



Cambridge IGCSE™

CHEMISTRY

0620/13

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.



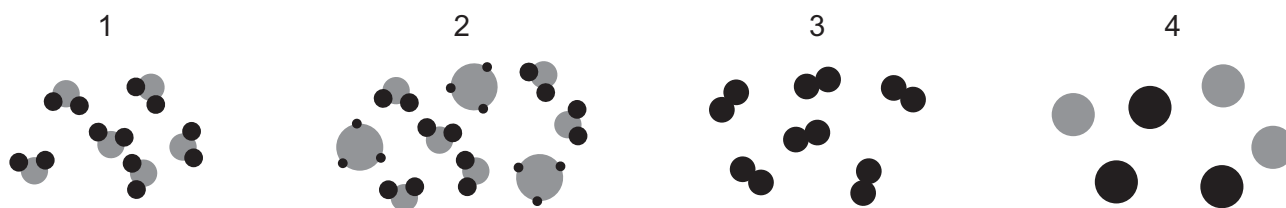
- 1 Nitrogen is heated in a balloon, which expands slightly.

Which statements about the molecules of nitrogen are correct?

- 1 They move further apart.
- 2 They move more quickly.
- 3 They remain the same distance apart.
- 4 Their speed remains unchanged.

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

- 2 The diagrams represent some elements, compounds and mixtures.



Which row describes the numbered substances?

| | 1 | 2 | 3 | 4 |
|----------|----------|----------------------|----------|----------------------|
| A | element | mixture of compounds | compound | mixture of elements |
| B | compound | mixture of compounds | element | mixture of elements |
| C | element | mixture of elements | compound | mixture of compounds |
| D | compound | mixture of elements | element | mixture of compounds |

- 3 Two atoms, X and Y, have the same mass number but different atomic numbers.

Which statement about X and Y is correct?

- A** They have the same number of protons.
- B** They have the same number of electrons.
- C** They are in the same group of the Periodic Table.
- D** They have different numbers of neutrons.

- 4 The symbols for two different isotopes of element S are shown.



The letters m, n, p and q represent whole numbers.

Which statements about the values of m, n, p and q are correct?

1 $m = p$

2 $n = q$

3 $m > q$

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

- 5 Which statement about potassium fluoride is correct?

- A** It can conduct electricity when it is solid.
B It dissolves in water.
C It has a low melting point.
D It is a molecule.

- 6 In which molecule are all the outer-shell electrons involved in covalent bonding?

- A** Cl_2 **B** CH_4 **C** HCl **D** NH_3

- 7 What is the formula of potassium oxide?

- A** P_2O **B** PO_2 **C** KO **D** K_2O

- 8 The compound magnesium nitrate has the formula $\text{Mg}(\text{NO}_3)_2$.

What is the relative formula mass of magnesium nitrate?

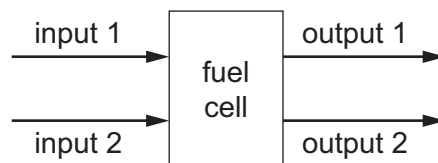
- A** 86 **B** 134 **C** 148 **D** 172

- 9 Dilute sulfuric acid is electrolysed using inert electrodes.

What is produced at the anode?

- A** hydrogen
B oxygen
C sulfur
D sulfur dioxide

10 The flow diagram represents a hydrogen–oxygen fuel cell.



Which row shows the inputs and outputs?

| | input 1 | input 2 | output 1 | output 2 |
|----------|-------------|-------------|----------|-------------|
| A | electricity | electrolyte | hydrogen | oxygen |
| B | electricity | water | hydrogen | oxygen |
| C | fuel | hydrogen | water | electricity |
| D | fuel | oxygen | water | electricity |

11 Which statement describes an exothermic reaction?

- A** Thermal energy is transferred to the surroundings leading to a decrease in the temperature of the surroundings.
- B** Thermal energy is transferred to the surroundings leading to an increase in the temperature of the surroundings.
- C** Thermal energy is taken in from the surroundings leading to an increase in the temperature of the surroundings.
- D** Thermal energy is taken in from the surroundings leading to a decrease in the temperature of the surroundings.

12 Which row shows the changes that **all** increase the rate of a chemical reaction?

| | concentration of reactants | temperature | particle size |
|----------|----------------------------|-------------|---------------|
| A | decrease | decrease | decrease |
| B | decrease | increase | increase |
| C | increase | decrease | increase |
| D | increase | increase | decrease |

- 13** A student heats hydrated copper(II) sulfate. The blue crystals change to a white powder.

How can the student reverse this reaction?

- A** Add anhydrous copper(II) sulfate to the white powder.
- B** Add water to the white powder.
- C** Cool the white powder.
- D** Reheat the white powder.

- 14** Acidified aqueous potassium manganate(VII) is a purple solution.

What does the (VII) in the name potassium manganate(VII) represent?

- A** the charge on the potassium ion
- B** the charge of the manganate ion
- C** the number of ions in the compound
- D** the oxidation number of manganese

- 15** Excess hydrochloric acid is added to aqueous sodium hydroxide containing thymolphthalein.

Which colour change is observed?

- A** blue to colourless
- B** colourless to blue
- C** red to yellow
- D** yellow to red

16 Information about four oxides, J, K, L and M, is listed.

J releases ammonia when added to aqueous ammonium chloride.

K reacts with aqueous sodium hydroxide.

L is the oxide of a Group I element.

M is an oxide of an element in the top right section of the Periodic Table.

Which row is correct?

| | acidic oxides | basic oxides |
|----------|---------------|--------------|
| A | J and K | L and M |
| B | L and M | J and K |
| C | K and M | J and L |
| D | J and L | K and M |

17 Three methods of preparing salts are listed.

- 1 acid + metal
- 2 acid + metal carbonate
- 3 acid + metal oxide

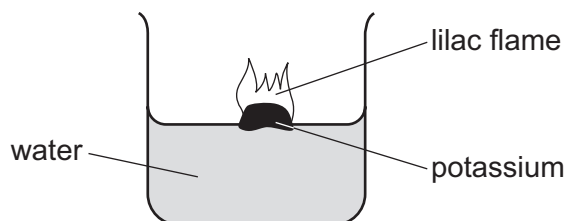
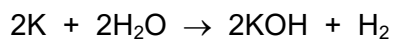
Which methods can be used to make copper(II) chloride?

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

18 Which set of elements shows the change from metallic to non-metallic character across a period of the Periodic Table?

- A** beryllium → magnesium → calcium
B fluorine → bromine → iodine
C oxygen → boron → lithium
D sodium → silicon → chlorine

- 19 The diagram shows the reaction that occurs when potassium is dropped into water.



Which row is correct?

| | density of potassium | pH of resulting solution |
|----------|----------------------|--------------------------|
| A | high | above 7 |
| B | high | below 7 |
| C | low | above 7 |
| D | low | below 7 |

- 20 Which statement about bromine is correct?

- A** Bromine has a greater density than chlorine.
- B** Bromine is a gas at room temperature and pressure.
- C** Bromine has a grey-black colour.
- D** Bromine is less reactive than iodine.

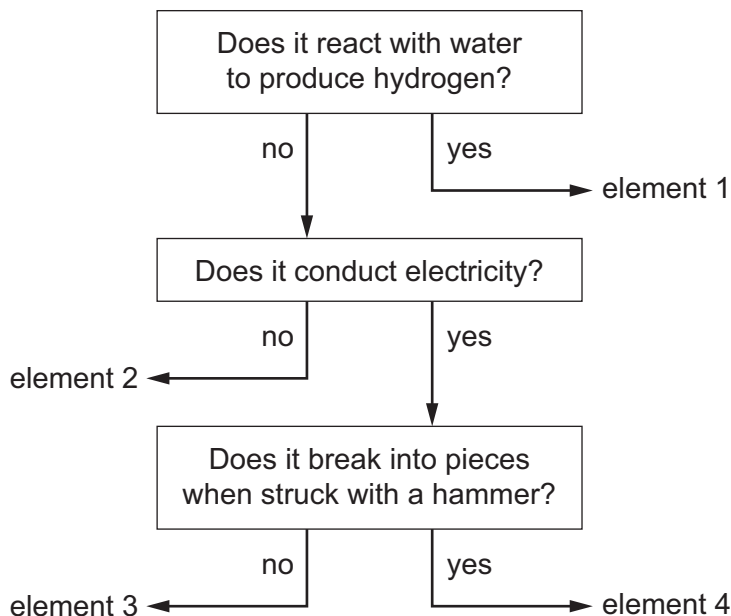
- 21 What is a typical property of transition elements?

- A** can act as catalysts
- B** poor electrical conductivity
- C** low melting point
- D** low density

- 22 Which description of elements in Group VIII of the Periodic Table is correct?

- A** They are diatomic.
- B** All atoms have eight outer electrons.
- C** They have high melting points.
- D** They are unreactive.

23 The flow chart shows some properties of four solid elements.



Which elements are non-metals?

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

24 Which statement about copper or aluminium is correct?

- A** Aluminium is more dense than copper.
B Aluminium is less reactive than copper.
C Copper has high ductility.
D Copper has poor electrical conductivity.

25 Water from a reservoir flows to the water works where purification process 1 takes place followed by process 2.

What are processes 1 and 2?

| | process 1 | process 2 |
|----------|-------------------------|-------------------------|
| A | chlorination | filtration |
| B | filtration | chlorination |
| C | fractional distillation | filtration |
| D | filtration | fractional distillation |

26 Calcium reacts with cold water to produce hydrogen.

Lead reacts slowly when heated in air to form an oxide but has almost no reaction with steam.

Silver does not react with either air or water.

Zinc reacts when heated with steam to produce hydrogen.

What is the order of reactivity starting with the least reactive?

| | least reactive → most reactive | | | |
|----------|--|------|------|---------|
| A | calcium | lead | zinc | silver |
| B | calcium | zinc | lead | silver |
| C | silver | lead | zinc | calcium |
| D | silver | zinc | lead | calcium |

27 Which statement about rusting is correct?

- A** Rust is anhydrous iron(II) oxide.
- B** Oxygen is required for iron to rust.
- C** Iron covered in grease rusts more quickly.
- D** Iron rusts more quickly in the absence of air.

28 Which statements about the extraction of iron in a blast furnace are correct?

- 1 The temperature inside the blast furnace is increased by burning carbon.
- 2 Iron(III) oxide is reduced to iron by carbon monoxide.
- 3 The thermal decomposition of calcium carbonate forms slag.
- 4 Slag reacts with acidic impurities.

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

29 Which statements about water are correct?

- 1 Tap water has fewer impurities than distilled water.
- 2 Tap water will turn anhydrous cobalt(II) chloride pink.
- 3 The domestic water supply is treated with carbon to kill microbes.
- 4 Phosphates from fertilisers can cause deoxygenation of water.

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

30 Which substance is used by farmers to improve plant growth?

- A ammonium nitrate
- B phosphoric acid
- C potassium
- D sodium oxide

31 Three air pollutants, X, Y and Z, are described.

X is a toxic gas formed by the incomplete combustion of an alkane.

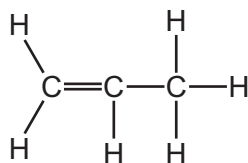
Y is formed by decomposing vegetation and increases global warming.

Z is a cause of breathing problems and acid rain.

Which pollutants are X, Y and Z?

| | X | Y | Z |
|---|-----------------|--------------|--------------------|
| A | carbon monoxide | methane | oxides of nitrogen |
| B | carbon monoxide | particulates | carbon dioxide |
| C | sulfur dioxide | methane | oxides of nitrogen |
| D | sulfur dioxide | particulates | carbon dioxide |

32 The displayed formula of an organic compound is shown.



To which homologous series does this compound belong?

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

33 Kerosene is one of the fractions of petroleum.

What is kerosene used for?

- A jet fuel
- B petrol
- C road making
- D waxes

34 A hydrocarbon P is cracked to make compound Q and hydrogen.

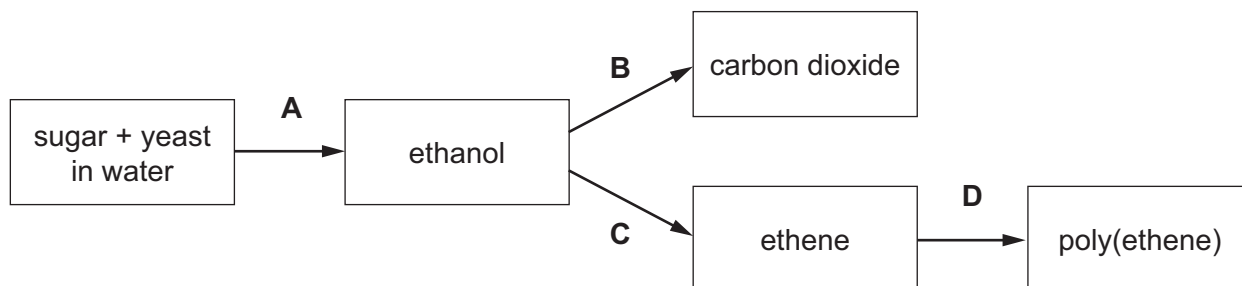
Compound R is formed by the addition polymerisation of compound Q.

To which homologous series do P, Q and R belong?

| | alkene | alkane |
|---|---------|---------|
| A | P only | Q and R |
| B | Q only | P and R |
| C | P and Q | R only |
| D | P and R | Q only |

35 Which process involves combustion?

(Some of the reaction products are **not** shown on the diagram.)



36 What are the products when ethanoic acid reacts with aqueous sodium hydroxide?

- A carbon dioxide and water
- B carbon dioxide and sodium ethanoate
- C sodium ethanoate and hydrogen
- D sodium ethanoate and water

37 Which statements are correct?

- 1 The polymer of ethene is poly(ethane).
- 2 Monomers are small molecules.
- 3 Monomers join together to form polymers.

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

38 Dilute hydrochloric acid is titrated into a conical flask containing sodium hydroxide solution and a few drops of methyl orange indicator.

Which piece of apparatus is used to add the hydrochloric acid?

- A** beaker
B burette
C measuring cylinder
D pipette

39 What could be the melting point and boiling point of water containing a dissolved impurity?

| | melting point /°C | boiling point /°C |
|----------|----------------------|----------------------|
| A | +3 | 96 |
| B | +3 | 104 |
| C | −3 | 96 |
| D | −3 | 104 |

40 Element X burns in air to form an acidic gas that decolourises potassium manganate(VII).

What is X?

- A** carbon
B nitrogen
C magnesium
D sulfur

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The Periodic Table of Elements

| Group | | | | | | | | | | | | | | | | | | |
|------------------------|-------------------------|---|-------------------------|-----------------------------|--------------------------|--------------------------|--------------------------|------------------------|--------------------------|----------------------------|---------------------------|---------------------------|-------------------------|-------------------------|--------------------------|---------------------------|--------------------------|-------------------------|
| I | II | | | | | | | | | | | III | IV | V | VI | VII | VIII | |
| | | <div>1Hhydrogen1</div> | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | <div>Key</div> <div>atomic number atomic symbol name relative atomic mass</div> | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 3Li lithium 7 | 4Be beryllium 9 | | | | | | | | | | | 5B boron 11 | 6C carbon 12 | 7N nitrogen 14 | 8O oxygen 16 | 9F fluorine 19 | 10Ne neon 20 | |
| 11Na sodium 23 | 12Mg magnesium 24 | | | | | | | | | | | 13Al aluminium 27 | 14Si silicon 28 | 15P phosphorus 31 | 16S sulfur 32 | 17Cl chlorine 35.5 | 18Ar argon 40 | |
| 19K potassium 39 | 20Ca calcium 40 | 21Sc scandium 45 | 22Ti titanium 48 | 23V vanadium 51 | 24Cr chromium 52 | 25Mn manganese 55 | 26Fe iron 56 | 27Co cobalt 59 | 28Ni nickel 59 | 29Cu copper 64 | 30Zn zinc 65 | 31Ga gallium 70 | 32Ge germanium 73 | 33As arsenic 75 | 34Se selenium 79 | 35Br bromine 80 | 36Kr krypton 84 | |
| 37Rb rubidium 85 | 38Sr strontium 88 | 39Y yttrium 89 | 40Zr zirconium 91 | 41Nb niobium 93 | 42Mo molybdenum 96 | 43Tc technetium — | 44Ru ruthenium 101 | 45Rh rhodium 103 | 46Pd palladium 106 | 47Ag silver 108 | 48Cd cadmium 112 | 49In indium 115 | 50Sn tin 119 | 51Sb antimony 122 | 52Te tellurium 128 | 53I iodine 127 | 54Xe xenon 131 | |
| 55Cs caesium 133 | 56Ba barium 137 | 57–71 lanthanoids | | 72Hf hafnium 178 | 73Ta tantalum 181 | 74W tungsten 184 | 75Re rhenium 186 | 76Os osmium 190 | 77Ir iridium 192 | 78Pt platinum 195 | 79Au gold 197 | 80Hg mercury 201 | 81Tl thallium 204 | 82Pb lead 207 | 83Bi bismuth 209 | 84Po polonium — | 85At astatine — | 86Rn radon — |
| 87Fr francium — | 88Ra radium — | 89–103 actinoids | | 104Rf rutherfordium — | 105Db dubnium — | 106Sg seaborgium — | 107Bh bohrium — | 108Hs hassium — | 109Mt meitnerium — | 110Ds darmstadtium — | 111Rg roentgenium — | 112Cn copernicium — | 113Nh nihonium — | 114Fl flerovium — | 115Mc moscovium — | 116Lv livermorium — | 117Ts tennessine — | 118Og oganesson — |

| | | | | | | | | | | | | | | | |
|-------------|------------------------------|----------------------------|---------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|----------------------------|-------------------------------|------------------------------|---------------------------|-------------------------------|------------------------------|------------------------------|
| lanthanoids | 57 La lanthanum 139 | 58 Ce cerium 140 | 59 Pr praseodymium 141 | 60 Nd neodymium 144 | 61 Pm promethium — | 62 Sm samarium 150 | 63 Eu europium 152 | 64 Gd gadolinium 157 | 65 Tb terbium 159 | 66 Dy dysprosium 163 | 67 Ho holmium 165 | 68 Er erbium 167 | 69 Tm thulium 169 | 70 Yb ytterbium 173 | 71 Lu lutetium 175 |
| | 89 Ac actinium — | 90 Th thorium 232 | 91 Pa protactinium 231 | 92 U uranium 238 | 93 Np neptunium — | 94 Pu plutonium — | 95 Am americium — | 96 Cm curium — | 97 Bk berkelium — | 98 Cf californium — | 99 Es einsteinium — | 100 Fm fermium — | 101 Md mendelevium — | 102 No nobelium — | 103 Lr lawrencium — |

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).