



Cambridge IGCSE™ (9–1)

CHEMISTRY

0971/11

Paper 1 Multiple Choice (Core)

May/June 2023

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

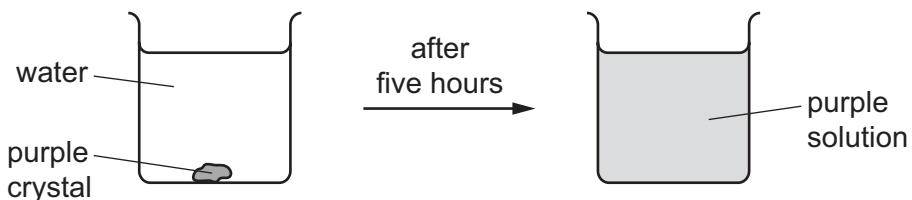
- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the 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 The diagram shows the result of dropping a purple crystal into water.



Which processes take place in this experiment?

| | chemical reaction | diffusing | dissolving |
|----------|-------------------|-----------|------------|
| A | ✓ | ✓ | ✗ |
| B | ✓ | ✗ | ✗ |
| C | ✗ | ✗ | ✓ |
| D | ✗ | ✓ | ✓ |

- 2 Which row about elements, mixtures and compounds is correct?

| | metallic element | non-metallic element | mixture | compound |
|----------|------------------|----------------------|---------|----------|
| A | copper | methane | brass | sulfur |
| B | brass | sulfur | copper | methane |
| C | copper | sulfur | brass | methane |
| D | brass | methane | copper | sulfur |

- 3 What are the relative charge and relative mass of an electron?

| | relative charge | relative mass |
|----------|-----------------|------------------|
| A | 0 | 1 |
| B | 0 | $\frac{1}{2000}$ |
| C | -1 | 1 |
| D | -1 | $\frac{1}{2000}$ |

- 4 The atomic structures of four particles, W, X, Y and Z, are shown.

| | electrons | neutrons | protons |
|---|-----------|----------|---------|
| W | 2 | 2 | 2 |
| X | 2 | 2 | 3 |
| Y | 2 | 3 | 2 |
| Z | 3 | 2 | 3 |

Which particles are isotopes of the same element?

- A W and X B W and Y C X and Y D X and Z
- 5 Which row shows the properties of an ionic compound?

| | electrical conductivity of solid | melting point /°C |
|---|----------------------------------|-------------------|
| A | good | 98 |
| B | good | 3652 |
| C | poor | 78 |
| D | poor | 801 |

- 6 Which row describes the formation of single covalent bonds in methane?

| | | |
|---|--|---|
| A | atoms share a pair of electrons | both atoms gain a noble gas electronic structure |
| B | atoms share a pair of electrons | both atoms have the same number of electrons in their outer shell |
| C | electrons are transferred from one atom to another | both atoms gain a noble gas electronic structure |
| D | electrons are transferred from one atom to another | both atoms have the same number of electrons in their outer shell |

- 7 Which equation represents the neutralisation of nitric acid using sodium hydroxide?

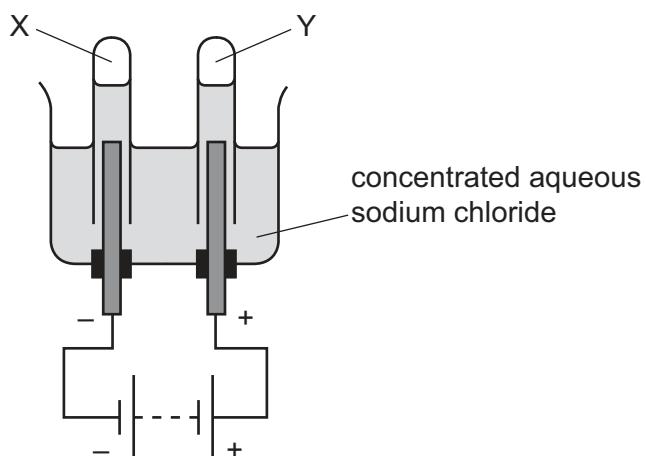
- A $\text{NaOH}(\text{aq}) + \text{HNO}_3(\text{aq}) \rightarrow \text{NaNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- B $\text{NaOH}(\text{aq}) + \text{HNO}_3(\text{aq}) \rightarrow \text{NaNO}_3(\text{l}) + \text{H}_2\text{O}(\text{l})$
- C $\text{NaOH}(\text{l}) + \text{HNO}_3(\text{l}) \rightarrow \text{NaNO}_3(\text{l}) + \text{H}_2\text{O}(\text{aq})$
- D $\text{NaOH}(\text{l}) + \text{HNO}_3(\text{l}) \rightarrow \text{NaNO}_3(\text{l}) + \text{H}_2\text{O}(\text{l})$

8 What is the relative formula mass of ammonium nitrate, NH_4NO_3 ?

- A** 80 **B** 108 **C** 122 **D** 150

9 Concentrated aqueous sodium chloride is electrolysed using inert electrodes.

Gases X and Y are produced at the electrodes shown.



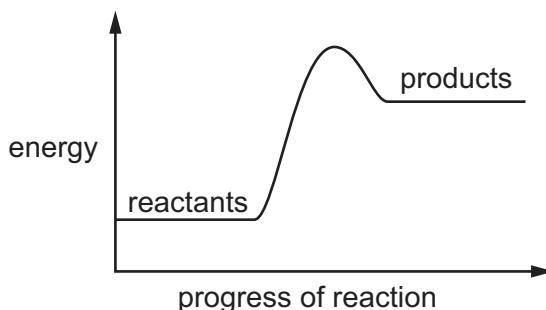
What are X and Y?

| | X | Y |
|----------|----------|----------|
| A | chlorine | hydrogen |
| B | hydrogen | chlorine |
| C | hydrogen | oxygen |
| D | oxygen | hydrogen |

10 Which statement about hydrogen fuel cells is correct?

- A** Hydrogen fuel cells do not produce carbon dioxide.
B Hydrogen fuel cells do not need oxygen.
C The waste from a hydrogen fuel cell is an acidic gas.
D The reaction in a fuel cell is endothermic.

- 11 A reaction pathway diagram is shown.



Which statement about this reaction is correct?

- A The reaction rate increases during the reaction.
 B The reaction is endothermic.
 C The reaction transfers thermal energy to the surroundings.
 D The temperature of the surroundings increases.
- 12 Lumps of calcium carbonate react with dilute hydrochloric acid as shown.

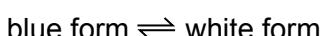


Which change in conditions decreases the rate of the reaction?

- A increasing the concentration of the acid
 B increasing the volume of the acid
 C increasing the size of the lumps of calcium carbonate
 D increasing the temperature
- 13 Solid copper(II) sulfate exists in two different forms, anhydrous and hydrated.

One of these forms is blue and the other is white.

The change between these two forms is reversible.



What is the blue form and how is the change from the blue form to the white form brought about?

| | blue form | change to white form |
|---|-----------|----------------------|
| A | anhydrous | add water |
| B | anhydrous | heat |
| C | hydrated | add water |
| D | hydrated | heat |

- 14 Four redox equations and statements about the equations are shown.

| | reaction | statement |
|---|---|-----------------------------|
| 1 | $C + O_2 \rightarrow CO_2$ | carbon is oxidised |
| 2 | $CO_2 + C \rightarrow 2CO$ | carbon dioxide is oxidised |
| 3 | $CO_2 + C \rightarrow 2CO$ | carbon is oxidised |
| 4 | $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ | iron(III) oxide is oxidised |

Which statements about the equations are correct?

- A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4
- 15 Sodium hydroxide forms an alkaline solution with a pH of 14.

Which indicator turns yellow when added to this solution?

- A litmus
 B methyl orange
 C thymolphthalein
 D universal indicator
- 16 Which row identifies an acidic oxide and a basic oxide?

| | acidic oxide | basic oxide |
|---|-----------------|-----------------|
| A | CaO | CuO |
| B | CaO | SO ₂ |
| C | CO ₂ | CuO |
| D | CO ₂ | SO ₂ |

- 17 A student makes aqueous copper(II) chloride by adding excess copper(II) carbonate to dilute hydrochloric acid.

What is the next step in the method in the formation of solid copper(II) chloride?

- A crystallisation
 B evaporation
 C filtration
 D titration

18 Which statements about the trends across a period of the Periodic Table are correct?

- 1 Aluminium is more metallic than sodium.
- 2 Beryllium is more metallic than carbon.
- 3 Boron is more metallic than lithium.
- 4 Magnesium is more metallic than silicon.

A 1 and 2

B 1 and 3

C 2 and 4

D 3 and 4

19 Which row shows the trend in melting point, density and reactivity as Group I is descended?

| | melting point | density | reactivity |
|---|---------------|-----------|------------|
| A | increases | decreases | decreases |
| B | decreases | increases | increases |
| C | increases | decreases | increases |
| D | decreases | increases | decreases |

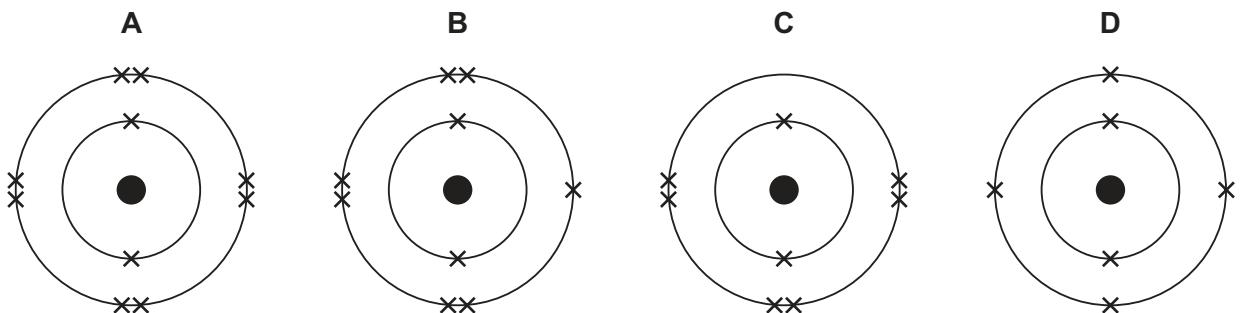
20 Which row describes a similarity and a difference between chlorine and bromine?

| | similarity | difference |
|---|--|--|
| A | both are gases at room temperature and pressure | chlorine and bromine have different colours |
| B | both exist as diatomic molecules | chlorine is more dense than bromine |
| C | both have atoms with seven outer-shell electrons | only bromine will react with aqueous sodium chloride |
| D | both react with aqueous potassium iodide | chlorine is more reactive than bromine |

21 Which statement describes transition elements?

- A They have high densities and high melting points.
- B They have high densities and low melting points.
- C They have low densities and high melting points.
- D They have low densities and low melting points.

22 Which diagram shows the electronic structure of a noble gas?



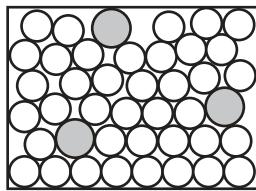
23 Which gas is made when powdered zinc is added to dilute hydrochloric acid?

- A carbon dioxide
- B chlorine
- C hydrogen
- D oxygen

24 Which metal is used in aircraft manufacture because it has a low density?

- A aluminium
- B copper
- C iron
- D potassium

25 The diagram represents the structure of a solid.



Which solids does the diagram represent?

| | brass | graphite | sodium chloride |
|---|-------|----------|-----------------|
| A | ✓ | ✓ | ✗ |
| B | ✓ | ✗ | ✗ |
| C | ✗ | ✓ | ✓ |
| D | ✗ | ✗ | ✓ |

- 26 Three students, X, Y and Z, are told that solid P reacts with dilute acids and also conducts electricity.

The table shows the students' suggestions about the identity of P.

| X | Y | Z |
|--------|------|----------|
| copper | iron | graphite |

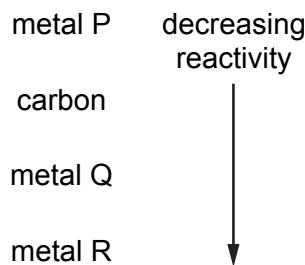
Which students are correct?

- A X, Y and Z B X only C Y only D Z only

- 27 Which substances in the air are needed for iron to rust?

- A oxygen and water
 B oxygen only
 C water and carbon dioxide
 D water only

- 28 Part of the reactivity series of metals is shown.



Which row shows how each metal is extracted from its ore?

| | metal P | metal Q | metal R |
|---|----------------------------|----------------------------|----------------------------|
| A | electrolysis of molten ore | electrolysis of molten ore | heating with carbon |
| B | heating with carbon | electrolysis of molten ore | electrolysis of molten ore |
| C | heating with carbon | heating with carbon | electrolysis of molten ore |
| D | electrolysis of molten ore | heating with carbon | heating with carbon |

29 Several processes are used to treat domestic water.

Which row identifies a reason for the given process?

| | process | reason |
|---|---------------|--------------------------|
| A | chlorination | removes impurities |
| B | filtration | removes insoluble solids |
| C | sedimentation | removes soluble solids |
| D | use of carbon | kills bacteria |

30 Which pair of compounds make an NPK fertiliser?

- A ammonium sulfate and potassium phosphate
- B calcium hydroxide and ammonium nitrate
- C calcium phosphate and potassium chloride
- D potassium nitrate and ammonium sulfate

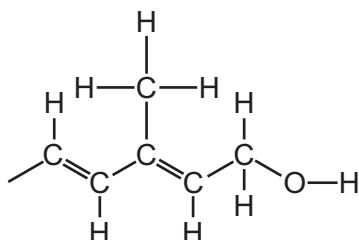
31 Some information about gas X is listed.

- It is not present in clean, dry air.
- It is not a cause of respiratory problems.
- It is responsible for global warming.

What is X?

- A carbon dioxide
- B carbon monoxide
- C methane
- D nitrogen dioxide

- 32 Part of the structure of a molecule of vitamin A is shown.



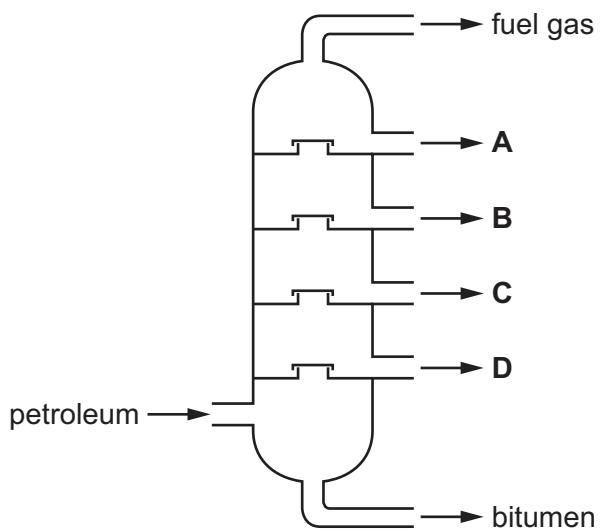
Which statements about this part of the structure are correct?

- 1 It is saturated.
- 2 There are two alkene groups.
- 3 The structure shows a carboxylic acid.

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

- 33 The fractional distillation of petroleum is shown.

Which fraction contains hydrocarbons with the longest chain length?



- 34 Which equation represents the cracking of an alkane?

- A** $3\text{C}_2\text{H}_4 \rightarrow \text{C}_6\text{H}_{12}$
- B** $\text{C}_6\text{H}_{12} + \text{H}_2 \rightarrow \text{C}_6\text{H}_{14}$
- C** $\text{C}_6\text{H}_{14} \rightarrow 6\text{C} + 7\text{H}_2$
- D** $\text{C}_6\text{H}_{14} \rightarrow \text{C}_2\text{H}_4 + \text{C}_4\text{H}_{10}$

35 Which statements about ethanol are correct?

- 1 Ethanol is made by reacting steam with ethene at 300 °C.
- 2 Ethanol is made by fermentation at 55 °C.
- 3 Ethanol burns to produce carbon dioxide and water.
- 4 Ethanol contains a carbon–carbon double bond.

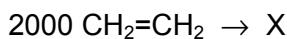
A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 and 4

36 Which substances react with aqueous ethanoic acid to form a gas?

- 1 magnesium
- 2 magnesium carbonate
- 3 magnesium oxide

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

37 In reaction R, 2000 molecules of $\text{CH}_2=\text{CH}_2$ react to form a single molecule X only.



Which terms describe reaction R, $\text{CH}_2=\text{CH}_2$ and X?

| | reaction R | $\text{CH}_2=\text{CH}_2$ | X |
|----------|--------------|---------------------------|---------|
| A | addition | monomer | polymer |
| B | addition | polymer | monomer |
| C | substitution | monomer | polymer |
| D | substitution | polymer | monomer |

- 38 The concentration of acids and alkalis can be determined by titration.

Which pieces of equipment are needed to perform a titration?

1



2



3



4



A 1 and 2

B 1 and 3

C 2 and 3

D 2 and 4

- 39 Which process is used to produce drinking water from sea water?

A crystallisation

B distillation

C filtration

D chlorination

- 40 The results of two separate tests on a white solid X are shown.

| test | result |
|---------------------------------------|--|
| add dilute nitric acid | effervescence |
| add aqueous sodium hydroxide and warm | a gas is formed which turns damp red litmus paper blue |

What is X?

A aluminium carbonate

B aluminium nitrate

C ammonium carbonate

D ammonium nitrate

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The Periodic Table of Elements

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).