

Name: () Class:

**ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2025**

SCIENCE (CHEMISTRY)

5086 / 03

5088 / 03



**ASSUMPTION
ENGLISH**

A Member of the Catholic Education System

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LEVEL: Sec 4 Express /
Sec 5 Normal (Academic)

DATE : 29 August 2025

CLASS(ES): Sec 4/2, 4/3, 4/5 SBB, 5/1

DURATION : 1 hour 15 minutes

Additional Materials Provided: NIL

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your NAME, CLASS and INDEX NUMBER at the top of this page. This paper consists of 2 sections.

Section A (55 marks)

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B (10 marks)

Answer **one** question.

Write your answers in the spaces provided on the question paper.

For Examiner's use:		
Section A	/	55
Section B	/	10
Paper 3	/	65
Paper 1	/	20
Paper 5	/	15
Total	/	100

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

A copy of the Data Sheet is printed on page 16.

A copy of the Periodic Table is printed on page 17.

The use of an approved scientific calculator is expected, where appropriate.

This question paper consists of 17 printed pages including this page.

[Turn over

Section A

Answer **all** the questions in the spaces provided.

- 1 Choose from the following substances to answer the questions.

ammonia	carbon monoxide	silver sulfate
aluminium oxide	copper	sulfur
calcium hydroxide	methane	sulfur dioxide

Each substance may be used once, more than once or not at all.

Identify a substance which

- (a) is a toxic gas that combines with haemoglobin in red blood cells,
..... [1]
- (b) is a gas that contributes to the formation of acid rain,
..... [1]
- (c) reacts with both acids and alkalis,
..... [1]
- (d) is an element which forms X^{2-} ion,
..... [1]
- (e) is used to reduce the acidity of soils,
..... [1]
- (f) is a greenhouse gas.
..... [1]

[Total: 6]

- 2 The table below contains details of seven different particles.
The letters are **not** the chemical symbols of the elements.

particles	mass number	proton number	number of electrons
A	4	2	2
B	12	6	6
C	14	6	6
D	14	7	10
E	24	12	10
F	19	9	9

- (a) State which particles **A**, **B**, **C**, **D**, **E** or **F** from the table

- (i) is a negatively charged ion, [1]
- (ii) is an ion of an element in group 2, [1]
- (iii) is an unreactive gas. [1]

- (b) Two particles in the table are isotopes of the same element.

- (i) Identify the two particles that are isotopes of the same element.
..... and [1]
- (ii) Do both isotopes have the same chemical reactivity?
Explain your answer.
..... [1]

- (c) Atom **B** forms a gas when it burns completely in oxygen.

- (i) Name the gas formed when atom **B** burns completely in oxygen.
..... [1]
- (ii) Suggest the type of bonding present in the gas in (c)(i) and explain
why it exists as a gas at room temperature and pressure.
.....
.....
..... [2]

[Total: 8]

- 3 The table shows some information about four different substances, **A**, **B**, **C** and **D** when heated.

Complete the table by identifying whether substances, **A**, **B**, **C** and **D** is an element, compound or mixture.

substance	melting point/ °C	colour	other information	element, compound or mixture
A	–10 to –6	green	A colourless gas is given off. A greenish-white solid is left behind. Another gas condenses into water droplets on the sides of the test tube.	
B	105	white	It melts into a colourless liquid and turns brown on further heating. Finally, a black residue is left behind.	
C	115	yellow	It cannot be decomposed into anything simpler.	
D	242	blue	A black solid is formed and a gas is given off.	

[4]

[Total: 4]

- 4 The table below describes and names different types of reactions.

Complete the table with the correct type of reactions.
The first reaction has been completed for you.

description of reaction	type of reaction
many monomers forming a polymer	polymerisation
changing long-chain hydrocarbons into short-chain hydrocarbons	
dead organic substances are broken down into simpler matter	
releases energy, often in the form of heat to the surrounding	

[3]

[Total: 3]

- 5 The table below shows the melting and boiling points of three substances.

substance	melting point / °C	boiling point / °C	solubility in water
P	-85	215	yes
Q	-62	70	yes
R	22	672	no

- (a) Describe the changes in movement and arrangement of substance **R** when it is heated from 30 °C to 700 °C.

.....

[2]

- (b) Sketch a graph of temperature versus time to show the change in temperature when substance **P** is heated from -100 °C to 150 °C. Label the axes.



[2]

- (c) (i) Suggest a suitable method to separate a mixture of **P** and **Q**.

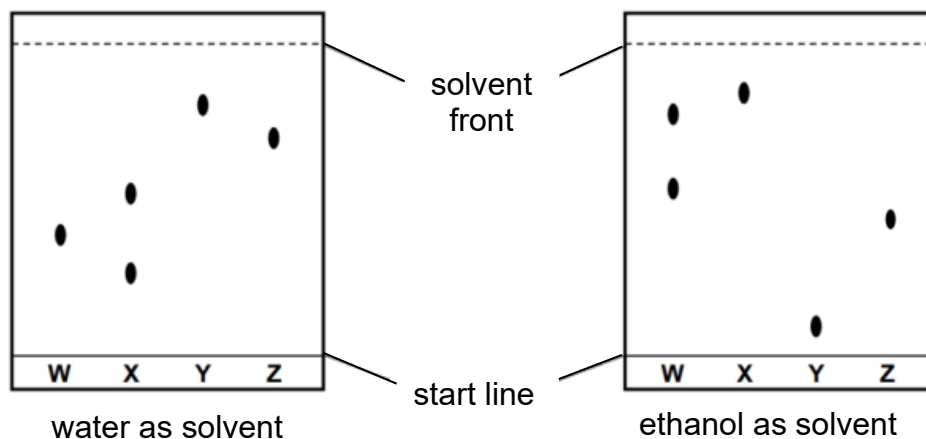
..... [1]

- (ii) Explain your answer in (c)(i).

.....
 [1]

[Total: 6]

- 6 Four food colourings, **W**, **X**, **Y** and **Z** were analysed using paper chromatography. The diagrams below show the chromatograms obtained with water and ethanol as the solvent respectively.



- (a) Which food colouring(s) is / are mixtures?

Explain your answer.

.....

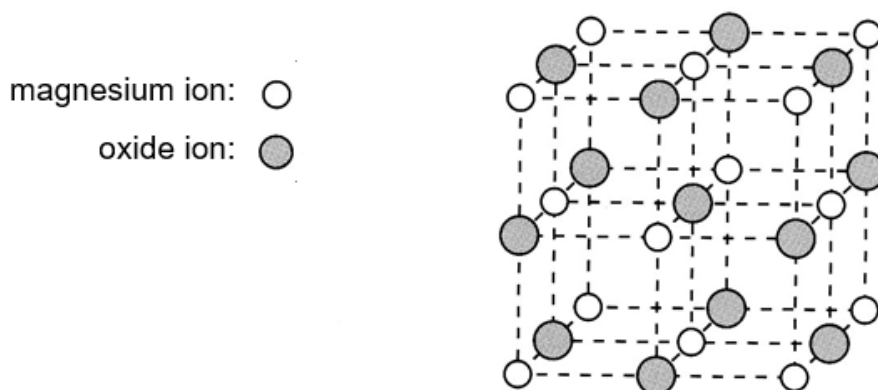
 [1]

- (b) Explain why the start line must be drawn in pencil.

.....
 [1]

[Total: 2]

- 7 The structure of magnesium oxide, an insoluble base is shown in the diagram below.



- (a) Explain why solid magnesium oxide does not conduct electricity.

.....
..... [1]

- (b) Complete the following table which gives information about the two ions.

ion	number of protons	number of neutrons	number of electrons	nucleon (mass) number
O^{2-}	8	8		
Mg^{2+}			10	24

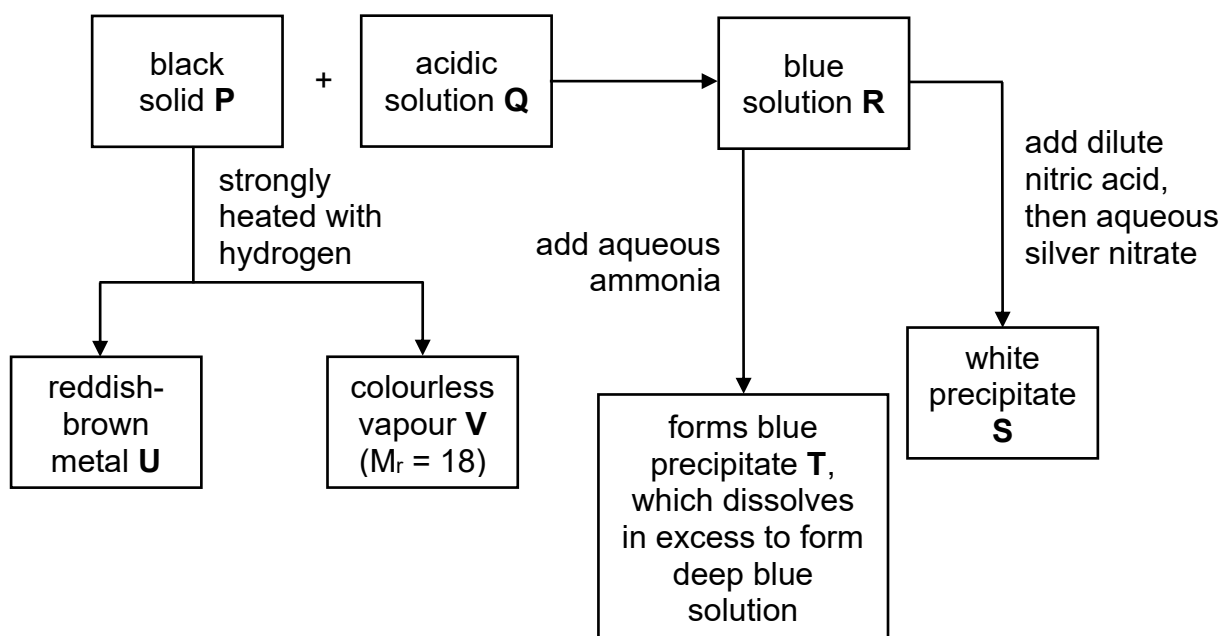
[2]

- (c) Draw a 'dot-and-cross' diagram to show the bonding in magnesium oxide. Show only the outer shell electrons.

[2]

[Total: 5]

8 The diagram below describes the reaction of substances **P** and **Q**.



(a) Identify substances **P**, **Q**, **R**, **S** and **T**.

P.....

Q.....

R.....

S.....

T.....

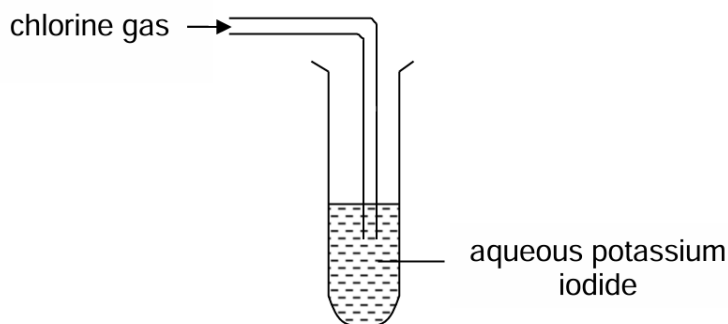
[5]

(b) Write an ionic equation for the formation of white precipitate **S**.

..... [1]

[Total: 6]

- 9 (a) Chlorine gas is bubbled into aqueous potassium iodide as shown below.



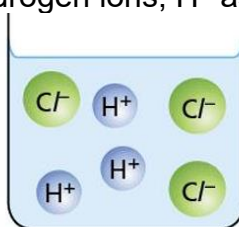
- (i) Describe the observation made.

..... [1]

- (ii) Explain why a reaction would occur between chlorine and aqueous potassium iodide.

.....
 [1]

- (b) When bubbled into a beaker of distilled water, hydrogen chloride molecules ionise to form hydrogen ions, H^+ as shown below.



- (i) Predict the approximate pH of the aqueous solution that is formed.

..... [1]

- (ii) Describe the observation made when copper(II) carbonate powder is added to the aqueous solution formed. Explain your answer.

observation.....

.....

explanation.....

.....

..... [2]

[Total: 5]

10 Barium is a metal in Group 2 of the Periodic Table.

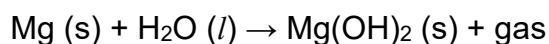
The general changes to the reactivity and physical properties of Group 2 metals are similar to Group 1 metals.

- (a) Predict how the reactivity and melting point of Group 2 metals changes down the group.

reactivity.....

melting point..... [2]

- (b) Another metal in Group 2, magnesium, is reacted with water. Magnesium hydroxide and a colourless gas are formed.



- (i) Describe a test that can be conducted to confirm the presence of the gas formed.

test.....

observation.....

..... [1]

- (ii) Potassium also reacts with cold water.

Compare the observations of the reaction of magnesium and cold water with the reaction of potassium and cold water.

In your answer you should include one similarity and one difference.

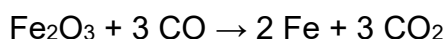
similarity.....

.....

difference.....

..... [2]

- (c) Barium can be extracted from its ore by heating the ore with carbon monoxide. Iron can also be extracted from haematite ore (containing mainly iron(III) oxide) using a similar method as shown below.



- (i) State the oxidation state of iron in iron(III) oxide.

..... [1]

- (ii) Identify the reducing agent in the reaction.

Explain your answer.

.....

 [1]

- (iii) A sample of haematite used in iron extraction contains 20% of iron(III) oxide.

Calculate the mass of iron(III) oxide present in 2 kg of haematite.

mass of iron(III) oxide g [1]

- (iv) Using your answer in (c)(iii), calculate the volume of carbon dioxide gas produced when 2 kg of haematite is reacted.
 [Relative atomic masses, Ar: C, 12; O, 16; Fe: 56]

volume of carbon dioxide dm³ [2]

[Total: 10]

Section B

Answer **one** question from this section.

- 11** Sodium carbonate is a soluble salt.
7.95 g of sodium carbonate, Na_2CO_3 was dissolved in 50 cm^3 of water.

- (a) Calculate the concentration of the solution in mol/dm^3 .
[Relative atomic masses, A_r : C, 12; O, 16; Na: 23]

concentration mol/dm^3 [2]

- (b) To study the rate of a reaction, 5 g of solid sodium carbonate is reacted with an excess of a 1 mol/dm^3 nitric acid.

State the two measurements that you will need to make to determine the speed of this reaction.

..... and [1]

- (c) Label the axes below and draw a graph for the measurements made in (b) that would show how the speed of the reaction changes.



[2]

- (d) On the same graph above, keeping all other conditions the same, sketch a graph obtained when

(i) 2.5 g of sodium carbonate is used instead. Label this graph **X**. [1]

(ii) 2 mol/dm^3 of nitric acid is used instead. Label this graph **Y**. [1]

- (e) Use the collision theory to explain the graph observed in (d)(ii).

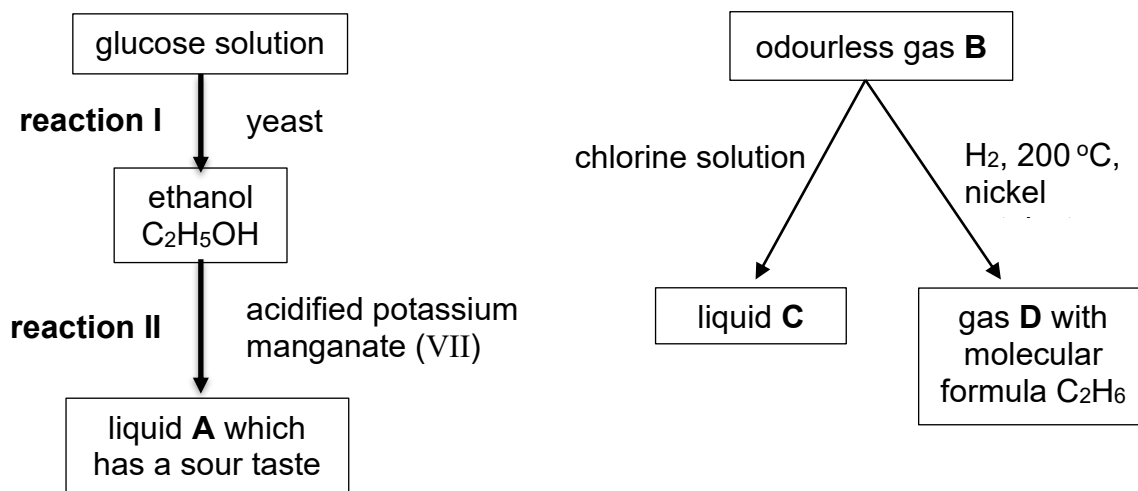
.....
.....
.....
..... [2]

- (f) Suggest how increasing the pressure will affect the rate of reaction of this experiment.

..... [1]

[Total: 10]

12 The following flowcharts describe some reactions involving organic compounds.



(a) Identify liquid A.

..... [1]

(b) Name the process that occurred in **reaction I**, and state the two other conditions needed for the reaction to occur.

name of process.....

conditions required.....

..... [2]

(c) Name the type of reaction in **reaction II** that occurred and describe the observation you would expect with acidified potassium manganate (VII).

type of reaction.....

observation.....

..... [2]

(d) Describe a chemical test to distinguish between gas B and gas D.

test.....

observation for gas B.....

.....

observation for gas D.....

..... [2]

(e) Draw the full structural formula of **C**.

[1]

(f) (i) Gas **B** can undergo addition polymerisation to form a useful polymer.

Draw the full structural formula of the polymer formed, showing two repeating units.

[1]

(ii) Describe one method of recycling plastics.

.....

..... [1]

[Total: 10]

- End of Paper 3 -

Colours of Some Common Metal Hydroxides

aluminium hydroxide	white
calcium hydroxide	white
copper(II) hydroxide	blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
zinc hydroxide	white

The Periodic Table of Elements

Group																							
1	2	Key										1	13	14	15	16	17	18					
		proton (atomic) number atomic symbol relative atomic mass										H hydrogen 1								He helium 4			
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20						
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40						
19 K potassium 39	20 Ca calcium 40	3	4	5	6	7	8	9	10	11	12						31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84	
37 Rb rubidium 85	38 Sr strontium 88	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65						49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131	
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids		72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201						81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —
87 Fr francium —	88 Ra radium —	89–103 actinoids		104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —						113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganesson —
lanthanoids		57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175							
actinoids		89 Ac actinium	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —							

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$.