Cambridge Assessment International Education

# Cambridge IGCSE™

**CHEMISTRY** **0620/12**

Paper 1 Multiple Choice (Core) **February/March 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.



IB25 03_0620_12/6RP


**[Turn over**

**1** Substance L takes the shape of the container that holds it.

What could be the state of matter of substance L?

**A** liquid or gas

**B** gas or solid

**C** solid or liquid

**D** solid only

**2** The melting points and boiling points of pure substances M, N and O are shown.

| | M | N | O |
|---|---|---|---|
| melting point / °C | –114 | 115 | –101 |
| boiling point / °C | 78 | 445 | –34 |

The substances are chlorine, ethanol and sulfur.

Which row identifies M, N and O?

| | M | N | O |
|---|---|---|---|
| **A** | chlorine | ethanol | sulfur |
| **B** | ethanol | sulfur | chlorine |
| **C** | sulfur | chlorine | ethanol |
| **D** | sulfur | ethanol | chlorine |

**3** Which statement explains why the noble gases are unreactive?

**A** They are in the same group of the Periodic Table.

**B** They are gases at room temperature.

**C** They each have a full outer electron shell.

**D** They are found in air.

**4** What is the electronic configuration of a $P^{3-}$ ion?

**A** 2,8,2 **B** 2,8,5 **C** 2,8,6 **D** 2,8,8

**5** Some information about four metal atoms or ions is shown.

| atom or ion | charge | proton number | number of electrons | nucleon number |
|---|---|---|---|---|
| Q | +3 | | 10 | 27 |
| R | +2 | 12 | | 24 |
| S | +2 | | 10 | 26 |
| T | | 16 | 16 | |

Which two atoms or ions are from isotopes of the same element?

**A** Q and R **B** Q and T **C** R and S **D** S and T

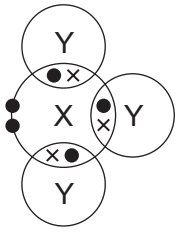
**6** Which row describes the changes to the atoms when a metal and a non-metal react together?

| | metal atoms | non-metal atoms |
|---|---|---|
| **A** | gain electrons to form anions | lose electrons to form cations |
| **B** | gain electrons to form cations | lose electrons to form anions |
| **C** | lose electrons to form anions | gain electrons to form cations |
| **D** | lose electrons to form cations | gain electrons to form anions |

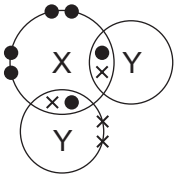
**7** In the following diagrams, X and Y are atoms of different elements.

Which diagram correctly shows the arrangement of outer shell electrons in a molecule of methane?

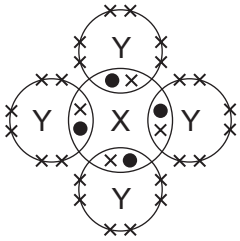
**A**



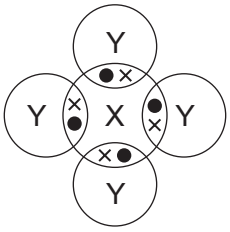

**B**



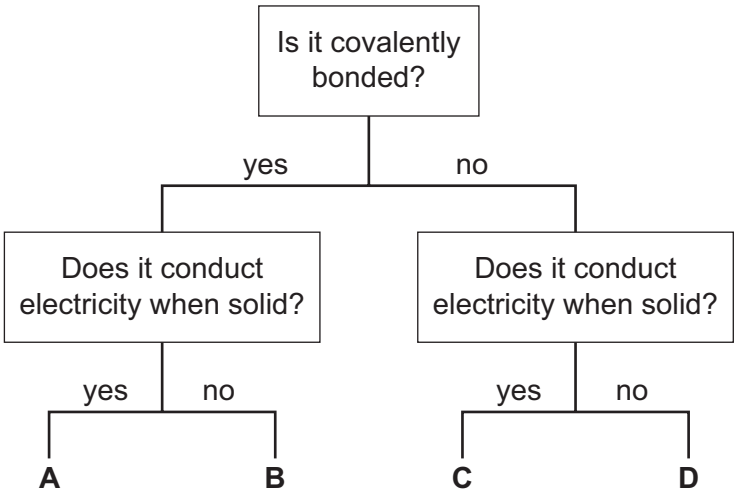

**C**




**D**



**8** Which pathway describes the properties of graphite?

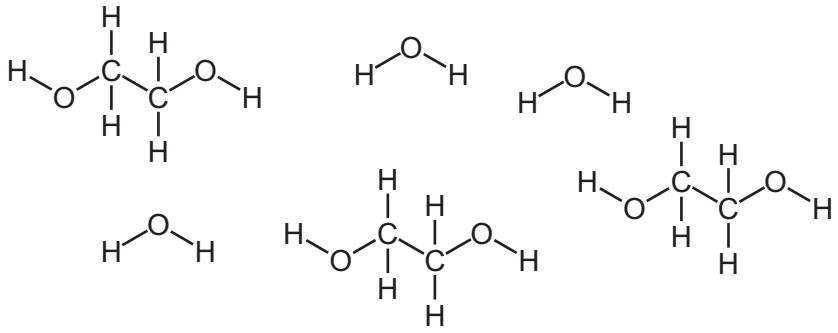



**9** Which row identifies the formula of the named substance?

| | substance | formula |
|---|---|---|
| **A** | cobalt(II) chloride | $CuCl_2$ |
| **B** | ethane | $C_2H_6$ |
| **C** | helium | $He_2$ |
| **D** | iron(III) oxide | $Fe_3O_2$ |

**10** Antifreeze contains a mixture of water and ethylene glycol.

The diagram shows their displayed formulae.



What is the molecular formula of ethylene glycol?

**A** CHO **B** $C_2H_6O_2$ **C** $C_2H_8O_3$ **D** $C_6H_{18}O_6$

**11** The equation for the reaction of magnesium with oxygen is shown.

$$2Mg + O_2 \rightarrow 2MgO$$

In an experiment, 6.0 g of magnesium is reacted with excess oxygen.

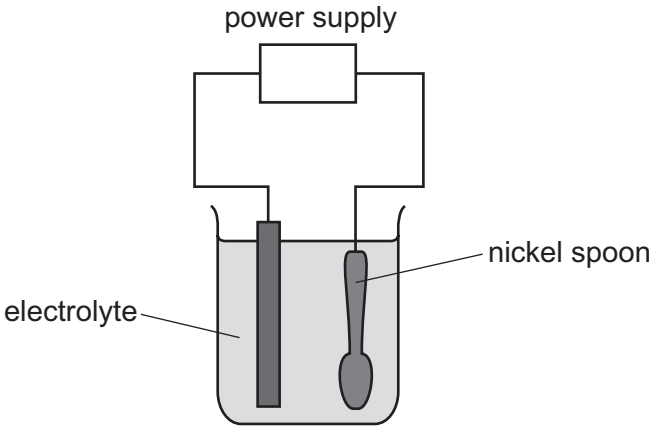
Which mass of magnesium oxide, MgO, is produced?

**A** 10 g **B** 20 g **C** 40 g **D** 80 g

**12** Which products are formed when dilute sulfuric acid undergoes electrolysis?

| | product formed at the anode | product formed at the cathode |
|---|---|---|
| **A** | oxygen | hydrogen |
| **B** | hydrogen | oxygen |
| **C** | sulfur dioxide | hydrogen |
| **D** | oxygen | sulfur dioxide |

**13** The diagram shows an experiment to electroplate a nickel spoon with silver.




Which row correctly describes the positive electrode, the negative electrode and the electrolyte?

| | positive electrode | negative electrode | electrolyte |
|---|---|---|---|
| **A** | nickel spoon | pure nickel | silver nitrate solution |
| **B** | nickel spoon | pure silver | nickel nitrate solution |
| **C** | pure nickel | nickel spoon | silver nitrate solution |
| **D** | pure silver | nickel spoon | silver nitrate solution |

**14** When dilute sulfuric acid reacts with aqueous sodium hydroxide, the temperature of the solution increases.

Which words describe this reaction?

**A** endothermic and neutralisation

**B** endothermic and redox

**C** exothermic and neutralisation

**D** exothermic and redox

**15** Which statement is correct for **both** physical and chemical changes?

**A** Covalent bonds are broken and formed during the changes.

**B** The total mass of substance is the same before and after the changes.

**C** The changes are usually reversible.

**D** The temperature always rises or falls during the changes.

**16** A sample of calcium carbonate reacts with dilute hydrochloric acid to produce a final volume of 60 $cm^3$ of gas.

The reaction finishes after 120 seconds.

The experiment is repeated at a lower temperature. All other conditions stay the same.

Which row shows the results of the second experiment?

| | final volume of gas produced / $cm^3$ | time for reaction to finish / s |
|---|---|---|
| **A** | 40 | 120 |
| **B** | 40 | 160 |
| **C** | 60 | 120 |
| **D** | 60 | 160 |

**17** In which equation is the iron oxidised?

**A** $C + FeO \rightarrow CO + Fe$

**B** $3CO + Fe_2O_3 \rightarrow 3CO_2 + 2Fe$

**C** $Fe_2O_3 + H_2 \rightarrow 2FeO + H_2O$

**D** $PbO + Fe \rightarrow Pb + FeO$

**18** HOC$l$ is an acid.

$NH_4OH$ is an alkali.

Which row shows the ions present in aqueous solutions that identify the acid and the alkali?

| | HOC$l$(aq) | $NH_4OH$(aq) |
|---|---|---|
| **A** | $H^+$ | $H^+$ |
| **B** | $H^+$ | $OH^-$ |
| **C** | $OH^-$ | $H^+$ |
| **D** | $OH^-$ | $OH^-$ |

**19** Which elements form an oxide that reacts with water to produce a blue solution with thymolphthalein?

1 calcium

2 carbon

3 sulfur

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

**20** A sample of fertiliser is tested by warming it with aqueous sodium hydroxide.

A colourless gas is produced which turns damp red litmus paper blue.

Which element, essential for plant growth, must be present?

**A** nitrogen

**B** phosphorus

**C** potassium

**D** sulfur

**21** Insoluble solid magnesium carbonate reacts with dilute sulfuric acid.

The equation is shown.

magnesium carbonate + sulfuric acid → magnesium sulfate + water + carbon dioxide

The steps used to make crystals of magnesium sulfate are listed.

step 1 Add excess magnesium carbonate to dilute sulfuric acid and stir the mixture.

step 2 Filter the mixture.

step 3 Heat the filtrate to the point of crystallisation.

step 4 Leave the filtrate to cool.

What is the residue removed from the mixture in step 2?

**A** magnesium carbonate

**B** sulfuric acid

**C** magnesium sulfate

**D** water

**22** Which trend occurs across the period from sodium to argon?

**A** a change from metal to non-metal

**B** an increase in melting point

**C** a more violent reaction with water

**D** an increase in electrical conductivity

**23** Which statement about the element bromine is correct?

**A** It displaces chlorine from aqueous potassium chloride.

**B** It has a higher density than chlorine.

**C** It is a diatomic metal.

**D** It is a green gas at room temperature.

**24** Metallic element X has a high density.

Which part of the Periodic Table is X in?

**A** Group I

**B** halogens

**C** transition elements

**D** Group VIII

**25** Which statement about the uses of metals is correct?

**A** Aluminium has a low density and good electrical conductivity which make it suitable for overhead electrical cables.

**B** Aluminium food containers can only be used for a short time because chemicals in the food react with the aluminium.

**C** Electrical wiring made from copper is covered with plastic because copper corrodes easily.

**D** Copper is used in the manufacture of aircraft because it has a low density and is **not** malleable.

**26** Steel bridges are painted to help stop rust from forming on their surfaces.

What causes steel to rust?

**A** water, oxygen and sunlight

**B** water and oxygen only

**C** water and sunlight only

**D** oxygen and sunlight only

**27** Which two metals are mixed together to make brass?

1 tin

2 zinc

3 nickel

4 copper

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

**28** Metal M is between zinc and iron in the reactivity series.

Which statements about metal M are correct?

1 It reacts with cold water to produce hydrogen gas.

2 It does **not** react with cold water but will react with dilute hydrochloric acid.

3 The metal can be obtained from its oxide by heating it strongly with carbon.

4 The metal oxide **cannot** be reduced using carbon.

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

**29** What is the colour change when water is added to anhydrous copper(II) sulfate?

**A** blue to white

**B** blue to pink

**C** pink to blue

**D** white to blue

**30** Which statement about the composition of clean, dry air is correct?

**A** It contains 78% oxygen.

**B** It contains 21% nitrogen.

**C** It contains less than 1% argon.

**D** It contains 4% carbon dioxide.

**31** Which row identifies a source and an adverse effect of methane?

| | source | adverse effect |
|---|---|---|
| **A** | car engines | acid rain |
| **B** | car engines | climate change |
| **C** | decomposition of vegetation | acid rain |
| **D** | decomposition of vegetation | climate change |

**32** Which statements about alkenes are correct?

1 Propene is a saturated hydrocarbon.

2 Ethene is made by heating long-chain alkanes to a high temperature in the presence of a catalyst.

3 Hexene reacts with aqueous bromine, changing its colour from colourless to orange.

4 Ethene, propene and butene have the same general formula.

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

**33** The table shows the formulae and names of some organic compounds.

| | formula | name |
|---|---|---|
| 1 | $CH_3Cl$ | chloroethane |
| 2 | $CH_3COOH$ | ethanoic acid |
| 3 | $BrCH_2CH_2Br$ | 1,2-dibromoethane |
| 4 | $(CH_3COO)_2Ca$ | calcium methanoate |

Which rows give the correct name for the formula shown?

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

**34** Which gas is the main constituent of natural gas?

**A** hydrogen

**B** nitrogen

**C** methane

**D** oxygen

**35** A sample of petroleum is separated into three fractions, X, Y and Z, using fractional distillation.

Some properties of X, Y and Z are listed.

- X is more viscous than Z.
- Y has a higher boiling point than X.

Which fraction has the longest carbon chain and which fraction is the most volatile?

| | longest carbon chain | most volatile |
|---|---|---|
| **A** | Y | X |
| **B** | Y | Z |
| **C** | Z | X |
| **D** | Z | Y |

**36** Two salt solutions, P and Q, are tested.

The table shows the results.

| test | P | Q |
|---|---|---|
| a few drops of aqueous sodium hydroxide are added | green precipitate forms | red-brown precipitate forms |
| a few drops of dilute nitric acid and a few drops of barium nitrate are added | no change seen | white precipitate forms |
| a few drops of dilute nitric acid and a few drops of silver nitrate are added | white precipitate forms | no change seen |

What are P and Q?

| | P | Q |
|---|---|---|
| **A** | iron(II) chloride | iron(III) sulfate |
| **B** | iron(III) chloride | iron(III) sulfate |
| **C** | iron(II) sulfate | iron(III) chloride |
| **D** | iron(III) sulfate | iron(III) chloride |

**37** A small quantity of a solid, E, is added to a large excess of aqueous ethanoic acid.

No bubbles of gas are seen and the solid dissolves to give a colourless solution.

What is solid E?

**A** calcium hydroxide

**B** copper(II) oxide

**C** magnesium

**D** sodium carbonate

**38** Ethanol is manufactured by two different processes.

Which raw materials are used by the two processes to make ethanol?

1 glucose

2 ethane

3 ethene

4 steam

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

**39** What is used to test for chlorine?

**A** a glowing splint

**B** damp litmus paper

**C** limewater

**D** aqueous potassium manganate(VII)

**40** Which statement about paper chromatography is correct?

**A** It can show if a substance is pure.

**B** It can separate a mixture of insoluble substances.

**C** It can separate a compound into its elements.

**D** It provides a way of combining substances to make new coloured compounds.

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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.).