Cambridge Assessment International Education

# 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.


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

Which statements about the molecules of nitrogen are correct?

1 They move further apart.

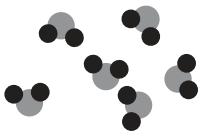
2 They move more quickly.

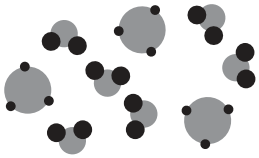
3 They remain the same distance apart.

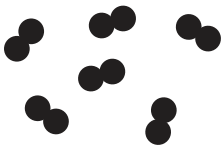
4 Their speed remains unchanged.

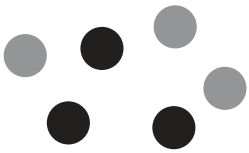
**A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

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

1 

2 

3 

4 

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.

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

$$^{m}_{n}S \qquad ^{p}_{q}S$$

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 $Mg(NO_3)_2$.

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

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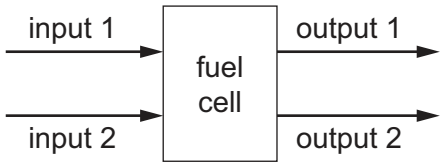
**10** The flow diagram represents a hydrogen–oxygen fuel cell.




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 |

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**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

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**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

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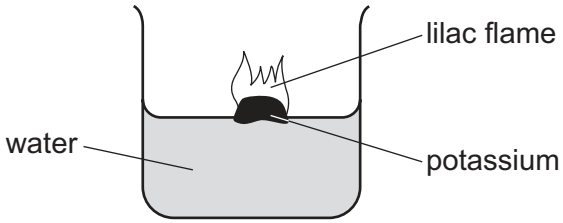
**19** The diagram shows the reaction that occurs when potassium is dropped into water.

$$2K + 2H_2O \rightarrow 2KOH + H_2$$




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.



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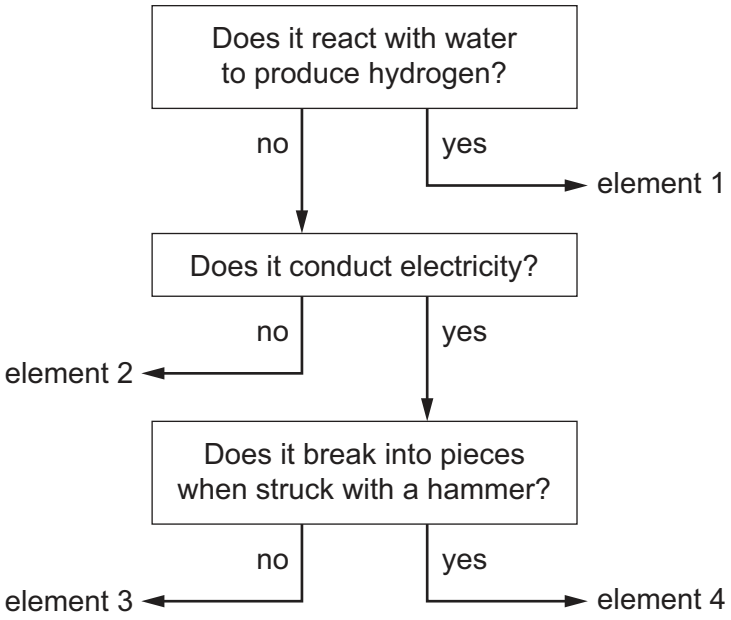
**23** The flow chart shows some properties of four solid elements.




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 |

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**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

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**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.

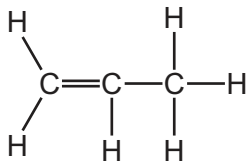
Y is formed by decomposing vegetation and increases global warming.

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

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**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.

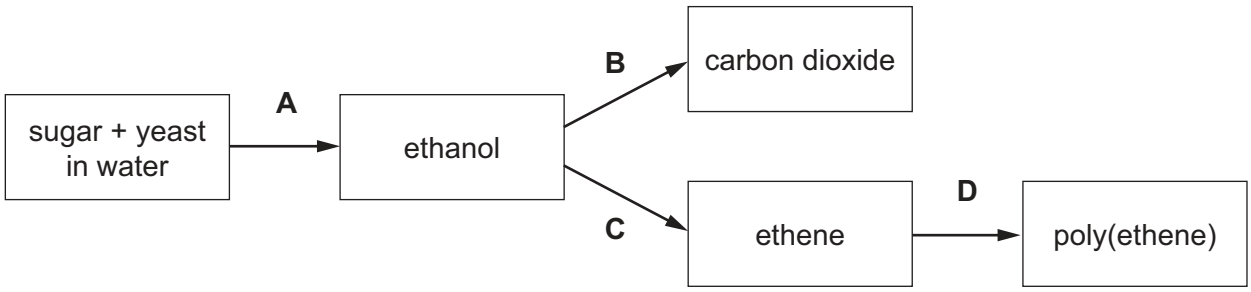
Compound R is formed by the addition polymerisation of compound Q.

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



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**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 |
| | | | | | | | 1 H hydrogen 1 | | | | | | | | | | 2 He helium 4 |
| 3 Li lithium 7 | 4 Be beryllium 9 | | | | | | | | | | | 5 B boron 11 | 6 C carbon 12 | 7 N nitrogen 14 | 8 O oxygen 16 | 9 F fluorine 19 | 10 Ne neon 20 |
| 11 Na sodium 23 | 12 Mg magnesium 24 | | | | | | | | | | | 13 Al aluminium 27 | 14 Si silicon 28 | 15 P phosphorus 31 | 16 S sulfur 32 | 17 Cl chlorine 35.5 | 18 Ar argon 40 |
| 19 K potassium 39 | 20 Ca calcium 40 | 21 Sc scandium 45 | 22 Ti titanium 48 | 23 V vanadium 51 | 24 Cr chromium 52 | 25 Mn manganese 55 | 26 Fe iron 56 | 27 Co cobalt 59 | 28 Ni nickel 59 | 29 Cu copper 64 | 30 Zn zinc 65 | 31 Ga gallium 70 | 32 Ge germanium 73 | 33 As arsenic 75 | 34 Se selenium 79 | 35 Br bromine 80 | 36 Kr krypton 84 |
| 37 Rb rubidium 85 | 38 Sr strontium 88 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 41 Nb niobium 93 | 42 Mo molybdenum 96 | 43 Tc technetium – | 44 Ru ruthenium 101 | 45 Rh rhodium 103 | 46 Pd palladium 106 | 47 Ag silver 108 | 48 Cd cadmium 112 | 49 In indium 115 | 50 Sn tin 119 | 51 Sb antimony 122 | 52 Te tellurium 128 | 53 I iodine 127 | 54 Xe xenon 131 |
| 55 Cs caesium 133 | 56 Ba barium 137 | 57–71 lanthanoids | 72 Hf hafnium 178 | 73 Ta tantalum 181 | 74 W tungsten 184 | 75 Re rhenium 186 | 76 Os osmium 190 | 77 Ir iridium 192 | 78 Pt platinum 195 | 79 Au gold 197 | 80 Hg mercury 201 | 81 Tl thallium 204 | 82 Pb lead 207 | 83 Bi bismuth 209 | 84 Po polonium – | 85 At astatine – | 86 Rn radon – |
| 87 Fr francium – | 88 Ra radium – | 89–103 actinoids | 104 Rf rutherfordium – | 105 Db dubnium – | 106 Sg seaborgium – | 107 Bh bohrium – | 108 Hs hassium – | 109 Mt meitnerium – | 110 Ds darmstadtium – | 111 Rg roentgenium – | 112 Cn copernicium – | 113 Nh nihonium – | 114 Fl flerovium – | 115 Mc moscovium – | 116 Lv livermorium – | 117 Ts tennessine – | 118 Og oganesson – |

**Key**

atomic number
atomic symbol
name
relative atomic mass

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| actinoids | 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 $dm^3$ at room temperature and pressure (r.t.p.).