



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

AS CHEMISTRY

Paper 1 Inorganic and Physical Chemistry

Tuesday 12 May 2026

Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a scientific calculator, which you are expected to use where appropriate.

Instructions

•

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do **not** write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.

Advice

- You are advised to spend 65 minutes on **Section A** and 25 minutes on **Section B**.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
Section B	
TOTAL	

* J u n 2 6 7 4 0 4 1 0 1 *

Section AAnswer **all** questions in this section.**0 1****Table 1** shows melting point and electrical conductivity information about four substances.**Table 1**

Substance	Melting point / °C	Electrical conductivity at 298 K
SiO ₂	1710	None
SCl ₂	−121	None
Na ₂ O	1132	None
Mg	650	Good

0 1. 1

Identify the crystal structure of each substance when it is in the solid state.

Tick (✓) **one** box for each substance.**[2 marks]**

Substance	Ionic	Metallic	Giant covalent	Molecular
SiO ₂				
SCl ₂				
Na ₂ O				
Mg				

0 1 . 2

Explain why the melting point of SiO_2 is higher than the melting point of SCl_2

[2 marks]

0 1 . 3

Explain why the electrical conductivity of solid Mg is greater than the electrical conductivity of solid Na_2O

[2 marks]

6

Turn over for the next question

Turn over ►

0	2
---	---

This question is about ionisation energies.

0	2	.	1
---	---	---	---

Explain why magnesium has a higher first ionisation energy than sodium.

[2 marks]

0	2	.	2
---	---	---	---

Explain why aluminium has a lower first ionisation energy than magnesium.

[2 marks]

0	2	.	3
---	---	---	---

Give the equation, including state symbols, that shows the change that occurs when the third ionisation energy of silicon is measured.

[1mark]

0 2 4

Table 2 shows some successive ionisation energies of an element in Period 3.

Table 2

	1st	2nd	3rd	4th	5th	6th	7th	8th
Ionisation energy / kJ mol⁻¹	1260	2300	3850	5150	6540	9330	11 000	33 600

Deduce which element gives these data.

Explain your reasoning.

[3 marks]

Element _____

Explanation _____

8

Turn over for the next question

Turn over ►

0 3

This question is about the shapes of molecules and ions.

0 3.1

Draw a diagram to show the shape of a molecule of PBr_3

Include any lone pairs of electrons that influence the shape of the molecule.

Name the shape.

Suggest a value for the bond angle.

[3 marks]

Name of shape _____

Bond angle _____

0 3.2

Some of the bond angles in the SF_5^- ion are approximately 90°

Give a reason why these bond angles are approximately 90°

Explain why these bond angles are **not** exactly 90°

[3 marks]

Reason _____

Explanation _____

0	4
---	---

This question is about inorganic salts.

0	4	.	1
---	---	---	---

Describe chemical tests to show that a solution contains ammonium carbonate.

[4marks]

Question 4 continues on the next page

0 4 2

A hydrated salt has the formula $\text{M}_a\text{X}_b \cdot n\text{H}_2\text{O}$ where **M** represents the cation and **X** represents the anion in the salt.

Table 3 shows the percentage composition by mass of the hydrated salt.

Table 3

Element	Al	H	O	S
Percentage by mass	8.1	5.4	72.0	14.5

Determine the empirical formula of the hydrated salt.

Deduce the formula of the hydrated salt, showing the water of crystallisation.

[4 marks]

Empirical formula _____

Formula of hydrated salt _____

8

0	5
---	---

This question is about Group 2 metals and their compounds.

0	5	.	1
---	---	---	---

Give **one** use for magnesium hydroxide.

[1 mark]

0	5	.	2
---	---	---	---

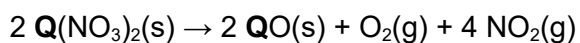
Give an equation to show how CaCO_3 is used to remove SO_2 from flue gases.

[1 mark]

Question 5 continues on the next page

0 5 3

A Group 2 metal nitrate $\mathbf{Q}(\text{NO}_3)_2$ decomposes when heated.



1.38 g of $\mathbf{Q}(\text{NO}_3)_2$ are completely decomposed at 525 °C

The gases collected have a total volume of 720 cm³ at 525 °C and 150 000 Pa

The gas constant, $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$

Determine the M_r of the metal nitrate.

Identify the Group 2 metal, $\mathbf{Q}$.

[6marks]

M_r of metal nitrate _____

Identity of $\mathbf{Q}$ _____

8

0 6

This question is about Group 7 elements and their compounds.

0 6 . 1

Give the full electron configuration of a bromine atom.

[1 mark]

0 6 . 2

Explain why the electronegativity of the halogens decreases down Group 7.

[2 marks]

0 6 . 3

 ClO_3^- ions react with SO_2 in acidic conditions in a redox reaction to form ClO_2 and SO_4^{2-} ions.Give a half-equation for the oxidation, in acidic conditions, of SO_2 to form SO_4^{2-} ions.Give a half-equation for the reduction, in acidic conditions, of ClO_3^- ions to form ClO_2 Deduce the overall equation for the reaction of ClO_3^- with SO_2 **[3marks]**

Oxidation half-equation

Reduction half-equation

Overall equation

Question 6 continues on the next page**Turn over ►**

A student adds a few drops of aqueous halogen solutions to a few drops of 0.1 mol dm^{-3} aqueous sodium halide solutions (**R**, **S** and **T**).

Table 4

	Test 1 Observation when a few drops of aqueous chlorine are added	Test 2 Observation when a few drops of aqueous bromine are added	Test 3 Observation when a few drops of aqueous iodine are added
Solution R	Yellow solution formed	No visible change	No visible change
Solution S	Brown solution formed	Brown solution formed	No visible change
Solution T	No visible change	No visible change	No visible change

In your answer you should:

- identify **R**, **S** and **T**
- give ionic equations, including state symbols, for any reactions that occur
- use the trend in oxidising ability of the halogens to account for the observations in each of the tests involving solution **R**.

[6marks]

[illegible]

[illegible]

12

$$* \quad 1 \quad 3 \quad *$$

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box*

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ANSWER IN THE SPACES PROVIDED**

0 7

This question is about two experiments to determine the enthalpy change when sodium hydroxide solution reacts with an acid.

Experiment 1

- Add a sample of sodium hydroxide solution to a beaker.
- Add a sample of hydrochloric acid to an insulated beaker.
- Place the two beakers next to each other.
- After a few minutes, record the temperature of the acid every minute for three minutes.
- At the fourth minute, add the sodium hydroxide solution to the hydrochloric acid but do not record the temperature.
- Stir the mixture.
- Record the temperature of the mixture every minute for several more minutes. Stir the mixture before recording each temperature.

0 7 . 1

Suggest why the two beakers are left next to each other for a few minutes.

[1 mark]

0 7 . 2

Suggest why the mixture is stirred before recording each temperature.

[1 mark]

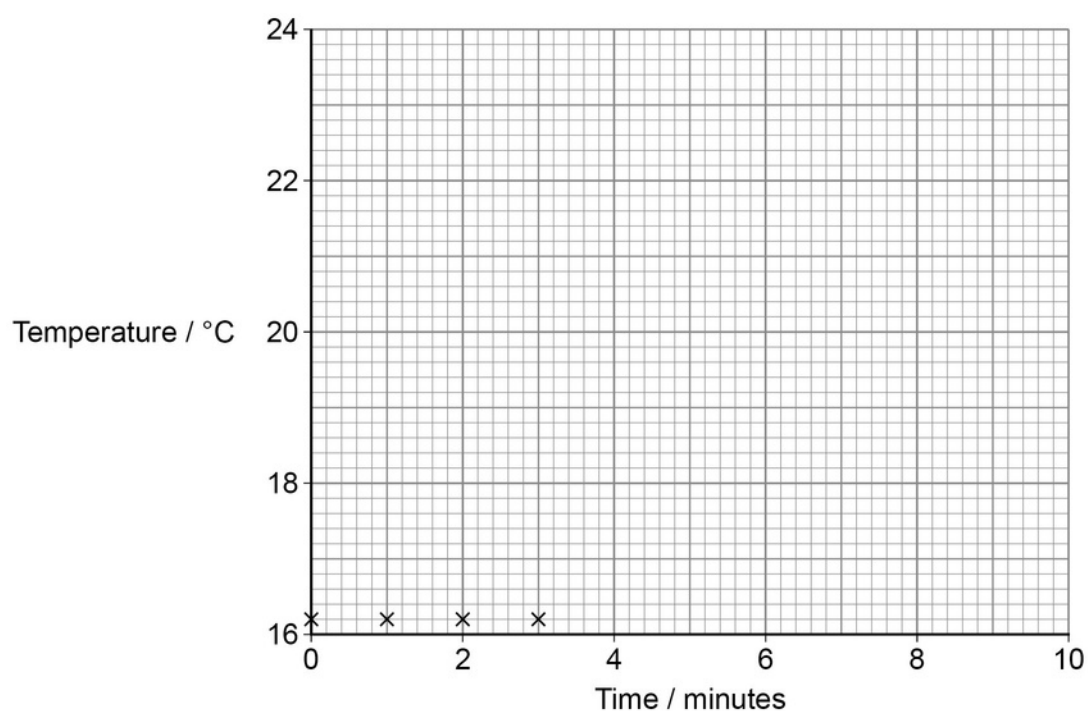
Question 7 continues on the next page

Turn over ►

0 7.3

Table 5 shows data from **Experiment 1**.Do not write
outside the
box**Table 5**

Time / minutes	Temperature / °C
0	16.2
1	16.2
2	16.2
3	16.2
4	No measurement
5	20.8
6	20.4
7	20.0
8	19.6
9	19.2
10	18.8

Figure 1 shows a graph with some of the data from **Table 5** already plotted.**Figure 1**

Plot the rest of the data from **Table 5** on **Figure 1**.

Draw **two** lines of best fit on **Figure 1**.

Use your lines of best fit to determine the temperature rise at the fourth minute.

[3marks]

Temperature rise _____ °C

0 7 . 4

The graphical method gives a more accurate result for the temperature rise than simply measuring the temperature at the fourth minute.

Suggest why.

[1mark]

Question 7 continues on the next page

Turn over ►

Experiment 2 is a similar experiment that uses sodium hydroxide solution and sulfuric acid.

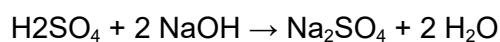
Table 6 shows data from **Experiment 2**.

Table 6

Volume of sodium hydroxide solution	25.00 cm ³
Concentration of sodium hydroxide solution	0.990 mol dm ⁻³
Volume of sulfuric acid	25.00 cm ³
Concentration of sulfuric acid	0.8 mol dm ⁻³
Temperature rise	5.7 °C

The enthalpy of neutralisation can be defined as the enthalpy change when solutions of acid and alkali react together to form 1 mol of water.

The sulfuric acid reacts with sodium hydroxide as shown.



0 7.5

The concentration of the sulfuric acid is only known approximately.

Explain why this does **not** affect the calculation of the enthalpy of neutralisation.

[1mark]

0 7.6

Use the data in **Table 6** to calculate the enthalpy of neutralisation, in kJ mol^{-1} , for this reaction.

Give your answer to the appropriate number of significant figures.

Specific heat capacity of the solution = $4.18 \text{ J K}^{-1} \text{ g}^{-1}$

You should assume that the density of the mixture = 1.00 g cm^{-3}

[4 marks]

Enthalpy of neutralisation _____ kJ mol^{-1}

0 7.7

The sodium hydroxide solution was added from a 50 cm^3 burette.

The uncertainty in each reading on the burette is $\pm 0.05 \text{ cm}^3$

Calculate the total percentage uncertainty in the volume of sodium hydroxide solution.

[1mark]

Total percentage uncertainty _____

12

Turn over ►

0 8

This question is about time of flight (TOF) mass spectrometry.

0 8 . 1

Describe how ions are accelerated in a TOF mass spectrometer.

[1 mark]

0 8 . 2

A compound is analysed by TOF mass spectrometry.

The compound is ionised by electron impact.

Use data from **Table 7** to calculate the M_r of this compound.**Table 7**

Kinetic energy	$1.41 \times 10^{-19} \text{ J}$
Length of flight tube	0.950 m
Time of flight	$6.40 \times 10^{-4} \text{ s}$

Avogadro constant, $L = 6.022 \times 10^{23} \text{ mol}^{-1}$

$$KE = \frac{1}{2} mv^2$$

[4 marks]

 M_r _____

5

Section B

Answer **all** questions in this section.Only **one** answer per question is allowed.

For each question completely fill in the circle alongside the appropriate answer.

CORRECT METHOD



WRONG METHODS



If you want to change your answer you must cross out your original answer as shown.



If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown.

You may do your working in the blank space around each question but this will not be marked.
Do **not** use additional sheets for this working.

0 9

What is the formula for ammonium sulfate(VI)?

[1 mark]

A $\text{NH}_4(\text{SO}_3)_2$ ☐B $(\text{NH}_4)_2\text{SO}_3$ ☐C NH_4SO_4 ☐D $(\text{NH}_4)_2\text{SO}_4$ ☐

1 0

 AsH_3 reacts with H^+ to form AsH_4^+ What type of interaction occurs between AsH_3 and H^+ ?

[1 mark]

A dative covalent bond

☐

B dipole–dipole force

☐

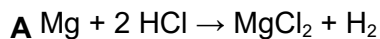
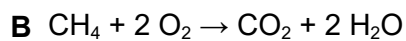
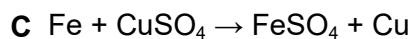
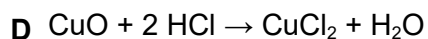
C hydrogen bond

☐

D ionic bond

☐

Turn over ►

1 1Which equation does **not** represent a redox reaction?**[1 mark]**☐☐☐☐**1 2**

Barium metal is added to a large excess of water.

Which observation is correct **and** complete?**[1 mark]****A** a colourless solution☐**B** a colourless solution and effervescence☐**C** a dense white precipitate☐**D** a dense white precipitate and effervescence☐**1 3**

When testing for halide ions in aqueous solution, dilute nitric acid is added before the addition of silver nitrate solution.

Which is the correct reason for the addition of nitric acid?

[1mark]**A** silver halides require an acidic solution for precipitation☐**B** to increasethe concentration of the nitrate ions☐**C** to preventthe precipitation of silver salts other than halides☐**D** to preventthe silver nitrate being precipitated☐

1 4

Which solid sodium halide reduces concentrated sulfuric acid to sulfur dioxide but **not** to hydrogen sulfide?

[1mark]

A NaF ☐

B NaCl ☐

C NaBr ☐

D NaI ☐

1 5

Chlorine reacts with cold, dilute, aqueous sodium hydroxide.

What products containing sodium are formed?

[1 mark]

A NaCl only ☐

B NaCl and NaOCl ☐

C NaOCl only ☐

D NaCl and NaClO₃ ☐

1 6

Which block in the Periodic Table contains uranium (U)?

[1 mark]

A s-block ☐

B p-block ☐

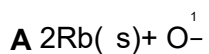
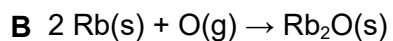
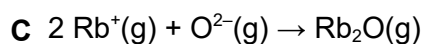
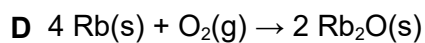
C d-block ☐

D f-block ☐

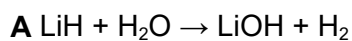
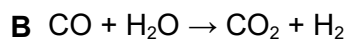
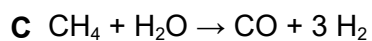
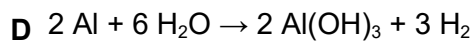
Turn over ►

1 7

Which equation shows the reaction that has an enthalpy change equal to the enthalpy of formation of rubidium oxide?

[1 mark]☐☐☐☐**1 8**

Which reaction has the greatest percentage atom economy for the production of hydrogen?

[1mark]☐☐☐☐

1 9

In a titration, a pipette is used to transfer 25.0 cm^3 of NaOH(aq) from a beaker to a conical flask.

HCl(aq) is added from a burette to the conical flask.

The final calculated concentration of HCl(aq) using results from this titration was **lower** than the correct value.

Which action could explain this?

[1 mark]

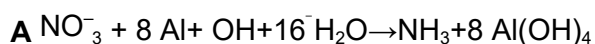
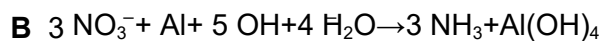
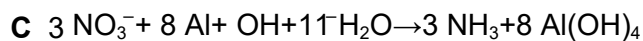
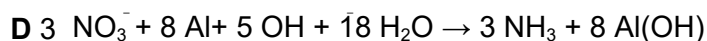
- A** rinsing the beaker with distilled water before adding NaOH(aq)
- B** rinsing the burette with distilled water before filling with HCl(aq)
- C** rinsing the pipette with distilled water before filling with NaOH(aq)
- D** rinsing the walls of the flask with distilled water during the titration

☐☐☐☐

2 0

Which equation is balanced?

[1 mark]

☐☐☐☐

2 1

A copper cube with sides of length 5.00 cm contains 1.060×10^{25} atoms of copper.

What is the density, in g cm^{-3} , of copper in this cube?

The Avogadro constant, $L = 6.022 \times 10^{23} \text{ mol}^{-1}$

[1 mark]

A 3.60

☐

B 7.10

☐

C 8.94

☐

D 17.60

☐

Turn over ►

2 2

What is the definition of the relative atomic mass of silicon?

[1 mark]

- A** the mean mass of a silicon atom compared to one twelfth of the mass of an atom of ^{12}C
- B** the mean mass of a silicon atom compared to the mass of an atom of ^{12}C
- C** the mean mass of one mole of atoms of silicon compared to one twelfth of the mass of an atom of ^{12}C
- D** the mean mass of a silicon atom compared to the mass of a carbon atom

☐☐☐☐**2 3**A sample of CH_2Br_2 is analysed using time of flight (TOF) mass spectrometry.

The sample is ionised using electrospray ionisation.

Bromine exists as two naturally occurring isotopes, ^{79}Br and ^{81}Br What are the m/z values of the molecular ion peaks on the spectrum?**[1 mark]****A** 172, 176☐**B** 173, 177☐**C** 172, 174, 176☐**D** 173, 175, 177☐**15****END OF QUESTIONS**

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[illegible]

[illegible]

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