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Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel Level 3 GCE

Tuesday 12 May 2026

Morning (Time: 1 hour 30 minutes)

**Paper
reference**

8CH0/01

Chemistry

Advanced Subsidiary

PAPER 1: Core Inorganic and Physical Chemistry

You must have:

Scientific calculator, Data Booklet, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- For the question marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing the points that you make are related or follow on from each other where appropriate.
- A Periodic Table is printed on the back cover of this paper.

Advice

- Read each question carefully before you start to answer it.
- Show all your working in calculations and include units where appropriate.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions.

Some questions must be answered with a cross ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

1 What is the sign (if any) of ionisation energies when measured in kJ mol^{-1} ?

- ☐ A no sign
- ☐ B positive
- ☐ C negative
- ☐ D negative or positive

(Total for Question 1 = 1 mark)

2 Which does **not** indicate the existence of quantum shells in atoms?

- ☐ A the atomic emission spectrum of an element
- ☐ B the direction of electron spin in an atom of an element
- ☐ C the first ionisation energies of successive elements
- ☐ D the successive ionisation energies of electrons in an atom

(Total for Question 2 = 1 mark)

3 Which is the electronic configuration of the gallium ion, Ga^{3+} ?

The atomic number of gallium is 31.

- ☐ A $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$
- ☐ B $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$
- ☐ C $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$
- ☐ D $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$

(Total for Question 3 = 1 mark)



- 4 This question is about structure and bonding in Group 4 elements and their compounds.

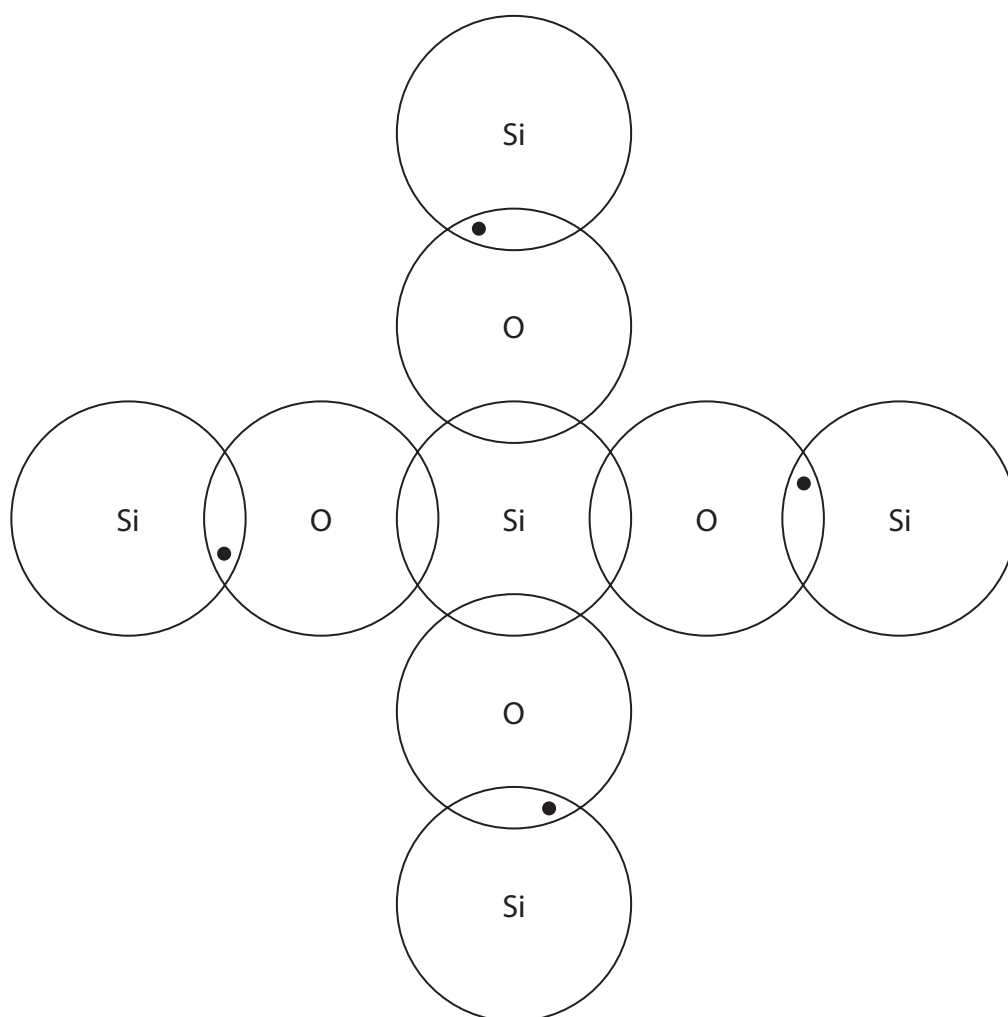
(a) Quartz is a naturally occurring form of the compound silicon dioxide (SiO_2).

Complete the dot-and-cross diagram for a section of the structure of quartz.

Show only the outer electrons for the central silicon atom and its four surrounding oxygen atoms.

Use dots (•) for the silicon electrons and crosses (×) for the oxygen electrons.

(2)



(b) Graphite is a form of carbon which is used for the 'lead' in pencils.

Explain how the structure of graphite makes it suitable for this use.

(2)



(c) Compare and contrast the structure and bonding in carbon (diamond) and in carbon dioxide, and the effect on their relative boiling temperatures.

(6)

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Substance	Boiling temperature / K
Carbon (diamond)	5100
Carbon dioxide	195

(Total for Question 4 = 10 marks)



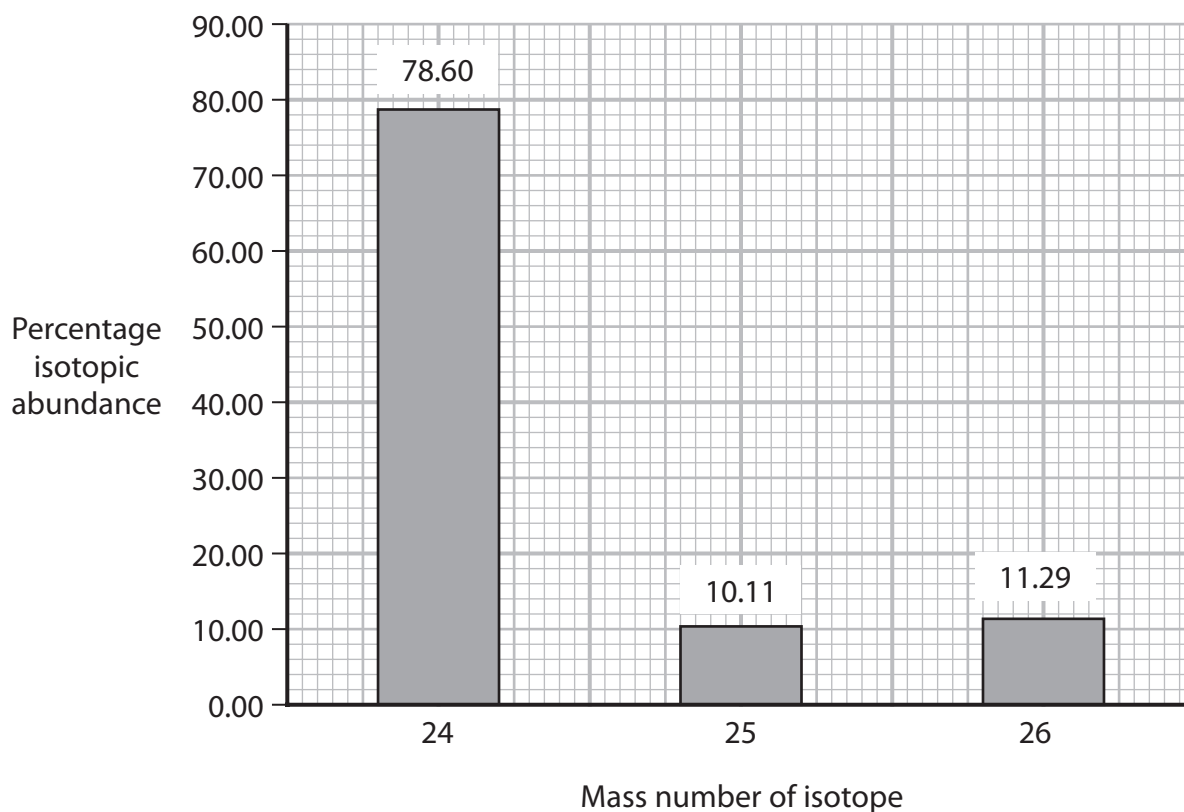
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Turn over

5 This question is about mass spectrometry, Group 2 elements and their compounds.

(a) A bar chart representation of the mass spectrum of element **A** is shown.



Calculate the relative atomic mass of element **A**.
Give your final answer to four significant figures.

(2)



(b) Element **A** is a Group 2 element.

Explain why the first ionisation energies of the Group 2 elements decrease down the group.

(3)

(c) State **one** similarity and **one** difference between the definitions of the relative atomic mass and the relative isotopic mass of an element.

(2)



(d) Calculate the **number** of chloride ions in 5.00 g of anhydrous strontium chloride.

[Avogadro constant (L) = $6.02 \times 10^{23} \text{ mol}^{-1}$]

(4)

(Total for Question 5 = 11 marks)



6 Sulfate ions in a solution can be detected by adding an acidified solution of compound **X**, resulting in a white precipitate.

(a) What is the name of compound **X**?

(1)

- ☐ **A** barium chloride
- ☐ **B** barium sulfate
- ☐ **C** calcium chloride
- ☐ **D** calcium sulfate

(b) Which acid should **not** be used in this test?

(1)

- ☐ **A** ethanoic acid
- ☐ **B** hydrochloric acid
- ☐ **C** nitric acid
- ☐ **D** sulfuric acid

(Total for Question 6 = 2 marks)



7 This question is about tests for halide ions.

(a) Halide ions are detected by the addition of dilute nitric acid, followed by silver nitrate solution.

(i) State the function of the nitric acid in this test.

(1)

(ii) What is observed when nitric acid is added to a solution of potassium iodide, followed by silver nitrate solution?

(1)

- ☐ **A** a colour change from brown to a colourless solution
- ☐ **B** a colour change from colourless to a brown solution
- ☐ **C** a white precipitate forms
- ☐ **D** a yellow precipitate forms

(iii) Which is the formula of the product responsible for the observation in (a)(ii)?

(1)

- ☐ **A** Ag_2I
- ☐ **B** AgI
- ☐ **C** AgI_2
- ☐ **D** AgI_3



(b) A textbook stated the following observations and conclusions when potassium iodide is warmed with concentrated sulfuric acid:

- steamy fumes caused by hydrogen iodide gas
- purple gas caused by iodine vapour
- yellow deposit due to solid sulfur
- a smell of rotten eggs caused by hydrogen sulfide gas.

(i) Explain the production of each of these four substances in this reaction, using the concept of redox where appropriate.

You may find it useful to identify oxidation numbers in the reactants and products.

Redox equations are not required.

(4)

(ii) The same textbook listed the following observations and conclusions when potassium bromide is warmed with concentrated sulfuric acid:

- steamy fumes caused by hydrogen bromide and sulfur dioxide gases
- brown gas caused by bromine vapour.

Explain why there are only two observations listed for this reaction compared to the four observations with potassium iodide.

(2)

(Total for Question 7 = 9 marks)



8 This is a question about Group 2 carbonates.

- (a) A student found a jar containing a white powder that was thought to be calcium carbonate.

A flame test was carried out on the white powder in an attempt to identify the cation present in the powder.

The student wrote:

"A cleaned platinum wire was dipped into concentrated sulfuric acid and then into the white powder before being placed in a yellow Bunsen flame."

- (i) Identify two errors and the changes that should be made to the procedure, giving a reason for each change.

(4)

Error 1 and change

Reason for this change

Error 2 and change

Reason for this change



- (ii) When a flame test was correctly carried out on the white powder, the flame colour was red.

State a reason why this result does not positively identify the cation as calcium.

(1)

- (iii) A sample of 4.00 g of the white powder was completely thermally decomposed.

The equation for the decomposition of a Group 2 carbonate is shown.



The gas evolved was collected and its volume measured at r.t.p. (room temperature and pressure).

The volume of gas collected at r.t.p. was 960 cm³.

Show that the volume of carbon dioxide collected confirms that the white powder was calcium carbonate.

[Molar volume of a gas at r.t.p. is 24 dm³ mol⁻¹]

(4)

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(iv) Which describes the structure of solid calcium carbonate?

(1)

- ☐ **A** covalent molecules
- ☐ **B** giant covalent lattice
- ☐ **C** giant ionic lattice
- ☐ **D** ionic molecules

(b) (i) Explain the trend in thermal stability of the Group 2 carbonates.

(4)

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(ii) Group 2 nitrates also undergo decomposition to produce an oxide when heated.

Write the equation for the thermal decomposition of calcium nitrate.

State symbols are not required.

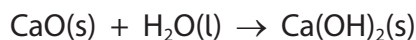
(1)

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- (c) (i) The calcium oxide produced by the thermal decomposition of calcium carbonate can be reacted with water to produce solid calcium hydroxide.

The equation for this reaction is shown.



Calculate the volume of water that will react with 5.00×10^{-2} mol of calcium oxide.

[Density of water = 1.00 g cm^{-3}]

(1)

- (ii) Calculate the volume, in cm^3 , of saturated calcium hydroxide solution that can be produced from 5.00×10^{-2} mol of calcium oxide.

You may assume that all the calcium oxide reacts with water and then dissolves.

Give your answer to an appropriate number of significant figures.

[Solubility of calcium hydroxide in water = $1.50 \times 10^{-2} \text{ mol dm}^{-3}$]

(2)

- (iii) Give the reason why the volume of water required to react with calcium oxide can be ignored in your answer to (c)(ii).

(1)

(Total for Question 8 = 19 marks)



9 This question is about an experiment to determine the concentration of an acidic solution.

- (a) A student decided to find the accurate concentration of a hydrochloric acid solution by titration with $0.310 \text{ mol dm}^{-3}$ sodium hydroxide solution.

Procedure:

The student used a pipette to transfer 25.0 cm^3 of a freshly prepared solution of $0.310 \text{ mol dm}^{-3}$ sodium hydroxide solution to a conical flask and then added two drops of phenolphthalein indicator.

Hydrochloric acid was then added to the flask from a burette. The contents of the flask were swirled frequently until the indicator changed colour. The procedure was repeated several times until concordant results were obtained.

The student's results are shown.

	Rough titration	1st titration	2nd titration	3rd titration
Initial burette reading / cm^3	0.00	2.55	2.05	3.10
Final burette reading / cm^3	28.00	29.15	28.30	29.60
Titre / cm^3	28.00	26.60	26.25	26.50

- (i) State what is meant by 'concordant results'.

(1)

- (ii) Calculate the mean of the concordant titres.

(1)



(iii) State the colour change of the phenolphthalein indicator in this titration.

(2)

(iv) Calculate the concentration, in mol dm^{-3} , of the hydrochloric acid.

(3)

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(b) The measurement uncertainty for each reading of the burette is $\pm 0.05 \text{ cm}^3$.

- (i) Calculate the percentage error in the titre for the **third** titration.
Give your answer to an appropriate number of significant figures.

(2)

- (ii) Another student decided to do a similar titration but instead of hydrochloric acid, they used sulfuric acid of the same concentration.

Explain the effect of this change on the percentage error of the titre.

(2)

(Total for Question 9 = 11 marks)



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10 The boiling temperatures of some Group 6 hydrides are shown.

Formula of hydride	Boiling temperature / K	Molar mass / g mol ⁻¹
H ₂ O	373	18.0
H ₂ S	212	34.1
H ₂ Se	232	
H ₂ Te	271	
H ₂ Po		211

(a) (i) The molar masses of three hydrides are shown in the table.

Complete the molar mass column for the remaining two hydrides.

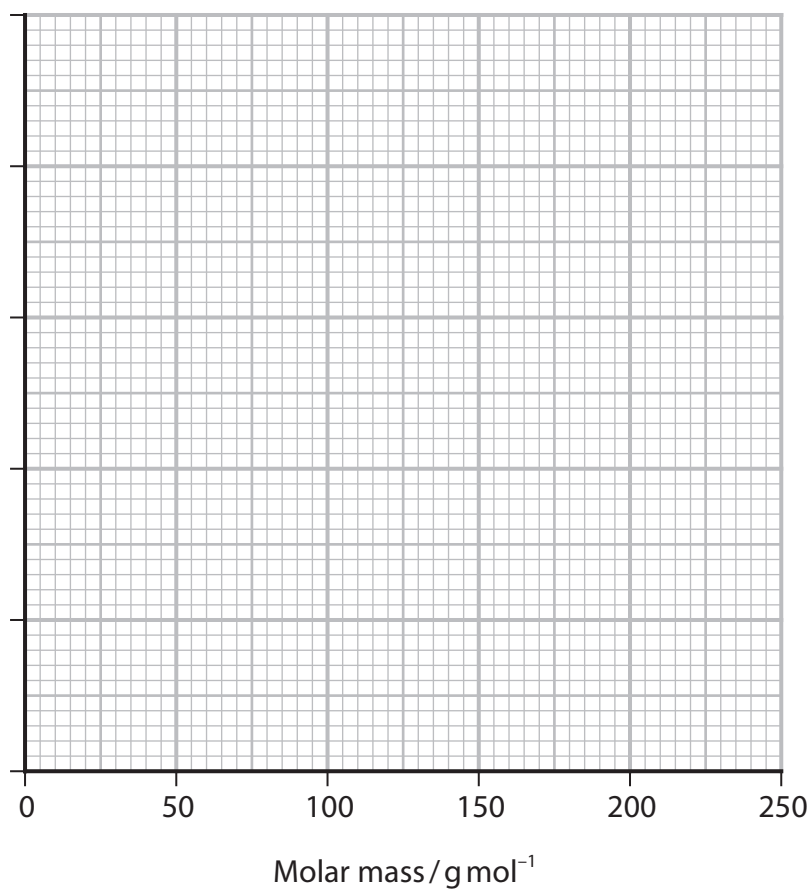
(1)



- (ii) Plot a graph of boiling temperature against molar mass for the Group 6 hydrides, using the axes provided. You should only plot the boiling temperatures for the first four hydrides, H_2O to H_2Te .

(2)

Boiling temperature
/K



- (iii) Predict the boiling temperature of polonium hydride, H_2Po , showing your working on the graph.

(2)



(b) (i) Give the molecular shape of H_2S .

(1)

*(ii) Explain the differences in the boiling temperatures of the Group 6 hydrides.
Your explanation should refer to **all** intermolecular forces.

(6)



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(c) H_2S is a common hydride of sulfur but other hydrides also exist.

Another hydride contains 2.035% of hydrogen.

Calculate the empirical formula of this hydride.

(3)

(Total for Question 10 = 15 marks)

TOTAL FOR PAPER = 80 MARKS



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28

* Lanthanide series

* Actinide series

Elements with atomic numbers 112-116 have been reported but not fully authenticated

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