



# Cambridge IGCSE™

## CHEMISTRY

Paper 2 Multiple Choice (Extended)

0620/23

May/June 2025

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)

## INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

## INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Any blank pages are indicated.

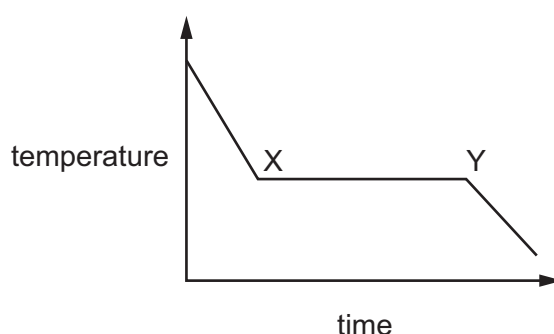


- 1 Which two changes, when applied **at the same time** to a fixed amount of gas, cause the greatest increase in volume of the gas?

|          | change in pressure | change in temperature |
|----------|--------------------|-----------------------|
| <b>A</b> | decrease by 10%    | decrease by 10%       |
| <b>B</b> | increase by 10%    | decrease by 10%       |
| <b>C</b> | decrease by 20%    | increase by 10%       |
| <b>D</b> | increase by 20%    | increase by 10%       |

- 2 Solid G is heated until it melts. It is then left to cool to room temperature.

The graph shows the cooling curve for G.



Four statements about the cooling curve between X and Y are listed.

- 1 The speed of the molecules of G decreases.
- 2 The molecules of G become less closely packed.
- 3 Thermal energy is released by the molecules of G to the surroundings.
- 4 G changes from solid to liquid.

Which statements are correct?

- A** 1 and 2      **B** 1 and 3      **C** 2 and 4      **D** 3 and 4

- 3 Which atom has twice as many neutrons as protons?

- A**  ${}^1_1\text{H}$       **B**  ${}^2_1\text{H}$       **C**  ${}^3_1\text{H}$       **D**  ${}^4_2\text{He}$

- 4 What is the nucleon number of an atom?

- A** the number of electrons, neutrons and protons in the nucleus  
**B** the number of neutrons and protons in the nucleus  
**C** the number of neutrons in the nucleus  
**D** the number of protons in the nucleus

- 5** The diagram shows the positions of elements P and Q in the Periodic Table.

A simplified periodic table grid is shown. The grid consists of 18 columns and 4 rows. The first two columns are on the left, and the next 14 columns are on the right, with a gap in the middle. The element 'P' is located in the second column of the second row. The element 'Q' is located in the 16th column of the second row. All other cells are empty.

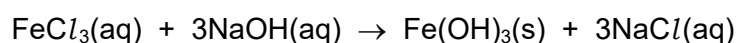
What is the formula of the compound that is formed between P and Q?

- A** PQ                      **B** P<sub>2</sub>Q                      **C** PQ<sub>2</sub>                      **D** P<sub>2</sub>Q<sub>7</sub>

- 6** Which statement about ionic compounds is correct?

- A** Giant lattices are formed when ionic compounds crystallise from solution.
- B** In all ionic compounds, the metal ions have fewer electrons than the non-metal ions.
- C** In a giant lattice, ions of the same charge are closer together than ions of opposite charge.
- D** When ionic compounds melt, strong intermolecular forces are broken.

- 7 The equation for the reaction between iron(III) chloride and sodium hydroxide is shown.



What is the ionic equation for this reaction?

- A**  $\text{Fe}^{3+}(\text{aq}) + 3\text{OH}^{-}(\text{aq}) \rightarrow \text{Fe}^{3+}(\text{s}) + 3\text{OH}^{-}(\text{s})$
- B**  $\text{Fe}^{3+}(\text{aq}) + 3\text{OH}^{-}(\text{aq}) \rightarrow \text{Fe}(\text{OH})_3(\text{s})$
- C**  $3\text{Na}^{+}(\text{aq}) + 3\text{Cl}^{-}(\text{aq}) \rightarrow 3\text{Na}^{+}(\text{aq}) + 3\text{Cl}^{-}(\text{aq})$
- D**  $3\text{Na}^{+}(\text{aq}) + 3\text{Cl}^{-}(\text{aq}) \rightarrow 3\text{NaCl}(\text{aq})$

- 8** A compound is analysed and found to contain 85.7% carbon and 14.3% hydrogen only.

What is its empirical formula?

- A** CH                      **B** CH<sub>2</sub>                      **C** C<sub>2</sub>H<sub>4</sub>                      **D** C<sub>6</sub>H

- 9 Aqueous barium hydroxide,  $\text{Ba}(\text{OH})_2$ , reacts with dilute nitric acid,  $\text{HNO}_3$ . The products are aqueous barium nitrate,  $\text{Ba}(\text{NO}_3)_2$ , and water.

In a titration,  $15.2\text{ cm}^3$  of  $0.75\text{ mol/dm}^3$  aqueous barium hydroxide is required to neutralise  $20.0\text{ cm}^3$  of dilute nitric acid.

What is the concentration of the nitric acid?

- A  $0.29\text{ mol/dm}^3$   
 B  $0.57\text{ mol/dm}^3$   
 C  $1.14\text{ mol/dm}^3$   
 D  $2.03\text{ mol/dm}^3$
- 10 Which particles are responsible for the transfer of charge in the external circuit during the electrolysis of molten lead(II) bromide?
- A anions  
 B atoms  
 C cations  
 D electrons
- 11 Two statements about hydrogen are listed.

- 1 Hydrogen is used as a fuel.  
 2 When hydrogen burns in the air to form water, thermal energy is produced.

Which conclusion about these statements is correct?

- A Both statements are correct, and statement 2 explains statement 1.  
 B Both statements are correct, but statement 2 does **not** explain statement 1.  
 C Statement 1 is correct, but statement 2 is **not** correct.  
 D Statement 2 is correct, but statement 1 is **not** correct.
- 12 Concentrated aqueous copper(II) chloride is electrolysed using carbon electrodes.

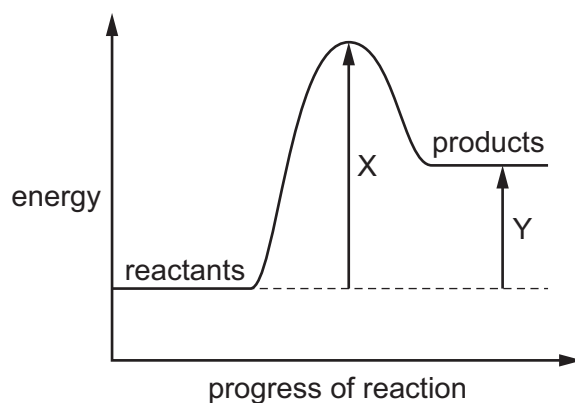
What is formed at each electrode?

|   | negative electrode | positive electrode |
|---|--------------------|--------------------|
| A | chlorine           | copper             |
| B | copper             | chlorine           |
| C | copper             | oxygen             |
| D | oxygen             | copper             |

13 Which row describes an exothermic reaction?

|          | sign of enthalpy change, $\Delta H$ | temperature of the surroundings |
|----------|-------------------------------------|---------------------------------|
| <b>A</b> | positive                            | decreases                       |
| <b>B</b> | positive                            | increases                       |
| <b>C</b> | negative                            | decreases                       |
| <b>D</b> | negative                            | increases                       |

14 A reaction pathway diagram is shown.



Which row shows the correct labels for X and Y and the type of reaction taking place?

|          | X                 | Y                 | type of reaction |
|----------|-------------------|-------------------|------------------|
| <b>A</b> | enthalpy change   | activation energy | exothermic       |
| <b>B</b> | activation energy | enthalpy change   | endothermic      |
| <b>C</b> | activation energy | enthalpy change   | exothermic       |
| <b>D</b> | enthalpy change   | activation energy | endothermic      |

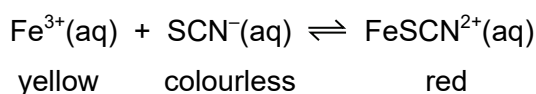
15 The rate of reaction between magnesium and dilute hydrochloric acid is increased by increasing the concentration of the acid.

How does this affect the reacting particles?

|          | collision rate of particles | proportion of particles with sufficient energy to react |
|----------|-----------------------------|---------------------------------------------------------|
| <b>A</b> | increases                   | increases                                               |
| <b>B</b> | increases                   | stays the same                                          |
| <b>C</b> | stays the same              | increases                                               |
| <b>D</b> | stays the same              | stays the same                                          |

- 16** The reaction between aqueous iron(III) ions,  $\text{Fe}^{3+}$ , and aqueous thiocyanate ions,  $\text{SCN}^-$ , is reversible.

The equation for the reaction is shown.

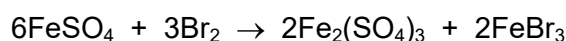


At equilibrium, the concentrations of  $\text{Fe}^{3+}$  ions,  $\text{SCN}^-$  ions, and  $\text{FeSCN}^{2+}$  ions are identical, and the mixture appears orange.

When a few drops of aqueous thiocyanate ions are added to the mixture, a new equilibrium forms.

How does the colour of the mixture change?

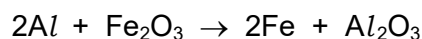
- A** It becomes colourless.
- B** It becomes a lighter orange.
- C** It becomes more yellow.
- D** It becomes more red.
- 17** The equation for the reaction between iron(II) sulfate and bromine is shown.



Which row identifies the oxidising agent and the reducing agent?

|          | oxidising agent              | reducing agent               |
|----------|------------------------------|------------------------------|
| <b>A</b> | $\text{Br}_2$                | $\text{FeSO}_4$              |
| <b>B</b> | $\text{FeSO}_4$              | $\text{Br}_2$                |
| <b>C</b> | $\text{FeBr}_3$              | $\text{Fe}_2(\text{SO}_4)_3$ |
| <b>D</b> | $\text{Fe}_2(\text{SO}_4)_3$ | $\text{FeBr}_3$              |

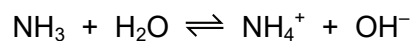
- 18** The equation represents a redox reaction.



What is the change in the oxidation number of iron in this reaction?

- A** from +2 to +3
- B** from +2 to 0
- C** from +3 to +2
- D** from +3 to 0

- 19 Aqueous ammonia forms an equilibrium with water.



In this equilibrium, which particle acts as an acid and which particle acts as a base?

|          | acid                 | base                 |
|----------|----------------------|----------------------|
| <b>A</b> | $\text{NH}_3$        | $\text{H}_2\text{O}$ |
| <b>B</b> | $\text{NH}_3$        | $\text{OH}^-$        |
| <b>C</b> | $\text{H}_2\text{O}$ | $\text{NH}_3$        |
| <b>D</b> | $\text{H}_2\text{O}$ | $\text{NH}_4^+$      |

- 20 Which row identifies an acidic oxide, a basic oxide and an amphoteric oxide?

|          | acidic        | basic                   | amphoteric              |
|----------|---------------|-------------------------|-------------------------|
| <b>A</b> | $\text{ZnO}$  | $\text{SO}_2$           | $\text{Al}_2\text{O}_3$ |
| <b>B</b> | $\text{SO}_2$ | $\text{Al}_2\text{O}_3$ | $\text{Na}_2\text{O}$   |
| <b>C</b> | $\text{ZnO}$  | $\text{Al}_2\text{O}_3$ | $\text{SO}_2$           |
| <b>D</b> | $\text{SO}_2$ | $\text{Na}_2\text{O}$   | $\text{Al}_2\text{O}_3$ |

- 21 A Group I metal (lithium or potassium) is reacted with a Group VII element (chlorine or iodine).

Which compound is formed when the Group I metal of highest density reacts with the Group VII element of lowest density?

- A** potassium chloride
- B** lithium chloride
- C** potassium iodide
- D** lithium iodide

- 22 Element X is in the same group of the Periodic Table as silicon.

An atom of element X has more protons than a silicon atom.

Which element could be X?

- A** aluminium
- B** carbon
- C** germanium
- D** phosphorus

**23** Which statement about the elements in Group VIII is correct?

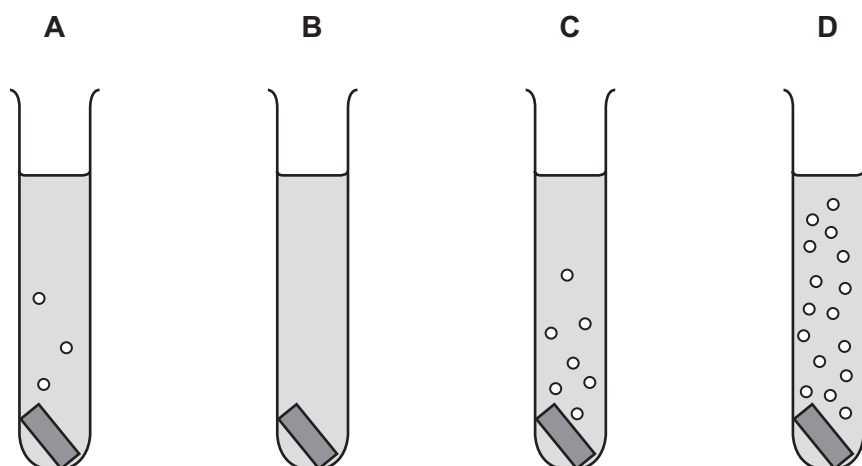
- A** They all form diatomic molecules.
- B** They all have eight electrons in their outer electron shells.
- C** They all react with oxygen to form oxides.
- D** They all are gases at room temperature.

**24** Which element is a transition element?

|          | melting point<br>in °C | density at r.t.p.<br>in g/cm <sup>3</sup> | colour of oxide<br>at r.t.p. |
|----------|------------------------|-------------------------------------------|------------------------------|
| <b>A</b> | 98                     | 1.0                                       | white                        |
| <b>B</b> | 328                    | 11.3                                      | yellow                       |
| <b>C</b> | 651                    | 1.7                                       | white                        |
| <b>D</b> | 1907                   | 7.2                                       | green                        |

**25** Four test-tubes contain dilute hydrochloric acid. Each test-tube has one piece of a different metal added to it. The metals are copper, iron, magnesium and zinc.

Which test-tube contains iron and dilute hydrochloric acid?



**26** Brass is a mixture of copper and zinc.

Which statement describes and explains the relative strength of brass compared to copper?

- A** Brass is stronger than copper because the layers of atoms in brass **cannot** easily slide over each other.
- B** Brass is stronger than copper because the intermolecular forces are greater in brass than in copper.
- C** Brass is weaker than copper because the layers of atoms slide more easily over each other in brass than in copper.
- D** Brass is weaker than copper because the intermolecular forces are weaker in brass than in copper.

**27** A sample of calcium carbonate is heated strongly, and substances U and V are formed.

Substance U is a white solid. Substance V is a colourless gas.

What are substances U and V?

|          | U                 | V              |
|----------|-------------------|----------------|
| <b>A</b> | calcium chloride  | oxygen         |
| <b>B</b> | calcium hydroxide | carbon dioxide |
| <b>C</b> | calcium oxide     | carbon dioxide |
| <b>D</b> | calcium sulfate   | oxygen         |

**28** A sample of water taken from a river contains harmful microbes.

What is a source of harmful microbes in the river water?

- A** sewage
- B** fertilisers
- C** detergents
- D** plastics

- 29** Anhydrous copper(II) sulfate and anhydrous cobalt(II) chloride change colour when water is added to them.

Which row shows the correct colour changes?

|          | copper(II) sulfate | cobalt(II) chloride |
|----------|--------------------|---------------------|
| <b>A</b> | blue to white      | blue to pink        |
| <b>B</b> | blue to white      | pink to blue        |
| <b>C</b> | white to blue      | blue to pink        |
| <b>D</b> | white to blue      | pink to blue        |

- 30** Which gas contributes to increased global warming?

- A** argon
- B** carbon dioxide
- C** nitrogen
- D** oxygen

- 31** Which statement describes how greenhouse gases increase global warming?

- A** Greenhouse gases absorb thermal energy from the Sun, reducing the Earth's temperature.
- B** Greenhouse gases reflect thermal energy back into space, cooling the Earth's surface.
- C** Greenhouse gases absorb and re-emit thermal energy radiated from the Earth's surface.
- D** Greenhouse gases release thermal energy from the Earth into space.

- 32** Nitrogen monoxide is produced in a car engine when petrol is burned.

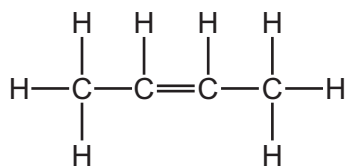
The gases from the car engine are passed through a catalytic converter.

In the catalytic converter, the nitrogen monoxide, NO, reacts with carbon monoxide, CO, to form nitrogen and carbon dioxide.

Which statement is **not** correct?

- A** Carbon monoxide is oxidised in the catalytic converter.
- B** Carbon monoxide is produced by the complete combustion of petrol.
- C** Nitrogen monoxide is formed by the reaction of nitrogen and oxygen.
- D** Nitrogen monoxide is reduced in the catalytic converter.

33 The displayed formula of but-2-ene is shown.



Which displayed formulae represent structural isomers of but-2-ene?

|                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $  \begin{array}{ccccccc}  & \text{H} & & \text{H} & & \text{H} & & \text{H} \\  &   & &   & &   & &   \\  \text{H} & - \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\  & & & & &   & &   \\  & & & & & \text{H} & & \text{H}  \end{array}  $ | $  \begin{array}{ccccc}  & \text{H} & & \text{H} & & \text{H} \\  &   & &   & &   \\  \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\  &   & &   & &   \\  & \text{H} & & \text{H} & & \text{H} \\  & & &   & & \\  & & & \text{H} & &   \end{array}  $ | $  \begin{array}{c}  & & \text{H} \\  & &   \\  \text{H} & \text{H} & - \text{C} & - \text{H} \\  & &   \\  & & \text{C} & = & \text{C} \\  & &   & &   \\  \text{H} & & \text{H} & - & \text{C} & - \text{H} \\  & & & &   \\  & & & & \text{H}  \end{array}  $ |
| 1                                                                                                                                                                                                                                                                    | 2                                                                                                                                                                                                                                                                           | 3                                                                                                                                                                                                                                                                |

- A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

34 Which row describes two characteristics of members of the same homologous series?

|          | characteristic 1                                                | characteristic 2              |
|----------|-----------------------------------------------------------------|-------------------------------|
| <b>A</b> | same functional group                                           | trend in physical properties  |
| <b>B</b> | same physical properties                                        | same functional group         |
| <b>C</b> | same general formula                                            | different chemical properties |
| <b>D</b> | differing from one member to the next by a CH <sub>3</sub> unit | similar chemical properties   |

35 Compound W is a hydrocarbon that contains single bonds only.

Which homologous series contains W?

- A** alkenes  
**B** alkanes  
**C** carboxylic acids  
**D** alcohols

**36** Methane forms chloromethane in a photochemical reaction using ultraviolet light.

Which statement about this reaction is correct?

- A** Methane is mixed with hydrogen chloride gas, and ultraviolet light prevents a combustion reaction.
- B** Methane is mixed with hydrogen chloride gas, and ultraviolet light provides the activation energy for the reaction.
- C** Methane is mixed with chlorine gas, and ultraviolet light prevents a combustion reaction.
- D** Methane is mixed with chlorine gas, and ultraviolet light provides the activation energy for the reaction.

**37** Which statement about polymers is correct?

- A** Nylon contains the  $\begin{array}{c} \text{O} \\ \parallel \\ \text{---C---N---} \\ | \\ \text{H} \end{array}$  linkage.
- B** Nylon is a polyester.
- C** Propane can be polymerised by addition polymerisation.
- D** The linkage in PET contains a carbon–carbon double bond.

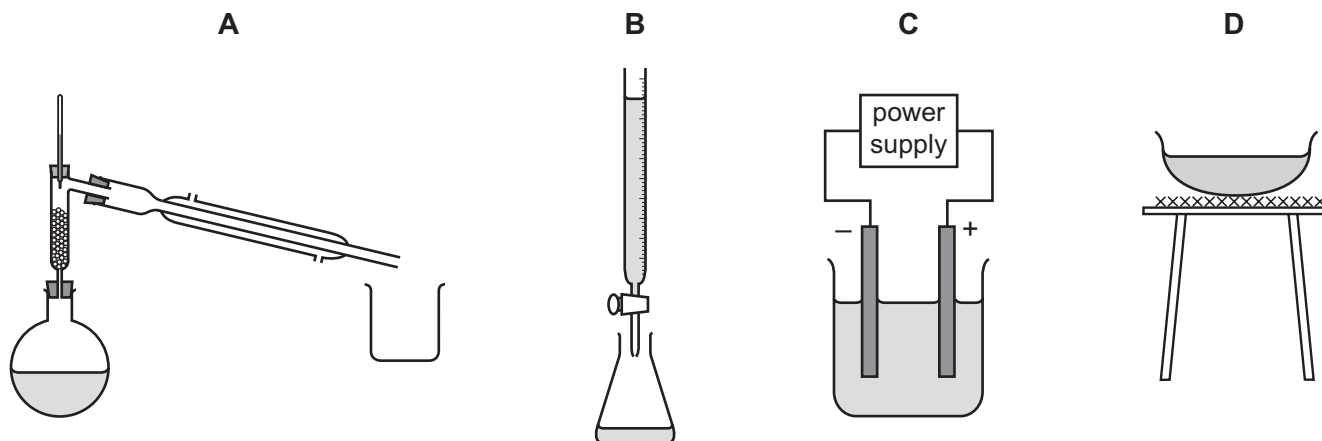
**38** The steps used to separate a mixture of a soluble solid and an insoluble solid are listed.

- A solution is made by adding the mixture to a suitable .....1..... .
- The mixture is stirred and then poured through a filter funnel lined with filter paper.
- The insoluble solid is collected on the filter paper as the .....2..... .

Which words complete gaps 1 and 2?

|          | 1       | 2        |
|----------|---------|----------|
| <b>A</b> | solute  | filtrate |
| <b>B</b> | solute  | residue  |
| <b>C</b> | solvent | filtrate |
| <b>D</b> | solvent | residue  |

39 Which items of apparatus are used to separate a mixture of liquids with different boiling points?



40 In paper chromatography, what is the equation for the  $R_f$  value?

- A  $R_f = \frac{\text{distance travelled by solvent}}{\text{distance travelled by substance}}$
- B  $R_f = \frac{\text{distance travelled by locating agent}}{\text{distance travelled by substance}}$
- C  $R_f = \frac{\text{distance travelled by substance}}{\text{distance travelled by locating agent}}$
- D  $R_f = \frac{\text{distance travelled by substance}}{\text{distance travelled by solvent}}$

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