



# Cambridge IGCSE™ (9–1)

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## CHEMISTRY

0971/12

Paper 1 Multiple Choice (Core)

May/June 2024

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)

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### 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.

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

1 Which statement about gases is correct?

A Gases are difficult to compress when pressure is applied.  
 B The particles in gases are close together.  
 C The particles in gases have a random arrangement.  
 D The particles in gases move slowly past each other.

2 A sample of argon gas is heated in a closed container.

Which row describes what happens to the pressure and the size of the argon atoms?

	pressure	size
A	decreases	increases
B	decreases	stays the same
C	increases	increases
D	increases	stays the same

3 Which statement is correct?

A Air is a mixture of gaseous elements only.  
 B Alloys are formed when a metal is ionically bonded to other elements.  
 C Carbon dioxide is a mixture of carbon and oxygen.  
 D Potassium bromide is an ionic compound.

4 Which row identifies methods of testing the purity of a compound?

	melting point	boiling point	chromatography
A	✓	✓	✓
B	✓	✗	✗
C	✓	✓	✗
D	✗	✓	✓

5 Which row shows the number of protons, neutrons and electrons in the ion  $^{18}_8\text{O}^{2-}$ ?

	protons	neutrons	electrons
<b>A</b>	10	8	8
<b>B</b>	8	10	8
<b>C</b>	10	8	10
<b>D</b>	8	10	10

6 Isotopes of the same element have some features that are the same and some that are different.

Which row shows the features that are the same and those that are different?

	nucleon number	proton number	number of outer shell electrons	
<b>A</b>	✓	✓	✗	key
<b>B</b>	✗	✓	✓	✓ = same
<b>C</b>	✓	✗	✗	✗ = different
<b>D</b>	✗	✗	✓	

7 The electronic configurations of four atoms, W, X, Y and Z, are shown.

atom	electronic configuration
W	2
X	2,6
Y	2,8,2
Z	2,8,6

Which atoms form an ion with a charge of 2– when they react?

**A** W and Y      **B** W only      **C** X and Z      **D** Y only

8 Which statement about bonding is correct?

A All the atoms in  $\text{CH}_4$ ,  $\text{NH}_3$  and  $\text{H}_2\text{O}$  molecules have noble gas electronic configurations.

B Calcium chloride is a covalent molecule.

C Group I metals gain electrons when they bond with Group VII elements.

D Oxide ions in calcium oxide are positively charged.

9 Which statement about diamond is correct?

A It is a giant covalent structure consisting of carbon atoms and each atom is bonded to four other atoms.

B It is a giant covalent structure consisting of flat sheets of carbon atoms.

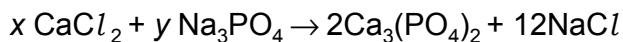
C It is a structure held together by ionic bonds and each ion is bonded to four other ions.

D It is a structure held together by ionic bonds and each ion is bonded to three other ions.

10 Which row shows the correct formulae of lead(II) bromide and butane?

	lead(II) bromide	butane
A	$\text{PbBr}_2$	$\text{C}_4\text{H}_8$
B	$\text{PbBr}_2$	$\text{C}_4\text{H}_{10}$
C	$\text{Pb}_2\text{Br}$	$\text{C}_4\text{H}_8$
D	$\text{Pb}_2\text{Br}$	$\text{C}_4\text{H}_{10}$

11 Calcium phosphate forms when calcium chloride and sodium phosphate solutions react together.



Which values of  $x$  and  $y$  balance the equation?

	$x$	$y$
A	2	2
B	3	4
C	6	3
D	6	4

12 What is the definition of relative molecular mass,  $M_r$ ?

- A It is the average mass of the isotopes in a compound.
- B It is the sum of the atomic numbers in a compound.
- C It is the sum of the relative atomic masses in a compound.
- D It is the total number of atoms in a compound.

13 In an experiment, a molten compound is broken down using electricity.

Which row identifies the negative electrode and the general name for the molten compound being broken down?

	negative electrode	general name for the molten compound
A	anode	electrolysis
B	anode	electrolyte
C	cathode	electrolyte
D	cathode	electrolysis

14 Hydrogen–oxygen fuel cells can be used to power vehicles.

What is produced by the fuel cells?

- 1 carbon dioxide
- 2 electricity
- 3 water

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

15 Three reactions are described.

- 1 An acid is added to substance H. Rapid fizzing happens and the temperature decreases.
- 2 When substance J is ignited, it produces large quantities of heat.
- 3 Substance K reacts slowly with air and becomes warmer.

Which reactions are endothermic?

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

16 Which of the processes produces a physical change?

- A thermal decomposition of calcium carbonate
- B addition of sodium chloride to water
- C addition of magnesium to hydrochloric acid
- D combustion of sodium

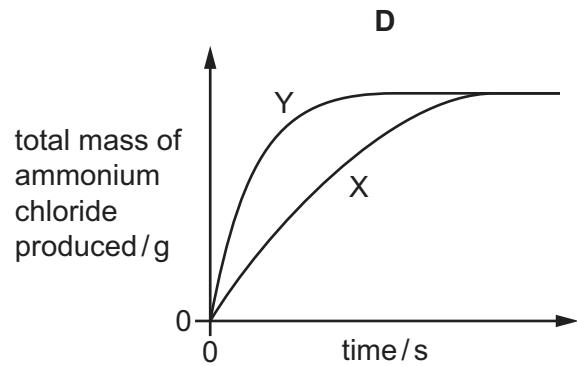
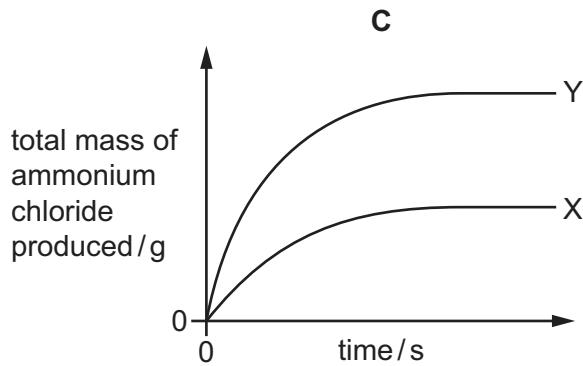
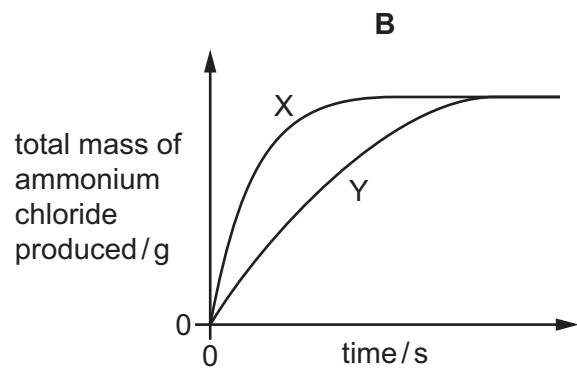
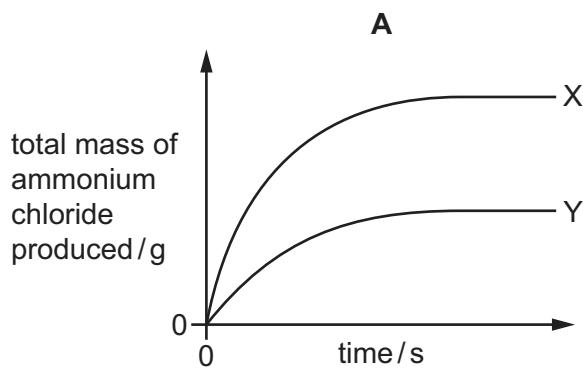
17 A known mass of gaseous ammonia and excess gaseous hydrogen chloride react together to make solid ammonium chloride.

Line X shows the total mass of ammonium chloride produced over time.

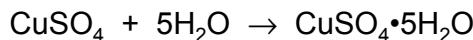
The reaction is repeated at a higher pressure. All other conditions are kept the same.

Line Y shows the total mass of ammonium chloride produced over time at the higher pressure.

Which diagram is correct?



18 The equation for the hydration of anhydrous copper(II) sulfate is shown.



Which colour change is observed in this reaction?

- A** blue to white
- B** white to blue
- C** pink to blue
- D** blue to pink

19 Which of the reactions show the underlined substance being reduced?

- 1  $\underline{\text{CuO}} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$
- 2  $2\underline{\text{Mg}} + \text{O}_2 \rightarrow 2\text{MgO}$
- 3  $\text{MgO} + 2\underline{\text{HCl}} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O}$

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

20 Four different solutions are separately tested with blue litmus and with methyl orange.

Each solution is known to be either acidic or alkaline. The results are shown.

solution	result with blue litmus	result with methyl orange
1	red	red
2	red	yellow
3	blue	yellow
4	blue	yellow

Which statement is correct?

- A** Solutions 1 and 4 are acidic.
- B** Solutions 1 and 2 are alkaline.
- C** Solutions 3 and 4 are acidic.
- D** Solutions 3 and 4 are alkaline.

21 Which statement about sulfur dioxide or calcium oxide is correct?

- A Calcium oxide is an acid.
- B Calcium oxide turns thymolphthalein yellow.
- C Sulfur dioxide is a base.
- D Sulfur dioxide turns thymolphthalein colourless.

22 Which substances can be used to make pure crystals of sodium sulfate?

- A potassium sulfate and sodium hydroxide
- B sodium carbonate and sulfuric acid
- C sodium nitrate and magnesium sulfate
- D sulfuric acid and sodium chloride

23 Which statements describe changes that occur from left to right across a period of the Periodic Table?

- 1 The atomic number of the elements increases.
- 2 The metallic character of the elements decreases.
- 3 The physical state of the elements changes from gas to solid.

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

24 Part of the Periodic Table is shown.

Which element is the **most** reactive non-metal?

25 An alloy contains aluminium, copper, magnesium, manganese, silver and zirconium.

Which row identifies the number of transition elements in the alloy and the relative density of the transition elements compared to sodium?

	number of transition elements in the alloy	relative density of transition elements compared to sodium
<b>A</b>	4	higher
<b>B</b>	4	lower
<b>C</b>	5	higher
<b>D</b>	5	lower

26 Which statement about the halogens and their compounds is correct?

- A** The colour of the element gets lighter going down Group VII.
- B** The elements get less dense going down Group VII.
- C** When chlorine is added to sodium iodide solution, iodine is formed.
- D** When iodine is added to sodium bromide solution, bromine is formed.

27 Which row describes an element in Group VIII of the Periodic Table?

	boiling point / °C	structure
<b>A</b>	-107	diatomic
<b>B</b>	-107	monatomic
<b>C</b>	107	diatomic
<b>D</b>	107	monatomic

28 Magnesium reacts with dilute hydrochloric acid.

Which gas is given off in this reaction?

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

29 Which statement about aluminium is correct?

- A Aluminium is easy to extract from its ore because it is near the bottom of the reactivity series.
- B Aluminium is formed when aluminium oxide is heated with carbon.
- C Bauxite is an important ore of aluminium.
- D Hematite is an important ore of aluminium.

30 Which statement shows that a liquid is pure water?

- A It boils at 100 °C.
- B It has a pH value of 7.
- C It turns blue cobalt(II) chloride pink.
- D It turns white copper(II) sulfate blue.

31 Which compound can be added to ammonium sulfate to make an NPK fertiliser?

- A  $(\text{NH}_4)_3\text{PO}_4$
- B  $\text{KNO}_3$
- C  $\text{K}_3\text{PO}_4$
- D  $\text{CO}(\text{NH}_2)_2$

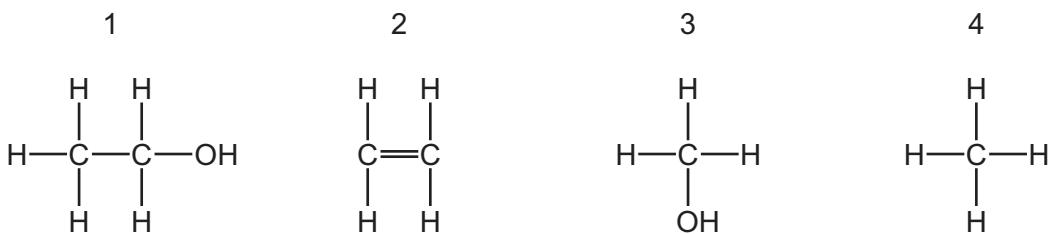
32 Four gases found in air are listed.

- 1 carbon dioxide
- 2 carbon monoxide
- 3 methane
- 4 sulfur dioxide

Which gases lead directly to global warming when their concentrations are increased?

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

33 The structures of four organic compounds are shown.



Which compounds are members of the same homologous series?

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

34 Which of the statements about propene are correct?

- 1 Propene contains only single bonds.
- 2 Propene decolourises aqueous bromine.
- 3 Propene is obtained by cracking large alkanes.
- 4 Propene is a hydrocarbon.

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

35 Petroleum is a mixture.

Which method is used to separate petroleum into its components?

**A** chromatography  
**B** cracking  
**C** filtration  
**D** fractional distillation

36 The equation for a reaction that produces ethanol is shown.



Which type of reaction does the equation represent?

**A** addition  
**B** combustion  
**C** fermentation  
**D** polymerisation

37 Four statements about ethene or poly(ethene) are listed.

- 1 Poly(ethene) is produced by an addition reaction.
- 2 Ethene is a monomer.
- 3 Poly(ethene) is a monomer.
- 4 Poly(ethene) decolourises aqueous bromine.

Which statements are correct?

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

38 Sea water contains dissolved sodium chloride.

Which method is used to obtain pure water from sea water?

**A** chromatography  
**B** distillation  
**C** evaporation  
**D** filtration

39 Which piece of apparatus is used to measure exactly  $21.4\text{ cm}^3$  of water?

**A** a  $25\text{ cm}^3$  beaker  
**B** a  $25\text{ cm}^3$  pipette  
**C** a  $50\text{ cm}^3$  burette  
**D** a  $50\text{ cm}^3$  measuring cylinder

40 An aqueous solution of compound M is tested.

The results are shown.

- a lilac colour in a flame test
- a white precipitate when tested with acidified barium nitrate

What is compound M?

**A** copper(II) chloride  
**B** copper(II) sulfate  
**C** potassium carbonate  
**D** potassium sulfate





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## The Periodic Table of Elements

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

16

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

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