Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CHEMISTRY **0971/12**

Paper 1 Multiple Choice (Core) **May/June 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.

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

1 Substance L melts at –7 °C and is a brown liquid at room temperature.

What is the boiling point of pure L?

A –77 °C

B –7 °C to +7 °C

C 59 °C

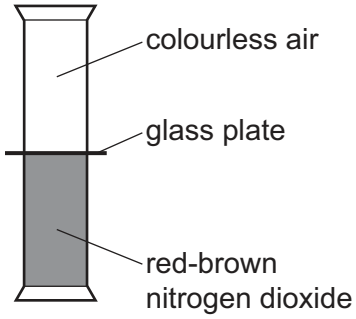
D 107 °C to 117 °C

2 Which row describes how the volume of a gas changes when its temperature is increased at constant pressure and when its pressure is increased at constant temperature?

	temperature is increased at constant pressure	pressure is increased at constant temperature
A	volume decreases	volume decreases
B	volume decreases	volume increases
C	volume increases	volume decreases
D	volume increases	volume increases

3 Nitrogen dioxide is a red-brown gas which is more dense than air.

The diagram shows the arrangement of two gas jars which contain nitrogen dioxide and air separated with a glass plate.

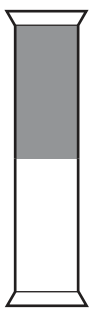


The glass plate is removed, and the gas jars are left for 24 hours.

Which diagram shows the gas jars after 24 hours?

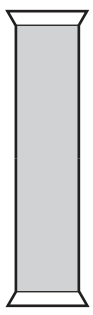
A

B



C

D



4 Which substance is a mixture of **one** element and **one** compound?

A aqueous glucose

B clean, dry air

C oxygen dissolved in distilled water

D stainless steel

5 Which statement defines the atomic number of an element?

A the group number of the element

B the mass of one atom of the element

C the number of particles in the nucleus of one atom of the element

D the number of protons in the nucleus of one atom of the element

6 What is different for isotopes of the same element?

A nucleon number

B number of electron shells

C number of electrons in the outer electron shell

D proton number

7 When sodium chloride is formed from its elements, each chlorine atom .....1..... one .....2..... .

Which words correctly complete gaps 1 and 2?

	1	2
A	gains	electron
B	gains	proton
C	loses	electron
D	loses	proton

8 In the molecules CH_4, HCl and H_2O, which atoms use **all** of their outer shell electrons in bonding?

A C and Cl **B** C and H **C** Cl and H **D** H and O

9 Which substance has a giant covalent structure?

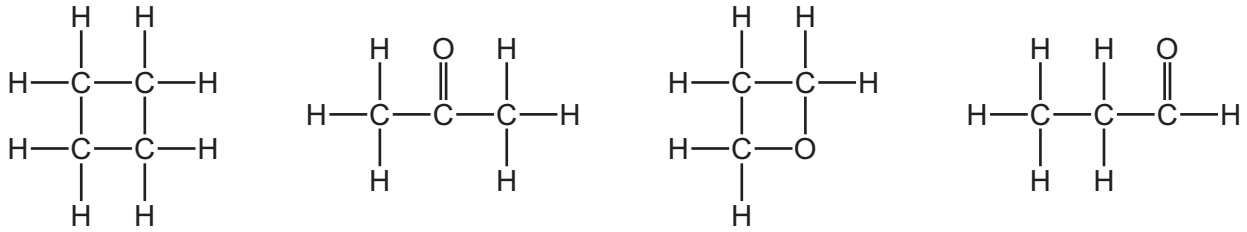
A sodium chloride

B ammonia

C magnesium chloride

D graphite

10 The diagrams show the structures of four molecules.



Which statement about these molecules is correct?

A All four molecules have different molecular formulae.

B All four molecules have the same molecular formula.

C Only two molecules have the same molecular formula.

D Only three molecules have the same molecular formula.

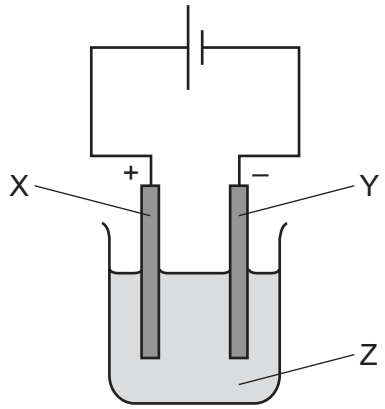
11 The equation for the reaction of magnesium with oxygen is shown.

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

Which mass of oxygen reacts exactly with 6 g of magnesium?

A 2 g **B** 4 g **C** 8 g **D** 16 g

12 The diagram shows a simple electrolytic cell for an electrolysis experiment.



Three parts of the electrolytic cell are labelled X, Y and Z.

Which row shows the correct labels to replace X, Y and Z in the diagram?

	X	Y	Z
A	anode	cathode	aqueous salt
B	anode	cathode	solid salt
C	cathode	anode	aqueous salt
D	cathode	anode	solid salt

13 Which equation represents the overall reaction that produces electricity in a hydrogen–oxygen fuel cell?

A $H_2 + O_2 \rightarrow H_2O_2$

B $2H_2O \rightarrow 2H_2 + O_2$

C $2H_2 + O_2 \rightarrow 2H_2O$

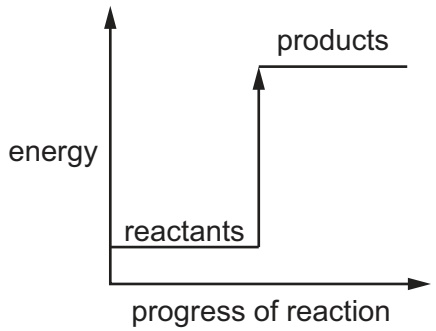
D $2H_2O_2 \rightarrow 2H_2O + O_2$

[Turn over

14 Which reaction pathway diagram shows the largest increase in the temperature of the surroundings?

(The scale on the *y*-axis is the same in each diagram.)

A



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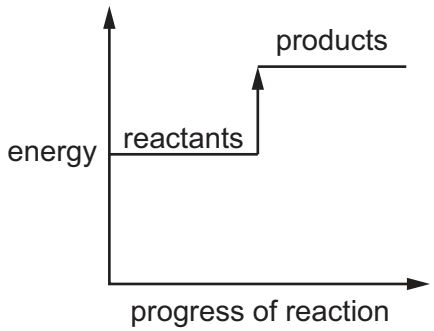

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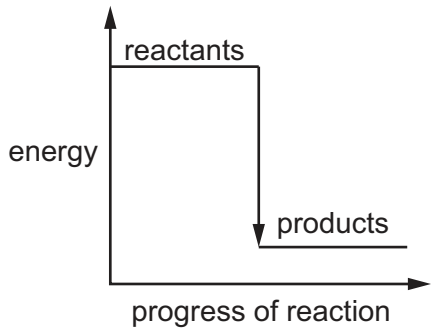
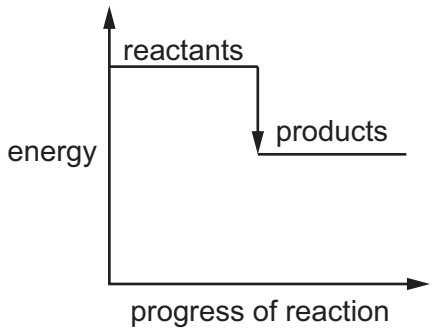


D



15 Which process involves a chemical change?

A dissolving copper(II) sulfate

B distilling ethanol

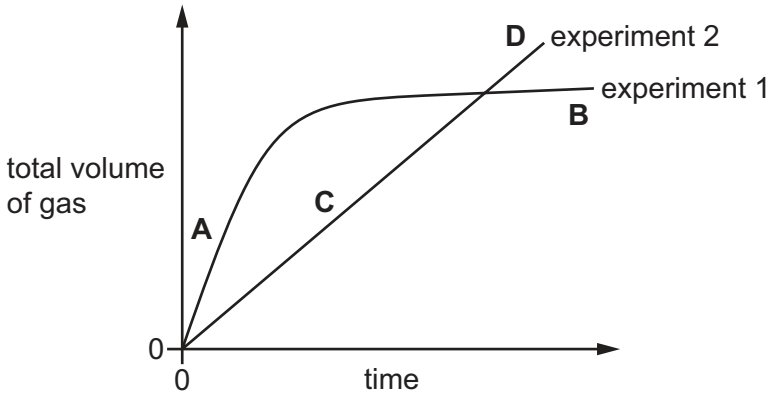
C freezing water

D neutralising copper(II) oxide

16 The total volume of gas produced in two different experiments is measured against time.

A graph of the results of the two experiments is shown.

Which point shows the fastest rate of reaction?



17 The equation for the reaction of sulfur dioxide with oxygen is shown.

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

What is meant by the symbol $\rightleftharpoons$?

A redox reaction

B reversible reaction

C displacement reaction

D thermal decomposition reaction

18 Which reactions are redox reactions?

1 the incomplete combustion of propane

2 the rusting of iron

3 the reaction of aqueous chloride ions with acidified aqueous silver nitrate

4 the thermal decomposition of calcium carbonate

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

19 Which row describes an aqueous solution for the pH shown?

	pH	description
A	1	has a very high alkalinity
B	5	is neutral
C	9	turns universal indicator yellow
D	14	contains OH^- ions

[Turn over

20 Which parts of the Periodic Table contain elements that **only** form basic oxides?

A Group I and Period 3

B Group I only

C Group VIII and Period 3

D Group VIII only

21 Which statement about elements in the Periodic Table is correct?

A Elements in the same group of the Periodic Table have the same electronic configuration.

B The atoms of the elements in Group VII form ions with a charge equal to the number of outer shell electrons minus 8.

C The metallic character of the elements increases from left to right across a period.

D The Periodic Table is an arrangement of elements in order of increasing nucleon number.

22 Which row identifies the trends in properties of the elements lithium to sodium to potassium?

	melting point	density	reactivity
A	decreasing	increasing	increasing
B	increasing	increasing	decreasing
C	increasing	decreasing	increasing
D	decreasing	decreasing	increasing

23 Which statements about the halogens are correct?

1 They are all diatomic molecules.

2 They are all gases at room temperature and pressure.

3 The density of the elements increases down the group.

4 The reactivity of the elements increases down the group.

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

24 Zirconium is a transition element.

What is a property of zirconium?

A high density

B does **not** conduct heat

C forms white compounds only

D low melting point

25 Some gases exist as single atoms, are unreactive and have eight electrons in their outer electron shell.

Which gases fit this description?

1 helium

2 argon

3 oxygen

4 krypton

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

26 Which statements about metals are correct?

1 Calcium reacts faster than magnesium with cold water.

2 Aluminium is more easily extracted than iron from its ore.

3 Copper reacts faster than iron with dilute hydrochloric acid.

4 Potassium and silver are both good conductors of electricity.

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

27 Four metals, P, Q, R and S, are separately reacted with dilute hydrochloric acid.

The table shows the observation for each metal.

metal	observation
P	lots of bubbles produced
Q	few bubbles produced
R	no bubbles produced
S	very few bubbles produced

What is the order of reactivity of these four metals, from most reactive to least reactive?

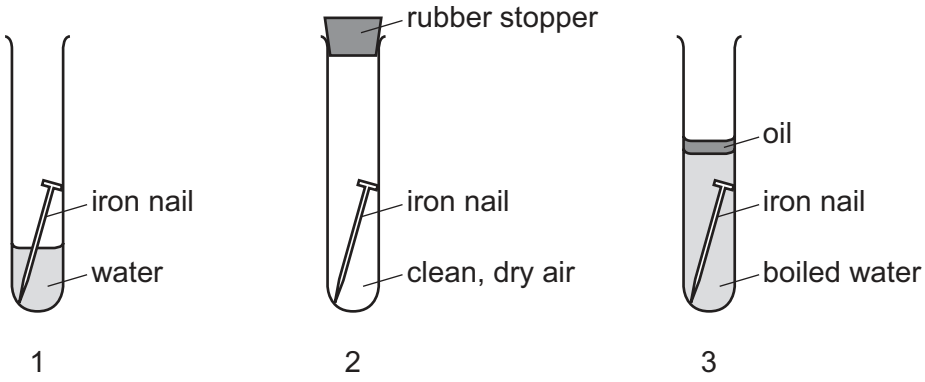
A R → S → Q → P

B P → S → Q → R

C P → Q → S → R

D Q → R → P → S

28 The diagram shows iron nails which are left for one week in separate test-tubes with the conditions shown.



Which test-tubes show evidence of rusting after one week?

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

29 Pure metals can be combined to make alloys.

Why are the alloys sometimes used rather than the metals they are made from?

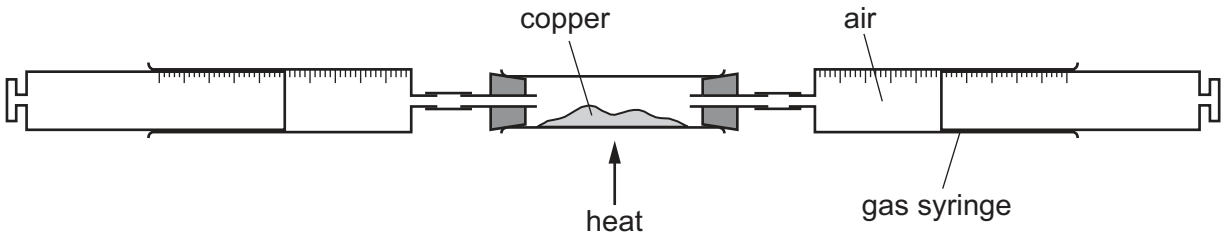
A Alloys are easier to extract and cheaper.

B Alloys are easier to hammer into different shapes.

C Alloys are harder and keep their shape better.

D Alloys contain only atoms of the same size but pure metals do **not**.

30 In the experiment shown, 100 cm^3 of clean, dry air is passed backwards and forwards through a tube containing heated copper until there is no further decrease in the volume of the air.



All of the gas is pushed into **one** syringe.

What is the final reading on this gas syringe?

A 0 cm^3 **B** 21 cm^3 **C** 79 cm^3 **D** 100 cm^3

31 Sulfur dioxide, carbon monoxide and oxides of nitrogen are gaseous pollutants found in the air.

Which pollutants contribute to acid rain?

A carbon monoxide and sulfur dioxide

B oxides of nitrogen and sulfur dioxide

C oxides of nitrogen only

D sulfur dioxide only

32 The formulae for three organic compounds are listed.

1 C_2H_4

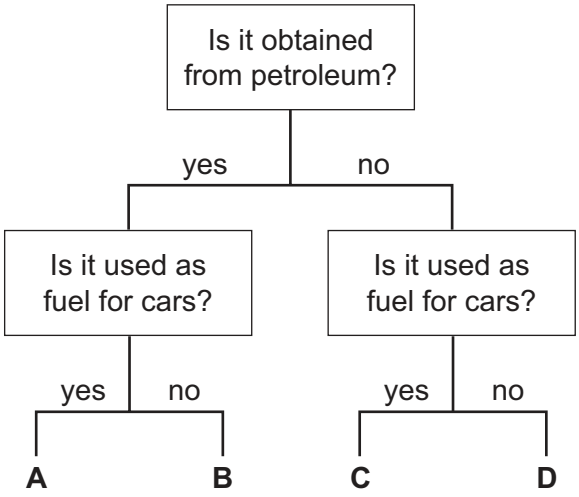
2 C_4H_8

3 C_4H_{10}

Which compounds belong to the same homologous series?

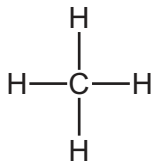
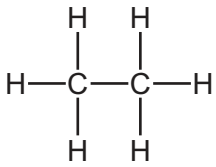
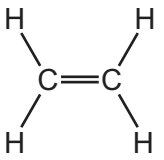
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

33 Which fuel could be gasoline?



34 Three hydrocarbons are separately mixed with aqueous bromine.

Which row gives the correct observation for each hydrocarbon?

			
A	colour changes from orange to colourless	colour stays unchanged	colour changes from orange to colourless
B	colour changes from orange to colourless	colour changes from orange to colourless	colour stays unchanged
C	colour stays unchanged	colour stays unchanged	colour changes from orange to colourless
D	colour stays unchanged	colour changes from orange to colourless	colour stays unchanged

35 Which compound is formed when ethene reacts with steam?

A ethane

B ethanoic acid

C ethanol

D poly(ethene)

36 Which statements about ethanoic acid are correct?

1 Its aqueous solution has a pH value of 10.

2 It reacts with metal carbonates to produce carbon dioxide gas.

3 It reacts with magnesium metal to produce hydrogen gas.

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

37 Which statement explains why plastic bags made from poly(ethene) accumulate in oceans?

A Poly(ethene) is a saturated molecule.

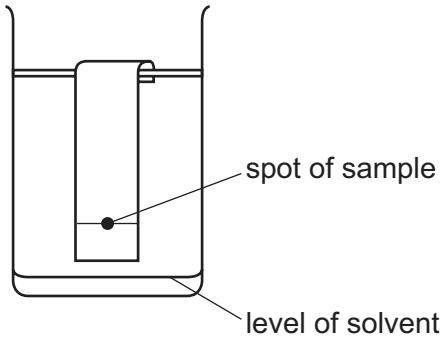
B Poly(ethene) is made from hydrocarbon monomers.

C Poly(ethene) reacts with water.

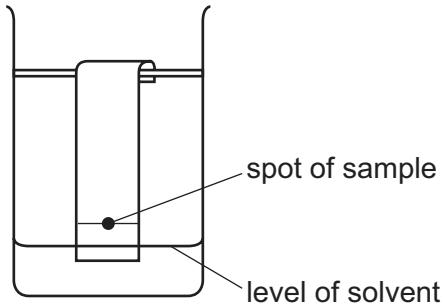
D Poly(ethene) does **not** decompose in water.

38 Which diagram shows the correct level of solvent at the start of a chromatography experiment?

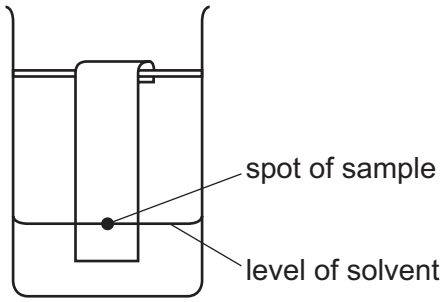
A



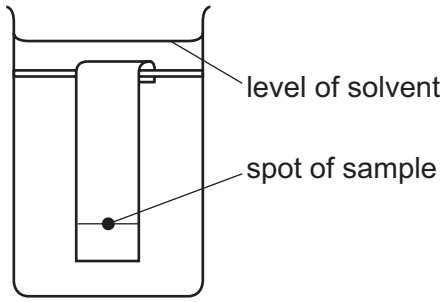
B



C



D



39 Which process is used to separate a mixture of liquids with different boiling points?

A dissolving

B crystallisation

C filtration

D fractional distillation

40 Four different colourless solutions are each tested separately with aqueous sodium hydroxide and with acidified aqueous silver nitrate.

Which row shows the results for sodium chloride?

	aqueous sodium hydroxide	acidified aqueous silver nitrate
A	no visible reaction	white precipitate
B	no visible reaction	no visible reaction
C	white precipitate	no visible reaction
D	white precipitate	white precipitate

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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.).