

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.

INTERNATIONAL AS CHEMISTRY (9620)

Unit 1: Inorganic 1 and Physical 1

Tuesday 28 April 2026

08:00 UK Time

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert
- 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 70.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



J U N 2 6 C H O 1 0 1

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

0 1

This question is about some Group 2 elements and their compounds.

Magnesium and barium react with H_2O under different conditions.

0 1 . 1

Magnesium reacts rapidly with H_2O

State the conditions needed for this reaction.

Give **one** observation.

Write an equation for this reaction.

[3 marks]

Conditions _____

Observation _____

Equation

0 1 . 2

Write an equation, including state symbols, for the reaction of barium with H_2O

[1 mark]



0	1	.	3
---	---	---	---

A student uses dilute sulfuric acid to distinguish between an aqueous solution of magnesium chloride and an aqueous solution of barium chloride.

State the observation the student would make with each solution.

Write an ionic equation for any reaction(s) that give(s) a visible change.

[3 marks]

Observation with magnesium chloride _____

Observation with barium chloride _____

Ionic equation(s)

7

Turn over for the next question

Turn over ►



0	2
---	---

This question is about shapes of molecules and the bonding in some aluminium compounds.

When aluminium reacts with chlorine, aluminium chloride (AlCl_3) is formed.

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

Write an equation for this reaction.

[1 mark]

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

Draw the shape of an aluminium chloride (AlCl_3) molecule.
Include any lone pairs that influence the shape.

Name the shape of the molecule.

State the bond angle.

[3 marks]

Shape

Name of shape _____

Bond angle _____



When sodium chloride reacts with aluminium chloride, a crystalline solid forms containing the AlCl_4^- ion.

0 2 . 3

Name the type of bond formed between a chloride ion and an aluminium chloride molecule.

Explain how this bond is formed.

[2 marks]

Type of bond _____

How the bond is formed _____

0 2 . 4

Explain why the crystalline solid formed has a high melting point.

[2 marks]

8

Turn over for the next question

Turn over ►



0 3

A time of flight (TOF) mass spectrometer can be used to determine the relative molecular mass of molecules.

0 3 . 1

Define relative molecular mass.

[2 marks]

Compound **Z** exists as large molecules.

Some **Z** is dissolved in a solvent and the molecules are ionised by electrospray ionisation in a TOF mass spectrometer.

0 3 . 2

Write an equation to show how a molecule of **Z** is ionised by electrospray ionisation.

[1 mark]

0 3 . 3

Give **two** reasons why the molecules of **Z** must be ionised before they can be analysed in a TOF mass spectrometer.

[2 marks]

1

2

0 3 . 4

Suggest why there is **no** peak in the spectrum for the solvent.

[1 mark]



0 3 . 5

The ions formed from **Z** by electrospray ionisation are accelerated to a kinetic energy of $1.13 \times 10^{-15} \text{ J}$

Each ion takes $3.83 \times 10^{-5} \text{ s}$ to travel along a flight tube that is 1.50 m long.

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

KE = kinetic energy / J

m = mass / kg

v = speed / m s^{-1}

Calculate the relative molecular mass of **Z**.

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

[5 marks]

Relative molecular mass of **Z** _____

11

Turn over ►



0	4
---	---

Magnesium reacts with nitrate ions, NO_3^- , in acidic conditions, to form ammonium ions, NH_4^+

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

Write a half-equation for the reaction of magnesium to form magnesium ions.

[1 mark]

0	4	.	2
---	---	---	---

Write a half-equation for the reaction of nitrate ions, in acidic conditions, to form ammonium ions.

[1 mark]

0	4	.	3
---	---	---	---

Write an overall equation for the reaction between magnesium and nitrate ions in acidic conditions.

[1 mark]

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

Identify the oxidising agent in this reaction.

Explain your answer in terms of electrons.

[2 marks]

Oxidising agent _____

Explanation _____

5



0 5

This question is about Period 3 elements and their compounds.

0 5 . 1

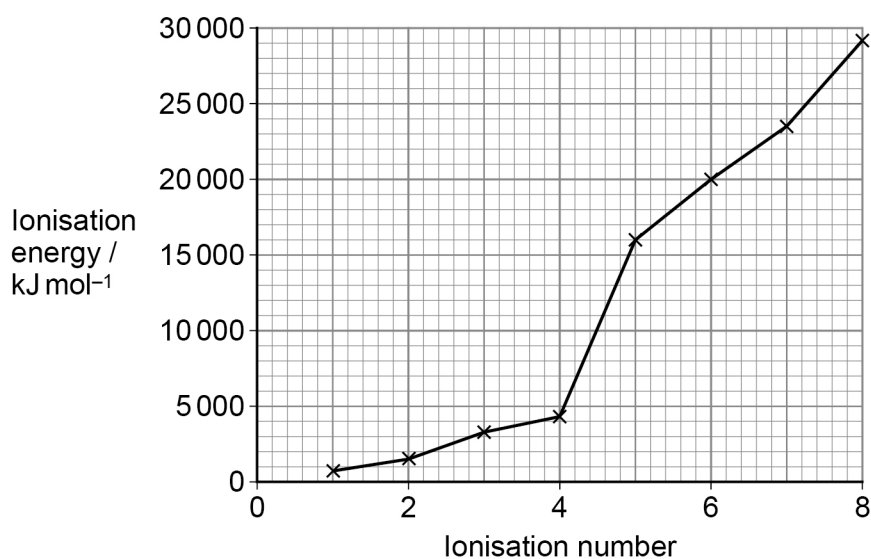
Give the meaning of the term periodicity.

[1 mark]

0 5 . 2

Figure 1 shows the successive ionisation energies of an element in Period 3.

Figure 1



Identify this element.

[1 mark]

0 5 . 3

Give the symbol of the element in Period 3 that has the highest **second** ionisation energy.Write an equation, including state symbols, to show this **second** ionisation.If you could not identify the element, you should use **X** in your equation.

[2 marks]

Element _____

Equation _____

Turn over ►



0 5 . 4

Give the formula of the compound formed by the **two** elements in Period 3 that have the biggest electronegativity difference between them.

[1 mark]

The elements in Period 3 from silicon to sulfur form fluorides SiF_4 , PF_5 and SF_6

0 5 . 5

Suggest why chlorine does not form ClF_7

[1 mark]

0 5 . 6

The melting point of SF_6 is $-50\text{ }^\circ\text{C}$

The melting point of PF_5 is $-94\text{ }^\circ\text{C}$

Explain why SF_6 has a higher melting point than PF_5

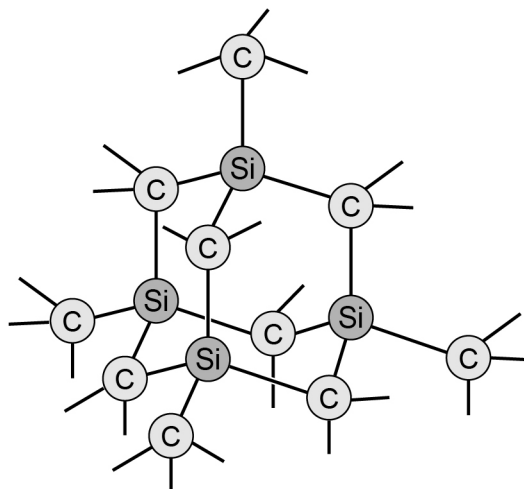
[2 marks]

0 5 . 7

Figure 2 shows a section of the structure of silicon carbide, formed from silicon atoms and carbon atoms.

Silicon carbide has a melting point of 2973 °C

Figure 2



State the type of crystal structure shown by silicon carbide.

Explain why silicon carbide has a high melting point.

[3 marks]

Crystal structure _____

Explanation _____

0 5 . 8

Which is the empirical formula of silicon carbide?

Tick (✓) **one** box.

[1 mark]

SiC

☐

SiC₂

☐

Si₄C

☐

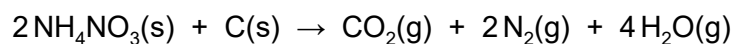
Si₂C₅

☐


0 6

This question is about ammonium nitrate.

Ammonium nitrate and powdered carbon react violently to form a mixture of gases.



0 6 . 1

Table 1 shows some enthalpy data.

Table 1

Substance	$\text{NH}_4\text{NO}_3(\text{s})$	$\text{CO}_2(\text{g})$	$\text{H}_2\text{O}(\text{g})$
$\Delta_f H^\circ / \text{kJ mol}^{-1}$	-365	-394	-242

Give the meaning of enthalpy change.

Use data from **Table 1** to calculate a value, in kJ mol^{-1} , for the enthalpy change for this reaction.

[3 marks]

Meaning of enthalpy change _____

Enthalpy change _____ kJ mol^{-1}



0 6 . 2

Calculate the mass, in g, of ammonium nitrate ($M_r = 80.0$) needed to form $3.20 \times 10^{-3} \text{ m}^3$ of gas at 350°C and 500 kPa in this reaction.

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

[5 marks]

Mass of ammonium nitrate _____ g

0 6 . 3

A student dissolves 5.00 g of ammonium nitrate in 50.0 cm^3 of water in a plastic cup.

The temperature of the solution falls from 22.5°C to 17.4°C

Calculate the enthalpy change, in kJ mol^{-1} , when one mole of ammonium nitrate dissolves.

Assume that the specific heat capacity of the aqueous solution is $4.18 \text{ J K}^{-1} \text{ g}^{-1}$

Assume that the density of the solution = 1.00 g cm^{-3}

[3 marks]

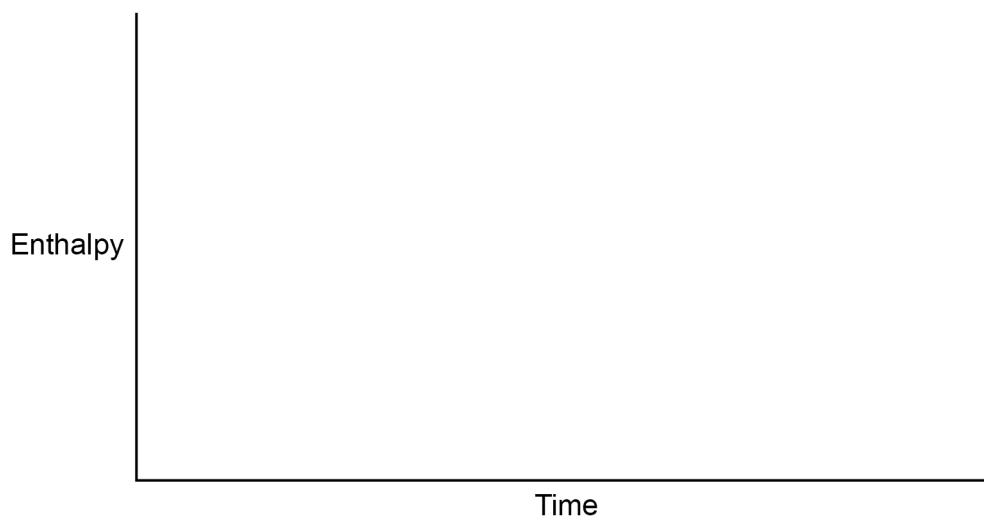
Enthalpy change _____ kJ mol^{-1}

Turn over ►

0 6 . 4

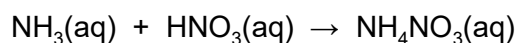
Complete the diagram to show the enthalpy change when ammonium nitrate dissolves in water and the temperature of the solution falls.

[1 mark]



0 6 . 5

When aqueous ammonia reacts with dilute nitric acid there is an enthalpy change and a solution of ammonium nitrate is formed.



28.00 cm³ of 0.500 mol dm⁻³ aqueous ammonia are added to
7.85 cm³ of 1.00 mol dm⁻³ nitric acid.

Calculate the amount, in mol, of each reagent.

Calculate the mass, in g, of ammonium nitrate ($M_r = 80.0$) formed.
Give your answer to 3 significant figures.

[3 marks]

Amount of ammonia _____ mol

Amount of nitric acid _____ mol

Mass of ammonium nitrate _____ g

15



0	7
---	---

This question is about the elements in Group 7 (Group 17) and their compounds.

0	7	.	1
---	---	---	---

A few drops of aqueous bromine are added separately to a few drops of aqueous sodium chloride and to a few drops of aqueous sodium iodide.

State what is observed.

Write an ionic equation for any reaction(s) that occur(s).

[3 marks]

Observation with aqueous sodium chloride _____

Observation with aqueous sodium iodide _____

Ionic equation(s)

0	7	.	2
---	---	---	---

Silver nitrate can be used to show the presence of iodide ions.

State an observation when aqueous silver nitrate is added to aqueous sodium iodide.

Write an ionic equation, including state symbols, for the reaction.

[2 marks]

Observation _____

Ionic equation

Question 7 continues on the next page

Turn over ►



0	7	.	3
---	---	---	---

When concentrated sulfuric acid is added to solid sodium iodide, one of the products is a gas that has sulfur in oxidation state -2

Identify the gas.

Write an equation to show how this gas is formed.

State the role of iodide ions in this reaction.

[3 marks]

Identity of gas _____

Equation _____

Role _____

0	7	.	4
---	---	---	---

Write an equation for the reaction of concentrated sulfuric acid with solid sodium fluoride.

State the role of fluoride ions in this reaction.

[2 marks]

Equation _____

Role _____

0	7	.	5
---	---	---	---

Chlorine is a toxic gas.

Write an equation for the equilibrium reaction that occurs when chlorine gas reacts with cold water.

Give **one** way chlorine can be used safely to purify drinking water even though the gas is toxic.

[2 marks]

Equation _____

How chlorine can be used safely _____

END OF QUESTIONS



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