Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CHEMISTRY **0971/12**

Paper 1 Multiple Choice (Core) **October/November 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 11_0971_12/FP

[Turn over

1 Water exists as solid ice, liquid water and steam.

In which states can water easily be compressed to half its original volume?

A ice, liquid water and steam

B liquid water and steam only

C liquid water only

D steam only

2 The melting point of sulfur is 113 °C.

Which row describes the arrangement and movement of sulfur particles at 25 °C?

	arrangement of particles	movement of particles
A	regular	vibrate about fixed positions
B	regular	random
C	random	vibrate about fixed positions
D	random	random

3 Solid Y is added to an excess of hot water.

A blue solution forms and a brown solid remains.

The brown solid is filtered off and dried.

The brown solid conducts electricity.

What is Y?

A a compound that contains a metal

B a mixture that contains a metal

C a pure substance that is a metal

D a pure substance that is a non-metal

4 Which statement about the structure of an atom is correct?

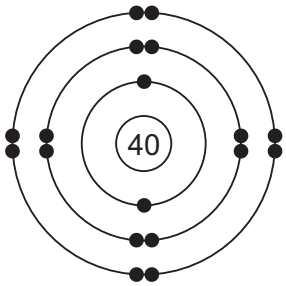
A Electrons and protons each have a relative mass of 1, and neutrons have no charge.

B Electrons have a relative mass of 1 and a negative charge.

C Protons have a relative mass of 1 and a negative charge.

D Neutrons have a relative mass of 1 and no charge.

5 The diagram shows the electronic configuration of a particle with a nucleon number of 40.



The table shows the suggestions that three students, 1, 2 and 3, made to identify the particle.

	student		
	1	2	3
particle	Ar	C*l*	Ca^{2+}

Which students are correct?

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

6 What is defined as different atoms of the same element with the same number of protons but different numbers of neutrons?

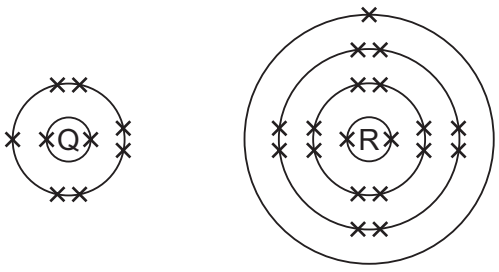
A homologous series

B isotopes

C mass number

D the group number

7 The electronic configurations of atoms Q and R are shown.



Q and R form an ionic compound.

What is the formula of the compound?

A R_7Q **B** R_4Q_2 **C** RQ **D** RQ_7

8 Which properties are typical of simple molecules?

1 high melting point

2 good electrical conductivity

3 low boiling point

4 high malleability

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

9 Diamond is extremely hard and does **not** conduct electricity.

Which statement explains these properties?

A It has positive carbon ions surrounded by delocalised electrons.

B It has strong ionic bonds between each carbon atom.

C It has delocalised electrons, and each carbon atom forms three covalent bonds with other carbon atoms.

D It has **no** delocalised electrons, and each carbon atom forms four covalent bonds with other carbon atoms.

10 Which equation represents the complete combustion of butane, C_4H_{10}?

A $2C_4H_{10} + 5O_2 \rightarrow 8C + 10H_2O$

B $2C_4H_{10} + 9O_2 \rightarrow 8CO + 10H_2O$

C $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

D $C_4H_{10} + 4O_2 \rightarrow 4CO_2 + 5H_2$

11 What is the relative formula mass of calcium sulfate, $CaSO_4$?

A 88 **B** 92 **C** 136 **D** 232

12 What is the product at each electrode when molten silver iodide is electrolysed using inert electrodes?

	cathode	anode
A	hydrogen	iodine
B	iodine	silver
C	silver	iodine
D	silver	oxygen

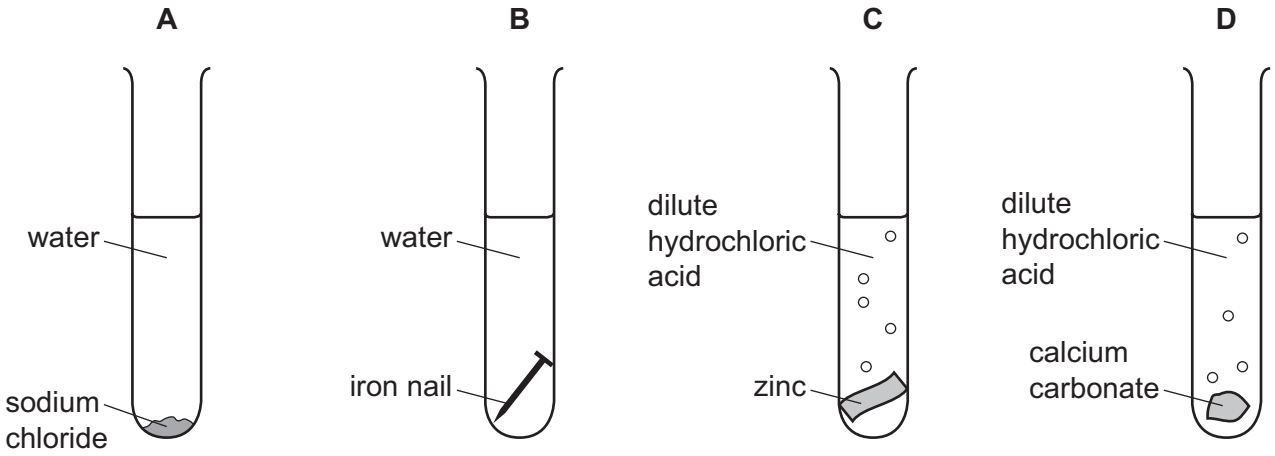
13 Which row describes a product at each electrode when dilute sulfuric acid is electrolysed using inert electrodes?

	product at anode	product at cathode
A	10 cm^3 of a colourless gas	10 cm^3 of a brown gas
B	10 cm^3 of a colourless gas	20 cm^3 of a colourless gas
C	20 cm^3 of a colourless gas	10 cm^3 of a colourless gas
D	20 cm^3 of a brown gas	10 cm^3 of a colourless gas

14 Which experiment is the most exothermic?

	initial temperature / °C	final temperature / °C
A	20	5
B	20	32
C	25	12
D	25	34

15 In which test-tube is a physical change taking place?



16 Which items of apparatus are essential when measuring the effect of temperature on the rate of any reaction?

1 balance

2 gas syringe

3 stop-watch

4 thermometer

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

17 When pink cobalt(II) chloride is heated, it forms a blue solid and water.

When water is added to the blue solid, it releases heat and a pink solid is formed.

Which row describes the type of reaction that occurs and the pink cobalt(II) chloride?

	type of reaction	pink cobalt(II) chloride
A	non-reversible	anhydrous
B	non-reversible	hydrated
C	reversible	anhydrous
D	reversible	hydrated

18 What is the oxidation number of iron in iron(III) oxide, Fe_2O_3?

A +2 **B** +3 **C** –2 **D** –3

19 Which substances react with dilute hydrochloric acid to form aqueous copper(II) chloride?

1 copper

2 copper(II) oxide

3 copper(II) carbonate

4 copper(II) hydroxide

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 2, 3 and 4 only

D 2 and 3 only

20 A few drops of thymolphthalein and methyl orange are added separately to two test-tubes containing solution X.

Solution Y is then added to both test-tubes until present in excess.

The colours of the indicators before and after addition of solution Y are shown.

	colour of thymolphthalein	colour of methyl orange
solution X only	colourless	red
mixture of solution X and excess solution Y	blue	yellow

What is solution Y?

A HCl(aq) **B** NaOH(aq) **C** H_2O(l) **D** NaCl(aq)

21 Which mixture of solids is separated by adding water, stirring, and then using filtration?

A ammonium chloride and silver chloride

B barium sulfate and calcium sulfate

C copper(II) hydroxide and iron(III) hydroxide

D potassium nitrate and sodium nitrate

22 The character of the elements and charges on the ions of the elements change across the Periodic Table.

Which row describes the elements on the left and the elements on the right of the Periodic Table?

	elements on the left		elements on the right	
	character	charge on ion	character	charge on ion
A	metallic	positive	non-metallic	negative
B	metallic	negative	non-metallic	positive
C	non-metallic	positive	metallic	negative
D	non-metallic	negative	metallic	positive

23 Which statement describes a general trend down Group I?

A The melting point increases.

B The reactivity decreases.

C The density increases.

D The total number of electrons decreases.

24 Which statement describes the appearance of the named halogen at room temperature and pressure?

A Chlorine is a colourless gas.

B Chlorine is a red-brown liquid.

C Iodine is a purple gas.

D Iodine is a grey-black solid.

25 Osmium is a transition element.

Which row gives the expected properties of osmium?

	melting point	density at r.t.p.	compounds formed
A	high	high	coloured
B	high	high	white
C	high	low	white
D	low	high	coloured

26 Which statement about the element neon, Ne, is correct?

A It is in Group VII of the Periodic Table.

B It reacts rapidly with oxygen.

C It exists as diatomic molecules.

D Its atoms have a full outer shell of electrons.

27 Substance G reacts with:

- dilute acids to produce hydrogen
- steam to produce a basic oxide
- oxygen to produce a basic oxide.

What is substance G?

A magnesium

B phosphorus

C silicon

D silver

28 Which row describes two properties and a use of the named metal?

	metal	property 1	property 2	use
A	aluminium	high density	resistant to corrosion	food containers
B	aluminium	low density	good electrical conductivity	overhead power cables
C	copper	good electrical conductivity	low ductility	electrical wiring
D	copper	high melting point	low density	aircraft manufacture

29 Four methods to prevent the rusting of iron are listed.

1 alloying

2 coating with plastic

3 greasing

4 painting

Which methods are barrier methods?

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

30 Iron is extracted from hematite in a blast furnace.

Which reaction involves thermal decomposition?

A Calcium carbonate reacts to form calcium oxide and carbon dioxide.

B Carbon (coke) reacts with oxygen to form carbon dioxide.

C Carbon dioxide reacts with carbon to form carbon monoxide.

D Iron(III) oxide reacts with carbon monoxide to form iron and carbon dioxide.

31 Clean, dry air contains nitrogen, oxygen and small amounts of other gases.

The noble gases have been left out of the table.

Which row shows the composition of clean, dry air?

	nitrogen / %	oxygen / %	other gases
A	21	78	small amount of carbon dioxide
B	21	78	small amount of carbon monoxide
C	78	21	small amount of carbon dioxide
D	78	21	small amount of carbon monoxide

32 Some substances found in water from natural sources are potentially harmful.

Which substance contains microbes that cause disease?

A metal compounds

B nitrates

C phosphates

D sewage

33 Gas X is a waste gas from digestion in animals.

Gas Y is formed when gas X is burned with an insufficient amount of oxygen.

Gas Z is formed when gas X is burned with an excess of oxygen.

What are X, Y and Z?

	X	Y	Z
A	carbon dioxide	methane	carbon monoxide
B	carbon monoxide	methane	carbon dioxide
C	methane	carbon dioxide	carbon monoxide
D	methane	carbon monoxide	carbon dioxide

34 Which statement about photosynthesis is correct?

A It decreases the amount of oxygen in the atmosphere.

B It is a reaction between carbon dioxide and water.

C It produces a gas that contributes to increased global warming.

D It requires a temperature greater than 50 °C.

35 L and M are different homologous series.

The first three members of homologous series L all decolourise aqueous bromine.

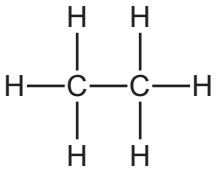
The first three members of homologous series M all dissolve in water to give solutions with a pH below 7.

What are the general formulae for homologous series L and M?

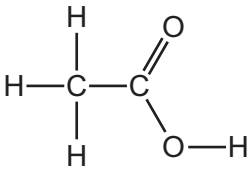
	homologous series L	homologous series M
A	C_nH_{2n}	$C_nH_{2n+1}COOH$
B	C_nH_{2n}	$C_nH_{2n+1}OH$
C	C_nH_{2n+2}	$C_nH_{2n+1}OH$
D	C_nH_{2n+2}	$C_nH_{2n+1}COOH$

36 Which structure represents an unsaturated hydrocarbon?

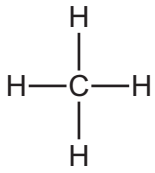
A



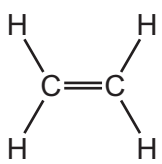
B



C



D



37 Petroleum is a mixture of compounds.

Which elements are present in all of these compounds?

1 carbon

2 hydrogen

3 oxygen

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

38 Which statement about ethanol explains why it is used as a fuel?

A It is a colourless liquid.

B It has a low density.

C It forms carbon dioxide when burned.

D It releases energy when burned.

39 The table shows the observations of two tests on an aqueous solution of a solid.

test	observations
add acidified silver nitrate	white precipitate
add aqueous sodium hydroxide	green precipitate that dissolves in excess sodium hydroxide

What is the solid?

A chromium(III) bromide

B chromium(III) chloride

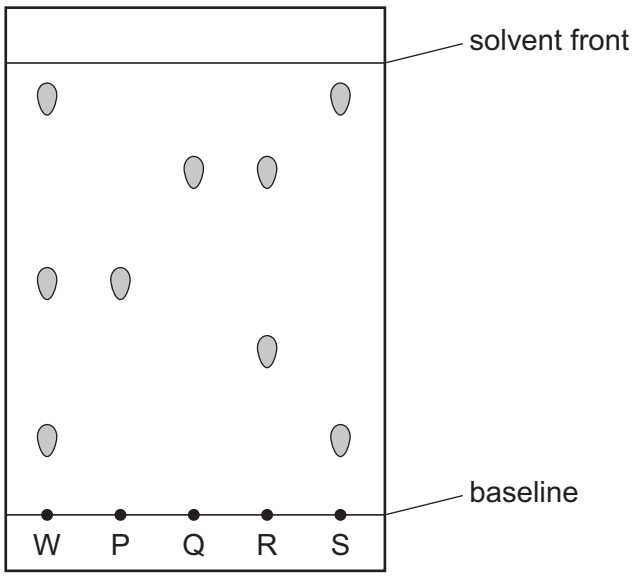
C iron(II) bromide

D iron(II) chloride

40 W is a mixture of coloured dyes. It is thought to contain dyes P, Q, R or S.

A sample of W is separated by chromatography.

The chromatogram is shown.



What does the chromatogram show?

A W contains P and S only.

B W contains P and R only.

C W contains P, Q and S.

D W contains P, R and S.

BLANK PAGE

BLANK PAGE

BLANK PAGE

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.).