Chemistry Model Paper 1 2025

Time Allowed: 1 hour 45 minutes
Total Marks: 65

You must bring a soft pencil (preferably type B or HB), a clean eraser, and a dark blue or black pen.

Before attempting the paper, write your name, candidate number, centre name, and centre number clearly in the designated spaces.

Instructions for Candidates

- All questions are compulsory.
- Read each question carefully before answering.
- You may use a simple calculator if needed.
- You should show all your working and use appropriate units.
- Do not use an erasable pen or correction fluid.
- Avoid writing over any barcodes printed on the paper.

Information for Candidates

- This paper consists of a total of **65 marks**.
- The number of marks for each question or part question is shown in brackets [ ].
- A copy of the periodic table will be provided with this paper.

Please read all questions carefully and follow the instructions exactly to ensure your responses are properly evaluated.

Answer all questions. Show all working where appropriate.

Question 1 (6 marks)

Chlorine exists naturally as two stable isotopes, ^{35}Cl and ^{37}Cl.

(a) State, with reference to subatomic particles, how these isotopes differ. [1]

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(b) State what additional information is required to calculate the relative atomic mass of chlorine. [1]

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(c) Phosphorus reacts with chlorine to form phosphorus trichloride, PCl_3.

(i) State the type of bonding within a PCl_3 molecule. [1]

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(ii) State the type of attraction between different PCl_3 molecules. [1]

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(d) Zinc oxide reacts with both acids and alkalis. State the type of chemical behaviour shown. [2]

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Question 2 (6 marks)

(a) When aqueous sodium iodide is added to silver nitrate solution, a pale-yellow precipitate forms and iodine is released.

(i)   Write a balanced chemical equation for the reaction, including state symbols. [2]

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(ii)   Deduce the oxidation number of silver in $AgNO_3$ and AgI. [1]

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(iii)   State the type of reaction and explain in terms of oxidation and reduction.[1]

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(b) A sample of hydrated magnesium sulfate, $MgSO_4 \cdot xH_2O$, has a mass of 15.6 g. After heating, the residue of anhydrous $MgSO_4$ weighs 7.8 g.

Calculate the value of x. Show your working clearly.[2]

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Question (7 marks)

(a) Write a balanced equation for the reaction of sodium oxide with water. State the pH of the resulting solution.[2]

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(b) Write a balanced equation for the reaction of phosphorus(V) oxide with water. State the pH of the resulting solution. [2]

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(c) Explain why the oxides of sodium and phosphorus show very different acid–base behaviours. [3]

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Question 4 (6marks)

(a) State the general trend in the solubility of hydroxides of Group 2 elements down the group. [1]

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(b) Explain this trend in terms of lattice energy and hydration energy.[2]

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(c) Magnesium hydroxide is used in medicine. State one common use and explain why it is suitable.[2]

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(d) Predict the shape and bond angle of a molecule of CH_4.[1]

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Question 5 (7 marks)

(a) Write an equation for the free radical substitution of methane with chlorine in the presence of UV light.[2]

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(b) State two observations when bromine water is added to an alkane and the mixture is exposed to sunlight. [2]

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(c) Define the term "structural isomerism" and give two examples using C_5H_{12}. [3]

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Question 6 (7 marks)

(a) Write the ionic equation for the displacement reaction between chlorine gas and aqueous potassium bromide.[2]

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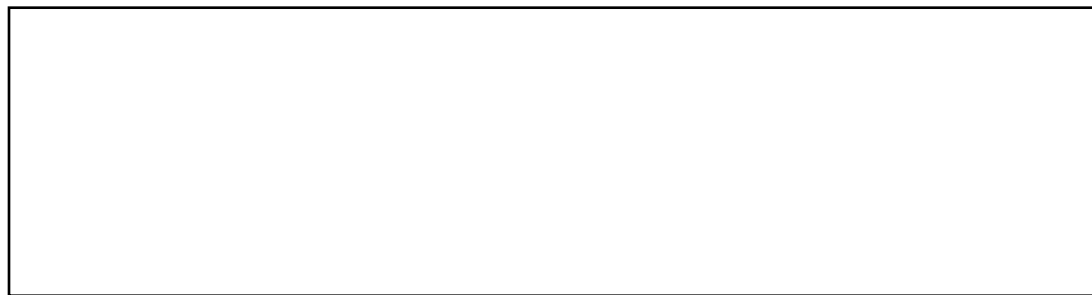_____
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(b) State what you would observe in this reaction.[1]

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(c) Iodine can act as both an oxidising agent and a reducing agent.
Write one equation to illustrate each role of iodine. [4]

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Question 7 (6 marks)

(a) Define the term "relative molecular mass." [1]

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(b) Draw a labelled diagram to show hydrogen bonding between two hydrogen fluoride molecules.[2]

(c) An interhalogen compound contains only bromine and chlorine. At room conditions, 1.00 dm³ of this gas has a mass of 6.50 g.

(i) Calculate its relative molecular mass.[2]

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(ii) Deduce its molecular formula.[1]

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Question 8 (7 Marks)

(a) Define the term "relative isotopic mass".[1]

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(b) Magnesium has three stable isotopes: ^{24}Mg, ^{25}Mg and ^{26}Mg. Explain, with reference to subatomic particles, how these isotopes differ.[2]

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(c) State the type of bonding in solid magnesium and explain how this accounts for its high melting point.[2]

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(d) A sample of $Na_2CO_3 \cdot xH_2O$ has a mass of 12.5 g. After heating to constant mass, 4.6 g of anhydrous Na_2CO_3 remains.

Calculate the value of x. [2]

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Question 9 (6 marks)

(a) Write a balanced equation for the thermal decomposition of calcium carbonate. State the type of reaction.[2]

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(b) Write an equation for the reaction of aluminium oxide with hot aqueous hydrochloric acid.[2]

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(c) State and explain one use of calcium hydroxide in agriculture.[2]

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Question 10 – Alkenes (7 marks)

(a) Write the equation for the reaction of ethene with hydrogen bromide.[1]

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(b) Draw the two possible carbocation intermediates formed during the reaction of propene with HBr.[2]

(c) Identify which carbocation is more stable and explain your answer.[2]

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(d) State two observations when bromine water is added to ethene.[2]

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Chemistry Model Paper 1 (2025)

MARKING SCHEME

HEME (Total Marks: 65)

QUESTION 1 (6 MARKS)
(a) Same number of protons, different number of neutrons – 1m
(b) Relative / percentage abundance – 1m
(c)(i) Covalent bonding – 1m
(c)(ii) Permanent dipole–dipole forces – 1m
(d) Amphoteric nature – 1m
    Reacts with acids and alkalis – 1m

QUESTION 2 (6 MARKS)
(a) Correct balanced equation – 1m
   Correct state symbols – 1m
   Oxidation number of Ag = +1 – 1m
   Redox reaction identified – 1m
   Explanation of oxidation/reduction – 1m
(b) Correct working – 1m
   Correct value of x = 7 – 1m

QUESTION 3 (7 MARKS)
(a) Correct equation – 1m
   Alkaline pH – 1m
(b) Correct equation – 1m
   Acidic pH – 1m
(c) Ionic oxide explanation – 1m
   Covalent oxide explanation – 1m
   Metal vs non-metal comparison – 1m

QUESTION 4 (6 MARKS)
(a) Solubility increases down the group – 1m
(b) Lattice energy decreases – 1m
   Hydration energy explanation – 1m
(c) Use stated – 1m
   Explanation – 1m
(d) Tetrahedral shape / 109.5° – 1m

QUESTION 5 (7 MARKS)

(a) Correct equation – 2m

(b) Two correct observations – 2m

(c) Definition of structural isomerism – 1m

   Two correct examples – 2m

QUESTION 6 (7 MARKS)

(a) Correct ionic equation – 2m

(b) Observation (brown/orange colour) – 1m

(c) Oxidising agent equation – 2m

   Reducing agent equation – 2m

QUESTION 7 (6 MARKS)

(a) Correct definition – 1m

(b) Correct hydrogen bonding diagram – 2m

(c)(i) Correct Mr calculation – 2m

(c)(ii) Correct molecular formula – 1m

QUESTION 8 (7 MARKS)

(a) Correct definition – 1m

(b) Neutron difference explained – 2m

(c) Metallic bonding stated and explained – 2m

(d) Correct working – 1m

   Correct value of x – 1m

QUESTION 9 (6 MARKS)

(a) Correct equation – 1m

   Thermal decomposition – 1m

(b) Correct equation – 2m

(c) Correct use – 1m

   Explanation – 1m

QUESTION 10 (7 MARKS)

(a) Correct equation – 1m

(b) Two correct carbocations – 2m

(c) Stability statement – 1m

   Explanation – 1m

(d) Two correct observations – 2m