable for making aeroplane wings. [2 marks]**

- ☐ **low density**
- ☐ **resists corrosion**
- ☐ **good thermal conductor**
- ☐ **non-toxic**
- ☐ **shiny**

☐

6

3 (a) **When a mixture of zinc and copper(II) oxide is heated it ignites and burns brightly.**

When silver is heated with copper(II) oxide no reaction takes place.

(i) **List silver, copper and zinc in order of reactivity. [1 mark]**

Most reactive _____

_____

Least reactive _____

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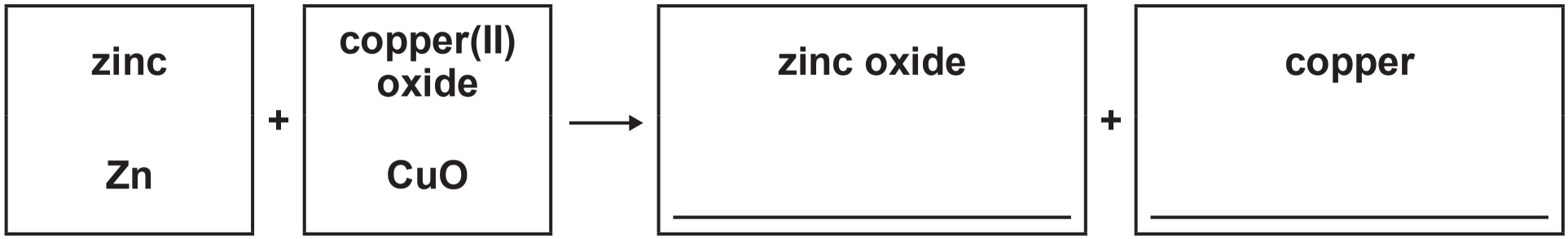
zinc
Zn
+
copper(II) oxide
CuO
zinc oxide
+
copper

3 (a)(ii)

The boxes on the opposite page show the word equation and an incomplete symbol equation for the reaction taking place between zinc and copper(II) oxide.

Complete the symbol equation. [2 marks]

3 (b) A SOLID precipitate of silver chloride is formed when silver nitrate solution is added to sodium chloride solution.

(i) Complete the equation for this reaction by writing the STATE SYMBOL for the silver chloride formed in the brackets. [1 mark]

$$AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(\_\_\_\_\_) + NaNO_3(aq)$$

(ii) <u>UNDERLINE</u> the correct word(s) in the bracket to complete the sentence. [1 mark]

The reaction shows that silver chloride is

(soluble / insoluble / a mixture) in water.

5

4 (a) DIAGRAM 4.1 in the separate diagram booklet shows Flying Saucers sweets which contain sherbet. Sherbet is a mixture of two solid substances – citric acid and sodium hydrogencarbonate.

When put in your mouth, the mixture fizzes and goes cold as it dissolves in your saliva.

A student investigated the temperature change during the reaction between citric acid and a solution of sodium hydrogencarbonate.

Some sodium hydrogencarbonate solution was added to a polystyrene cup and the temperature of the solution was recorded. Citric acid was added to the solution and the temperature was recorded every 10 seconds for 60 seconds. This is shown in DIAGRAM 4.2 in the separate diagram booklet.

The results are shown in TABLE 4.3 in the separate diagram booklet.

(i) Complete GRAPH 4.4 in the separate diagram booklet by plotting the results for 10, 20 and 30 seconds.

The results for 0, 40, 50 and 60 seconds have been plotted for you.

Draw a suitable line using all the results.
[3 marks]

4 (a)(ii)

Use the graph to answer parts I and II.

I. **CIRCLE the maximum CHANGE in temperature during the reaction. [1 mark]**

3.7 °C 4.0 °C 21.0 °C 17.3 °C

II. **This is described as an endothermic reaction.**

UNDERLINE the correct word(s) in the brackets to complete the sentence. [1 mark]

In an endothermic reaction the temperature

(increases / stays the same / decreases).

III. **The temperature of the contents of the cup was recorded two hours later.**

UNDERLINE the most likely temperature reading. [1 mark]

4.0 °C 18.0 °C 17.3 °C 21.0 °C

4 (a)(iii)

All the temperature readings were higher than expected due to heat being taken in from the surroundings.

Tick (✓) the box next to the change that would NOT result in the temperature readings being closer to their expected values. [1 mark]

- ☐ **put bubble wrap around the cup**
- ☐ **put a lid on the cup**
- ☐ **use a cup made from copper**

4 (b) **Calculate the relative formula mass (M_r) of sodium hydrogencarbonate, $NaHCO_3$. [2 marks]**

A_r(H) = 1 A_r(C) = 12 A_r(O) = 16 A_r(Na) = 23

M_r = _____

9

5 (a) **TABLE 5.1 in the separate diagram booklet shows information about the Haber process and the contact process.**

Use the information in TABLE 5.1 and your own knowledge to answer this question.

State whether the statements below are TRUE or FALSE. [3 marks]

	TRUE or FALSE?
Both processes use a catalyst that is a metallic element	
Both processes are carried out at the same temperature and pressure	
Both processes are reversible reactions	
Both processes use air as a raw material	

5 (b) **The equation in DIAGRAM 5.2 in the separate diagram booklet shows the bonds that are broken and the bonds that are formed when ammonia is produced.**

(i) **The energy released when one N—H bond forms is 391 kJ.**

Give the total number of N—H bonds in two molecules of ammonia and show that the amount of energy released when all the bonds are formed is 2346 kJ. [1 mark]

5 (b)(ii)

The energy released when all the bonds in the PRODUCT are formed is 2346 kJ.

The energy needed to break all the bonds in the REACTANTS is 2253 kJ.

I. Give the term that describes a reaction where more energy is released in forming bonds than is needed to break the bonds in the reactants. [1 mark]

II. Calculate the overall energy change that takes place during this reaction. [1 mark]

Overall energy change = _____ kJ

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ION	TEST AND OBSERVATION
	add dilute hydrochloric acid; gas formed turns limewater milky
carbonate ion, CO_3^{2-}	carry out a flame test; flame turns brick red
	add sodium hydroxide solution; pungent smelling gas is formed
sulfate ion, SO_4^{2-}	carry out a flame test; flame turns apple green
	add barium chloride solution; white precipitate is formed

5 (c) **Ammonia is used to make ammonium sulfate and ammonium carbonate.**

Tests can be carried out to identify the negative ion in each of these compounds.

On the opposite page, draw a line from each ion to the appropriate test and observation. [2 marks]

8

6 (a) **DIAGRAM 6.1 in the separate diagram booklet shows the electronic changes that occur when calcium reacts with oxygen to form calcium oxide. The ● and ✕ symbols represent outer shell electrons.**

(i) **Complete the right-hand side of DIAGRAM 6.1 by putting the CHARGE of the calcium ion in the box and the ELECTRONIC STRUCTURE of the oxide ion in the brackets. [2 marks]**

(ii) **Complete and balance the symbol equation for the reaction between calcium and oxygen. [2 marks]**

$$\square\ Ca + O_2 \longrightarrow 2\ \_\_\_\_\_$$

(b) **DIAGRAM 6.2 in the separate diagram booklet shows the outer shell electrons in an atom of hydrogen and an atom of oxygen.**

Complete DIAGRAM 6.3 in the separate diagram booklet to show the outer shell electrons in a molecule of water. [2 marks]

6

7 (a) **Crude oil can be separated into simpler mixtures, called fractions. Fractions contain hydrocarbon compounds called alkanes.**

TABLE 7.1 in the separate diagram booklet shows information about some of the fractions obtained from crude oil.

USE ONLY THE INFORMATION IN TABLE 7.1 TO ANSWER PARTS (i)–(iii).

(i) **Complete the sentence below by <u>UNDERLINING</u> the correct word(s). [1 mark]**

As the number of carbon atoms in an alkane

increases, the boiling point

(increases / decreases / stays the same).

(ii) **Hexane has a boiling point of 69 °C.**

Give the name of the fraction that contains hexane. [1 mark]

(iii) **One alkane is found in the kerosene and diesel oil fractions.**

Give the number of carbon atoms in this alkane. [1 mark]

---

7 (b) In DIAGRAM 7.2 in the separate diagram booklet, A–E show the structural formulae of some carbon compounds.

(i) Circle the molecular formula for compound A. [1 mark]

C_3H_3 C_8H_3 C_3H_8 3C8H C^3H^8

(ii) Give the LETTER of the compound that is unsaturated. [1 mark]

_____

(iii) Explain why compound E is NOT a hydrocarbon. [1 mark]

_____

_____

_____

(iv) Give the LETTER of the compound that belongs to the family of carbon compounds with the general formula C_nH_{2n}. [1 mark]

_____

7 (c) **DIAGRAM 7.3 in the separate diagram booklet shows the stages used in the laboratory to make ethanol from glucose solution.**

(i) **Give the number of the stage in which distillation is used. [1 mark]**

Stage _____

(ii) **The formula of ethanol is C_2H_5OH.**

Complete the structure of ethanol below by adding all the atoms and bonds present. [1 mark]

C — C

7 (c)(iii)

Ethanol is the alcohol found in alcoholic drinks.

The following information appears on a bottle of wine.

Volume: 750 millilitres
Alcohol by volume: 13.5%

The formula below can be used to calculate the mass of ethanol in an alcoholic drink.

mass of ethanol (g) = 8 × volume (litres) × alcohol by volume (%)

Use the formula to find the mass of ethanol in a bottle of wine. [2 marks]

1 litre = 1000 millilitres

Mass = _____ g

11

8 (a) **The photographs in DIAGRAM 8.1 in the separate diagram booklet show three different methods of fighting fires.**

Each method removes a different part of the fire triangle.

Use the fire triangle to explain how the different methods shown in DIAGRAM 8.1 help to extinguish fires or prevent them from spreading. [6 marks QER]

continue answer on the next page

8 (b) FIGHTING FIRES

There are five main types of fire extinguisher – water, foam, dry powder, carbon dioxide and wet chemical, as shown in DIAGRAM 8.2 in the separate diagram booklet. Modern fire extinguishers have a red body with a coloured band at the top. Each colour represents a different type of extinguisher, used on different types or 'classes' of fire.

There is no one extinguisher type that works on all classes of fire.

CHART 8.3 in the separate diagram booklet shows which type of extinguisher should be used on each class of fire.

USE ONLY THE INFORMATION IN CHART 8.3 TO ANSWER PARTS (i)–(iii).

(i) **<u>UNDERLINE</u> the type of extinguisher used to put out a fire involving burning cooking oil. [1 mark]**

water **foam** **dry powder**

carbon dioxide **wet chemical**

8 (b)(ii)

UNDERLINE the type of extinguisher that would be the most useful in a school chemistry laboratory. [1 mark]

water foam dry powder

carbon dioxide wet chemical

(iii) Tick (✓) the box next to the fire that should be put out using a water extinguisher. [1 mark]

- ☐ chip pan fire
- ☐ burning plug and socket
- ☐ burning butane cylinder
- ☐ burning waste cardboard

☐

9

9 The list below shows part of the reactivity series.

magnesium
zinc
iron
nickel

A student investigated the temperature rise when four different metal powders were added to excess copper(II) sulfate solution.

The same mass of each metal was added to 50 cm^3 samples of copper(II) sulfate solution.

Look at DIAGRAM 9.1 in the separate diagram booklet. The maximum temperature for each reaction was measured. The temperature rise was calculated in each case and used to find the energy given out.

The results are shown in TABLE 9.2 in the separate diagram booklet.

(a) In one of the reactions, the initial temperature was 19.7 °C and the maximum temperature was 52.7 °C.

State which one of the four metals was used in this reaction. [1 mark]

---

9 (b) **Tick (✓) the box next to the conclusion the student can draw from the results. [1 mark]**

☐ **The higher the metal in the reactivity series, the greater the energy given out**

☐ **The lower the metal in the reactivity series, the greater the energy given out**

☐ **The energy given out is not related to the metal's position in the reactivity series**

(c) **The word equation below represents the reaction between iron and nickel(II) sulfate solution.**

iron + nickel(II) sulfate ⟶ iron(II) sulfate + nickel

Iron(II) sulfate contains Fe^{2+} and SO_4^{2-} ions.

Complete the symbol equation for the reaction. [2 marks]

$Fe + NiSO_4 \longrightarrow$ _____ + _____

9 (d) **The experiment shows that a more reactive metal will replace a less reactive metal in its compounds.**

Give the term used to describe this type of reaction. [1 mark]

---

9 (e) **When the experiment was repeated using TITANIUM, the temperature rise recorded was 35.4 °C.**

Calculate the energy given out during the reaction between TITANIUM and 50 cm^3 of copper(II) sulfate solution. Give your answer to the nearest 100 J. [2 marks]

$$\text{energy given out (J)} = \text{volume of solution} \times 4.2 \times \text{temperature rise}$$

Energy given out = _____ J

7

10 (a) **DIAGRAM 10.1 in the separate diagram booklet shows the apparatus used by a student to investigate the electrolysis of water.**

(i) **The student collected a sample of the oxygen formed in a test tube.**

Give the test the student would carry out to show the presence of oxygen in the test tube. Include the observation the student would expect. [1 mark]

_____

_____

_____

(ii) **Use the formula of water, H_2O.**

Give the volume of hydrogen that would form in the same time as 10 cm^3 of oxygen. [1 mark]

_____ cm^3

10 (b) TABLE 10.2 in the separate diagram booklet shows information about the electrolysis of three different electrolytes. The table is incomplete.

(i) Complete TABLE 10.2 by adding the SYMBOLS of the missing IONS. [2 marks]

(ii) Name substances A, B and C. [3 marks]

Metal A _____

Gas B _____

Compound C _____

7

11 **DIAGRAM 11.1 in the separate diagram booklet shows the structure of diamond and graphite.**

(a) **Name the atom being represented by a • in both diagrams. [1 mark]**

(b) **Name the type of BONDING found in both diamond and graphite. [1 mark]**

---

11 (c) **TABLE 11.2 in the separate diagram booklet shows some properties of graphite.**

USE ONLY PROPERTIES FROM TABLE 11.2 TO ANSWER THIS QUESTION.

Give TWO properties of graphite that are DIFFERENT from those of diamond. Give a use relating to each property. [4 marks]

Property 1 _____

Use _____

_____

Property 2 _____

Use _____

_____

6

END OF PAPER

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

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FRIDAY, 17 MAY 2024 – MORNING

CHEMISTRY – Unit 2:

Chemical Bonding, Application of Chemical Reactions and Organic Chemistry

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.

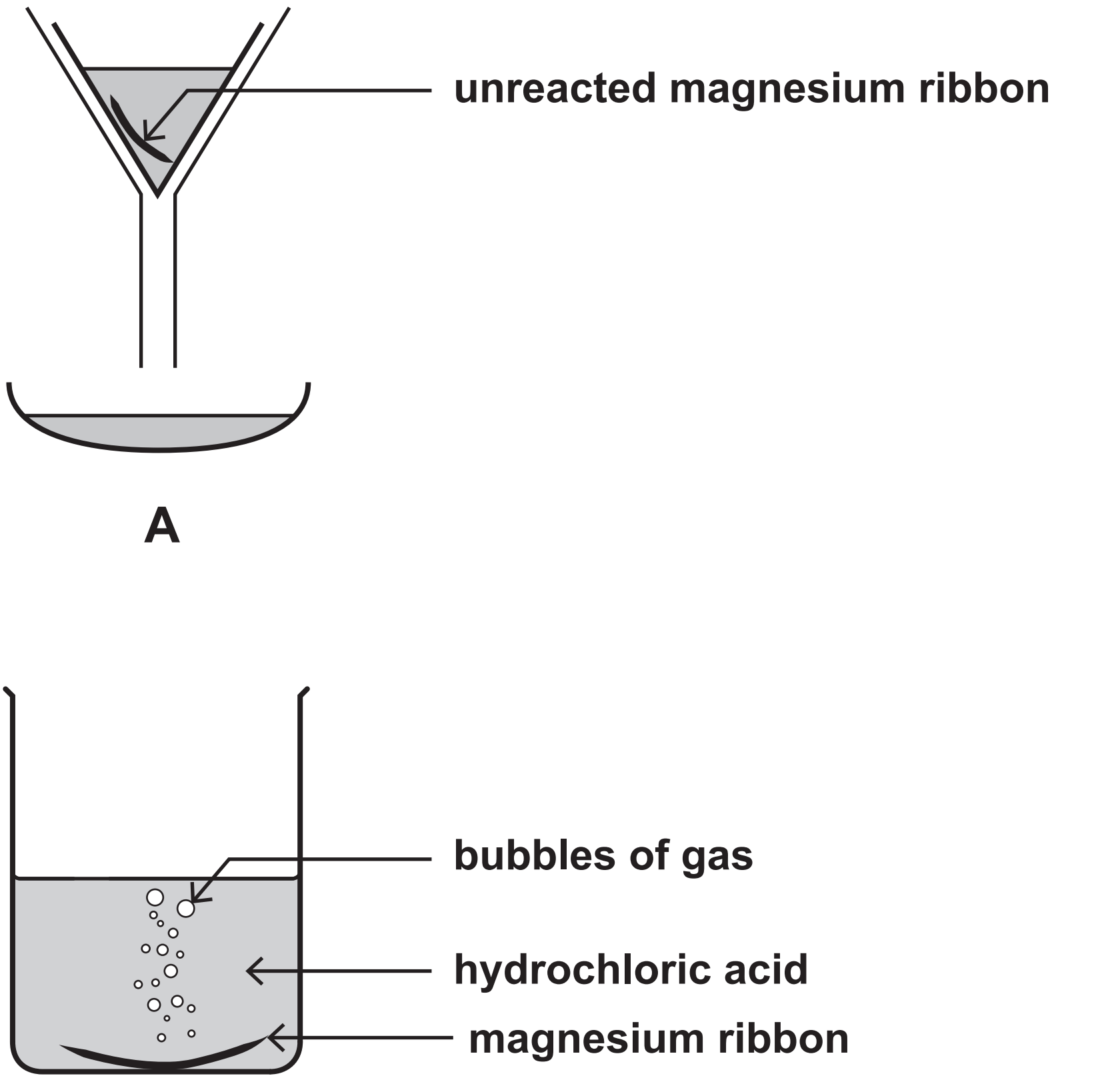
Surname _____

First name(s) _____

Centre Number _____

Candidate Number 0 _____

DIAGRAM 1.1


unreacted magnesium ribbon
A
bubbles of gas
hydrochloric acid
magnesium ribbon
B
dry magnesium chloride crystals
C

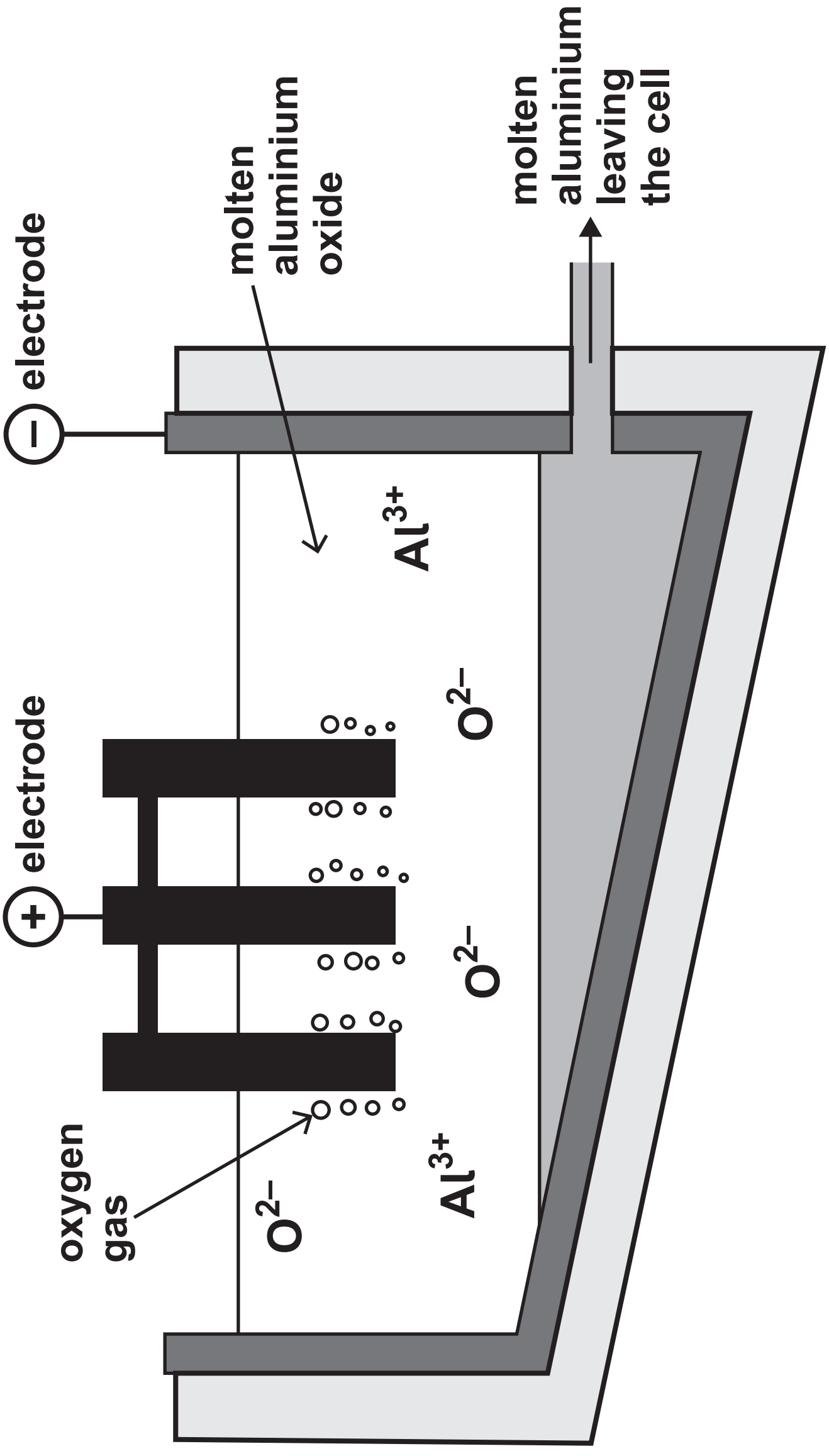

molten aluminium oxide
molten aluminium leaving the cell
electrode
Al3+
O2–
electrode
O2–
oxygen gas
O2–
Al3+

DIAGRAM 2.1

DIAGRAM 4.1

DIAGRAM 4.2

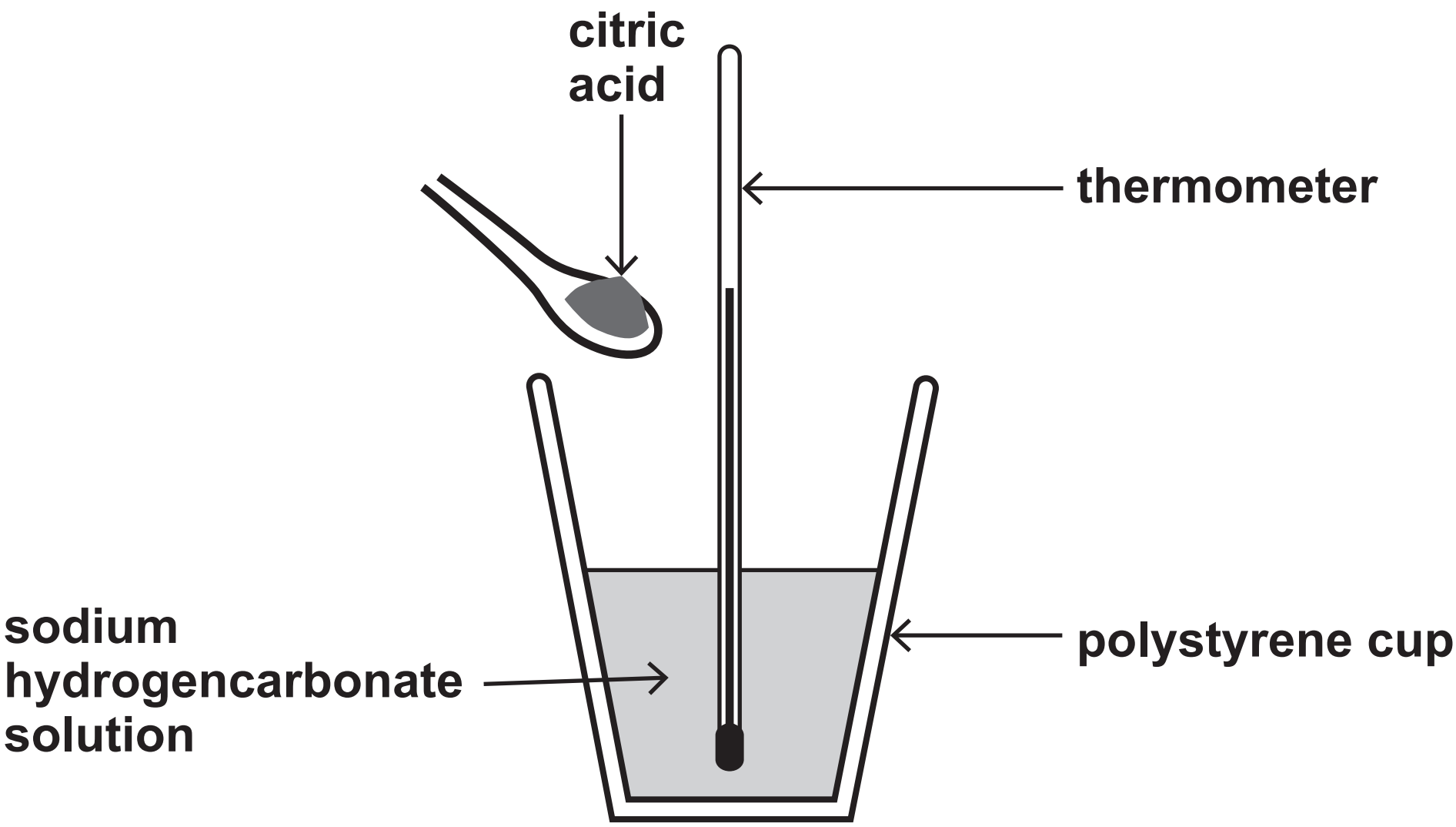

citric acid
thermometer
sodium hydrogencarbonate solution
polystyrene cup

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TABLE 4.3

Time (s)	0	10	20	30	40	50	60
Temperature (°C)	21.0	19.0	17.8	17.2	17.0	17.1	17.3

GRAPH 4.4

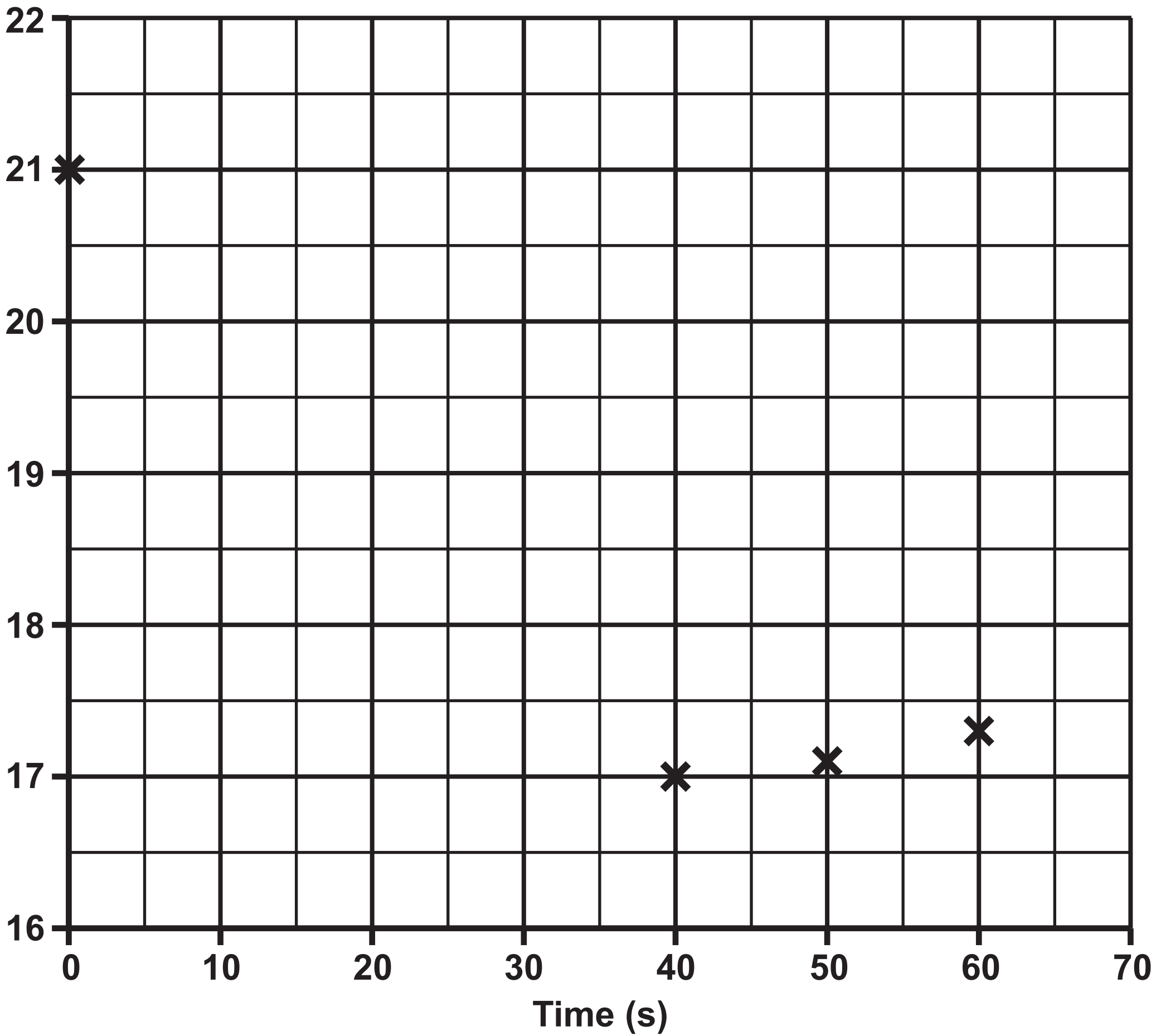
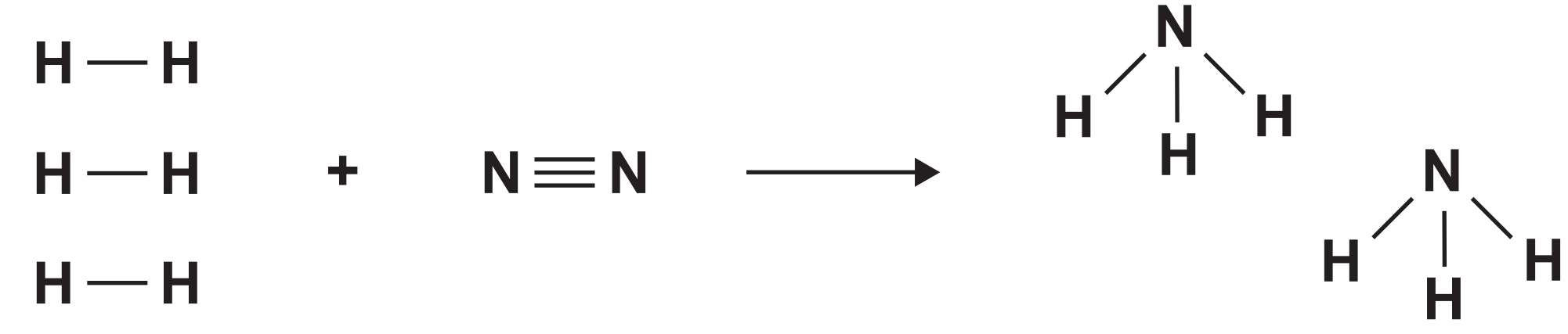


TABLE 5.1

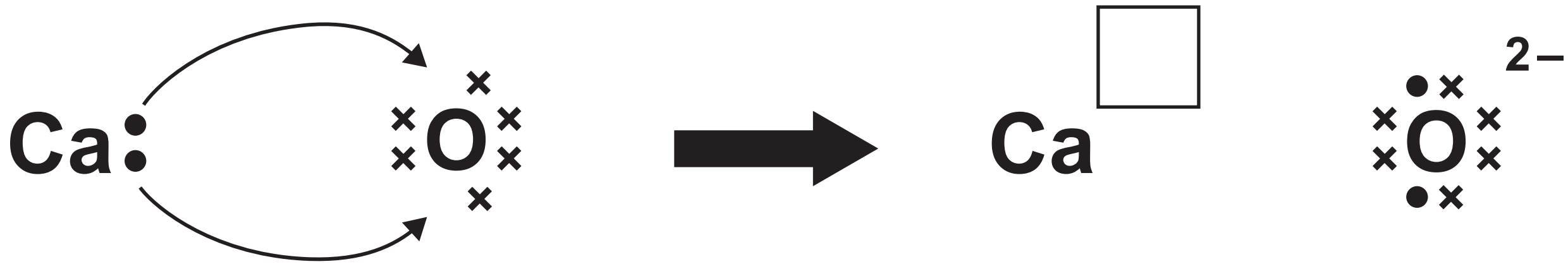
	Haber process	Contact process
Raw materials	nitrogen comes from the air hydrogen is made from natural gas	sulfur is made from impurities in natural gas oxygen comes from the air
Conditions	iron catalyst 450 °C 200 atm	vanadium(V) oxide catalyst 450 °C 1 atm
Equation	$N_2 + 3H_2 \rightleftharpoons 2NH_3$	$2SO_2 + O_2 \rightleftharpoons 2SO_3$

DIAGRAM 5.2



hydrogen nitrogen ammonia

DIAGRAM 6.1



calcium atom	oxygen atom		calcium ion	oxide ion
(2,8,8,2)	(2,6)		(2,8,8)	(_____)

DIAGRAM 6.2

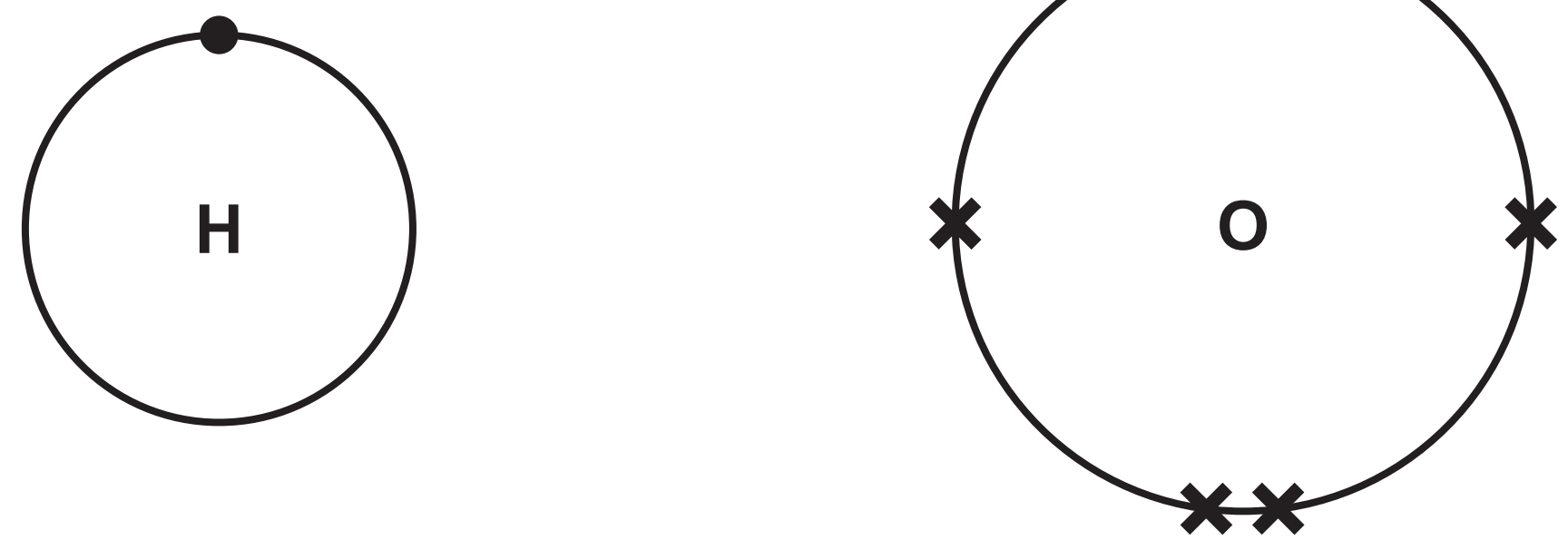


DIAGRAM 6.3

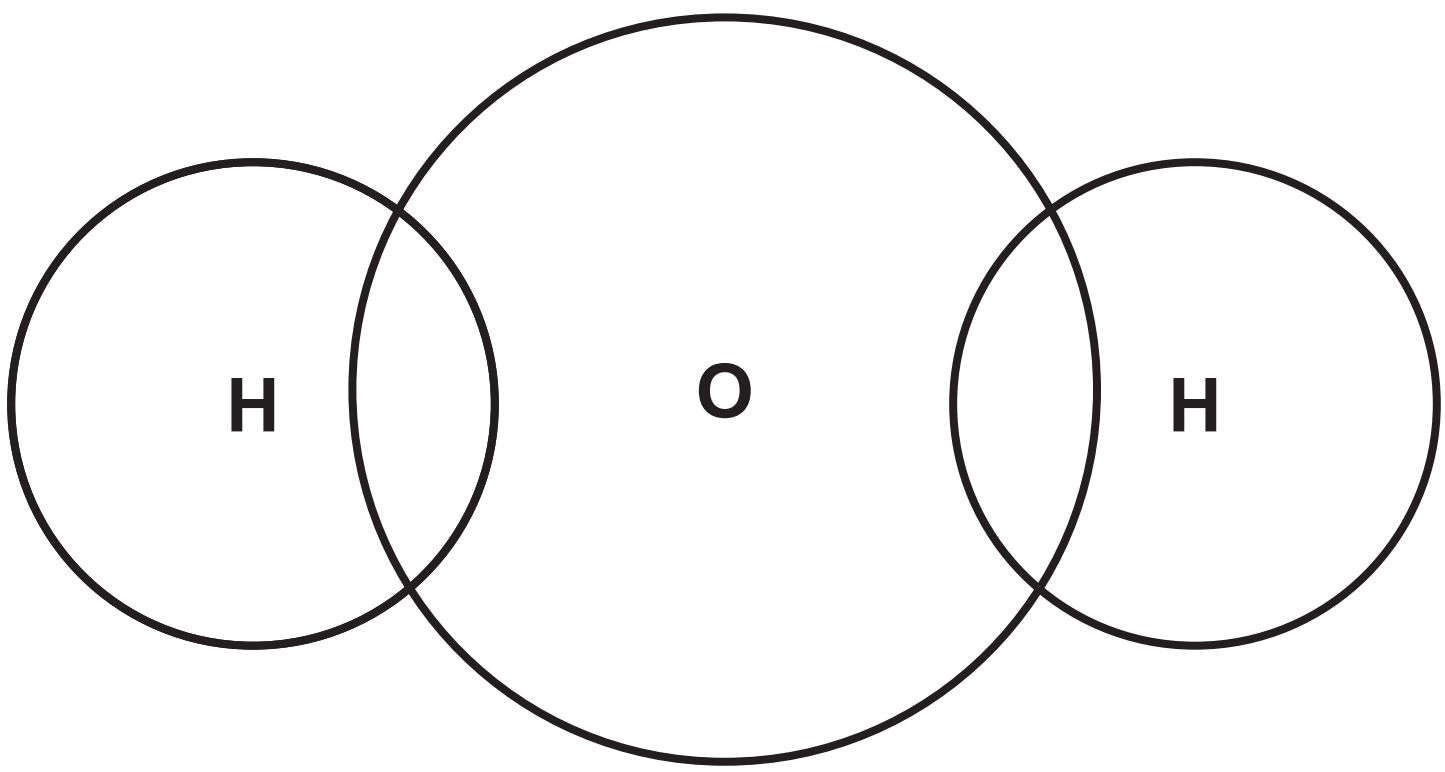
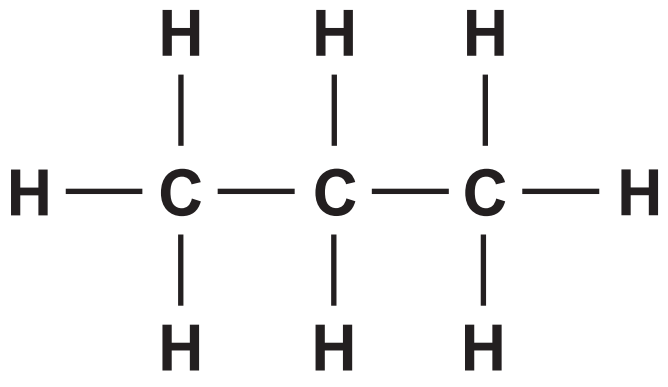


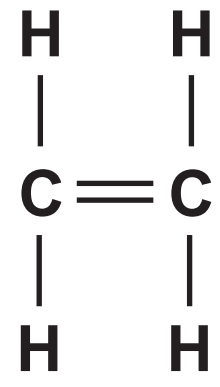
TABLE 7.1

Fraction	Boiling point range (°C)	Number of carbon atoms in the alkanes
refinery gases	−160 to 20	1–4
petrol	20 to 240	4–12
naphtha	100 to 250	7–14
kerosene	200 to 280	11–15
diesel oil	280 to 350	15–19

DIAGRAM 7.2



A



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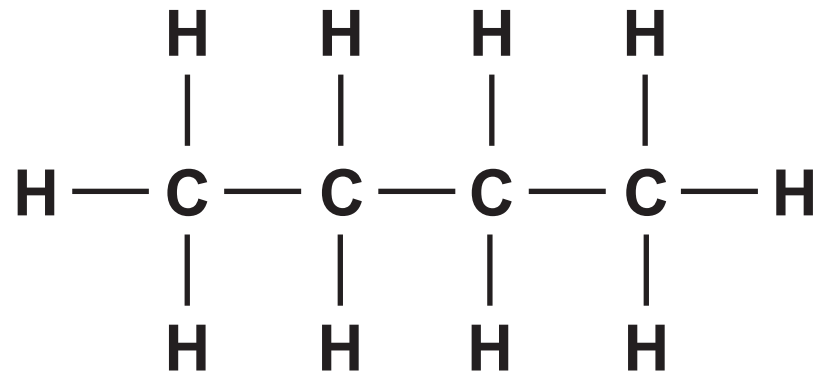

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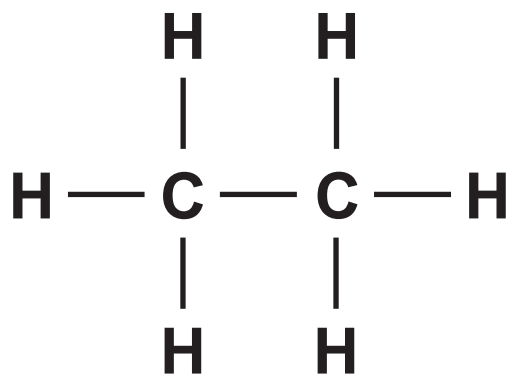

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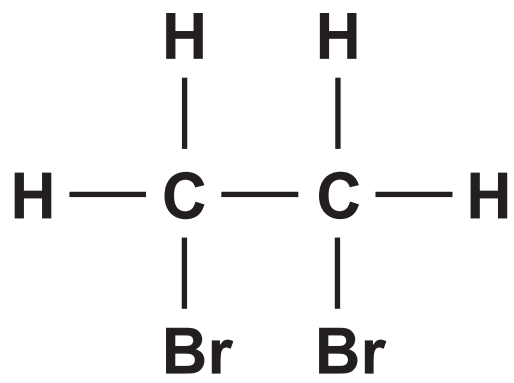

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DIAGRAM 7.3

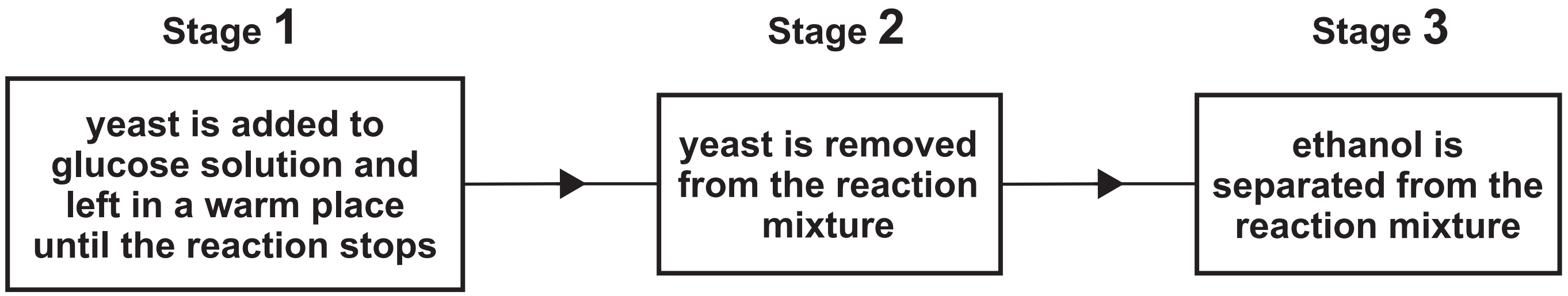
Stage 1
yeast is added to glucose solution and left in a warm place until the reaction stops
Stage 2
yeast is removed from the reaction mixture
Stage 3
ethanol is separated from the reaction mixture

DIAGRAM 8.1

METHOD A

METHOD A shows a firefighter using a hosepipe to extinguish a fire.

METHOD B

METHOD B shows a firefighter using a simple implement to extinguish a fire.

METHOD C

METHOD C shows a mechanical excavator clearing a wide path through a forest.

DIAGRAM 8.2


CO_2
Fire Extinguisher
Safe for use
on flammable liquid fires
on electrical fires
DO NOT use
on wood, paper, fabric fires
in cenlined space
FOAM
Fire Extinguisher
Safe for use
on wood, paper fabric fires
on flammable liquid fires
DO NOT use
on electrical fires
on flammable metal fires
WET
CHEMICAL
Fire Extinguisher
Safe for use
on wood, paper fabric fires
on cooking oil, fat fires
DO NOT use
on electrical fires
on flammable liquids
on gaseous fires
WATER
Fire Extinguisher
Safe for use
on wood, paper fabric fires
DO NOT use
on electrical fires
on flammable metal fires
on flammable liquids
POWDER
Fire Extinguisher
Safe for use
on wood, paper fabric fires
on flammable liquid fires
on gaseous fires
on electrical fires

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CHART 8.3

▼ TYPE / ► FIRE		CLASS A	CLASS B	CLASS C
▼ EXTINGUISHER		Flammable solids, for example paper	Flammable liquids, for example ethanol	Flammable gases, for example methane
	WATER	✓	✗	✗
	FOAM	✓	✓	✗
	DRY POWDER	✓	✓	✓
	CO_2	✗	✓	✗
	WET CHEMICAL	✓	✗	✗

CHART 8.3 continued

▼ TYPE	► FIRE	CLASS D	CLASS E	CLASS F
▼ EXTINGUISHER		Flammable metals, for example magnesium	Electrical equipment, for example computer	Cooking oil, for example deep fat fryer
	WATER	✗	✗	✗
	FOAM	✗	✗	✗
	DRY POWDER	✓	✓	✗
	CO_2	✗	✓	✗
	WET CHEMICAL	✗	✗	✓

DIAGRAM 9.1

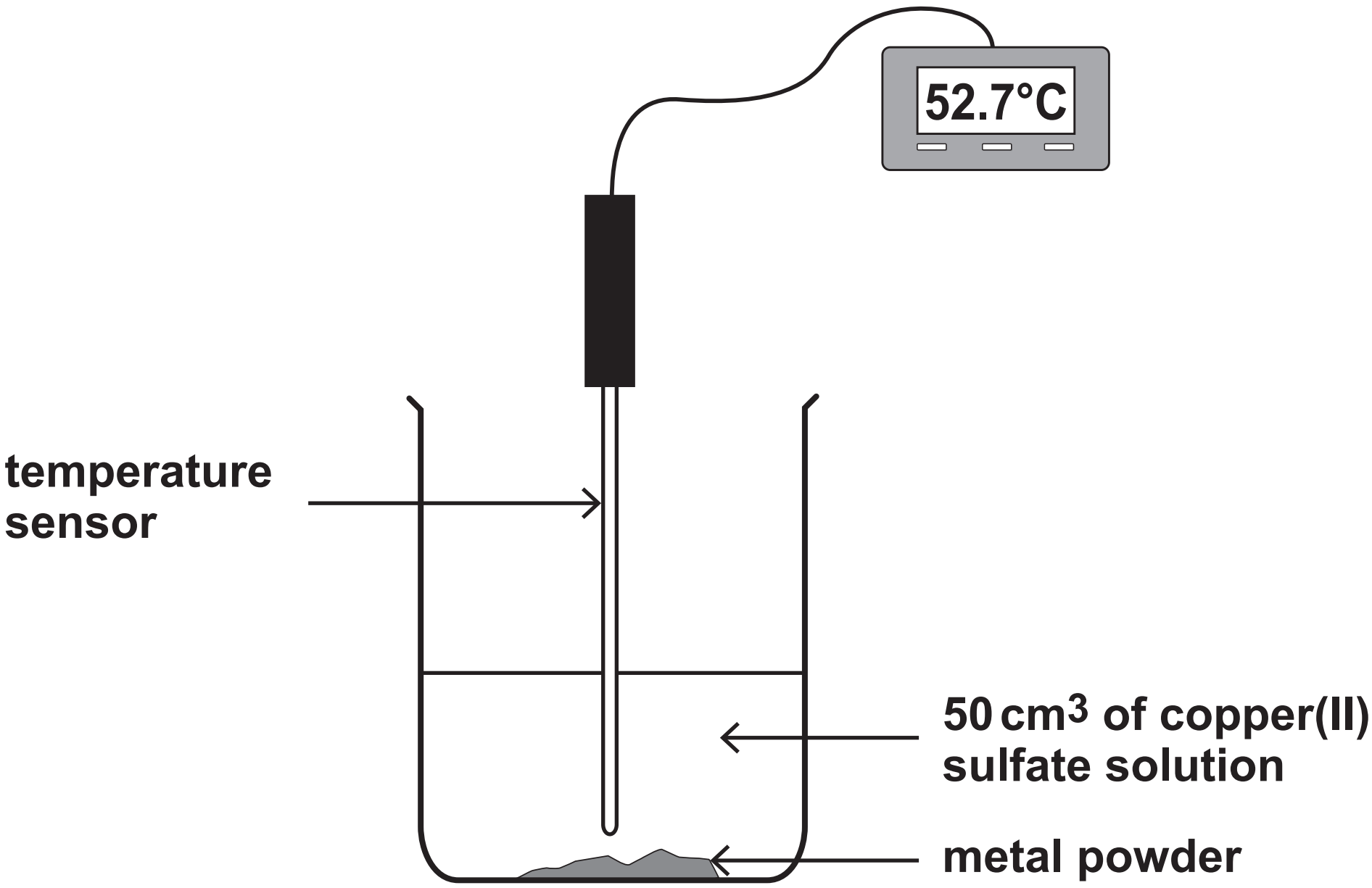

52.7°C
temperature sensor
50 cm3 of copper(II) sulfate solution
metal powder

TABLE 9.2

Metal	Temperature rise (°C)	Energy given out (J)
magnesium	40.5	8500
zinc	33.0	6900
iron	23.2	4900
nickel	19.0	4000

DIAGRAM 10.1

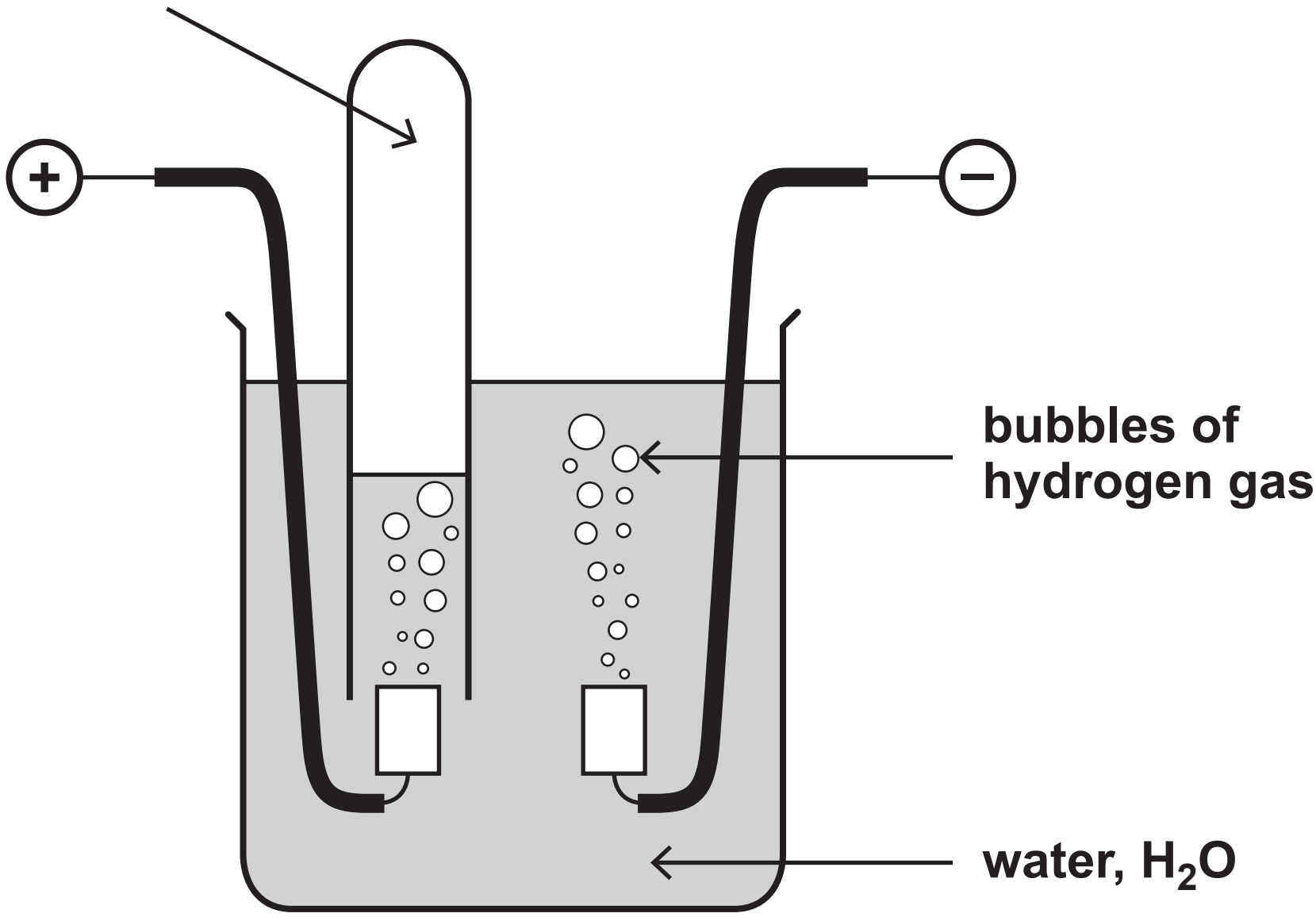
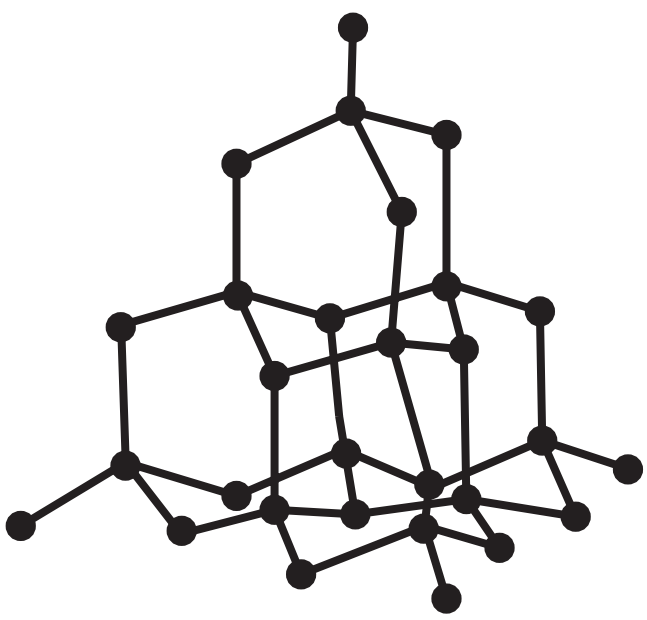


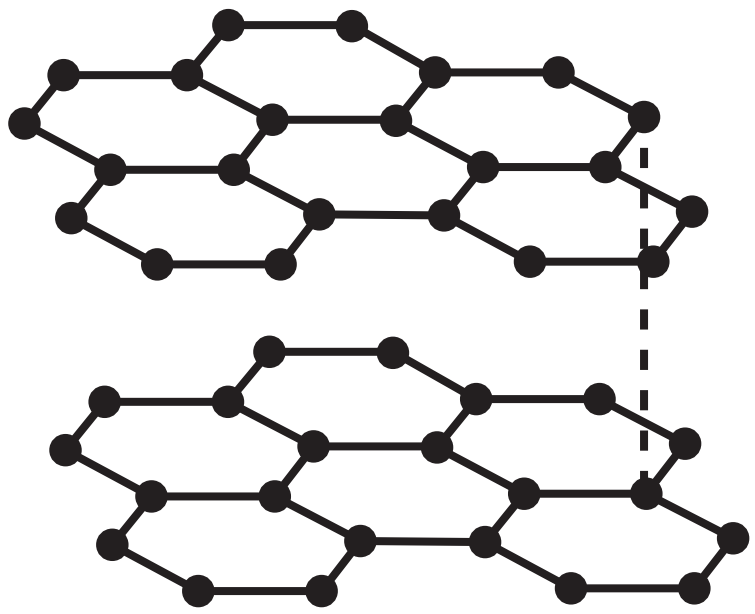
TABLE 10.2

Electrolyte	Ions present in the electrolyte		Observations	
	Positive ion(s)	Negative ion(s)	At the negative (−) electrode	At the positive (+) electrode
molten lead(II) bromide	Pb^{2+}	_____	grey metal **A** formed	orange gas formed
aqueous copper(II) chloride	_____ and H^+	Cl^- and OH^-	brown metal formed	green-yellow gas **B** formed
aqueous compound **C**	Zn^{2+} and H^+	I^- and OH^-	grey metal formed	brown solution formed

DIAGRAM 11.1



diamond



graphite

TABLE 11.2

Properties of graphite
soft
high melting point
insoluble in water
conducts electricity

GCSE

3410U20-1

FRIDAY, 17 MAY 2024 – MORNING

CHEMISTRY – Unit 2:
Chemical Bonding, Application of Chemical Reactions and Organic Chemistry

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