Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CHEMISTRY **0971/01**

Paper 1 Multiple Choice (Core) **For examination from 2023**

SPECIMEN PAPER **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 Which statement about liquids and gases is correct?

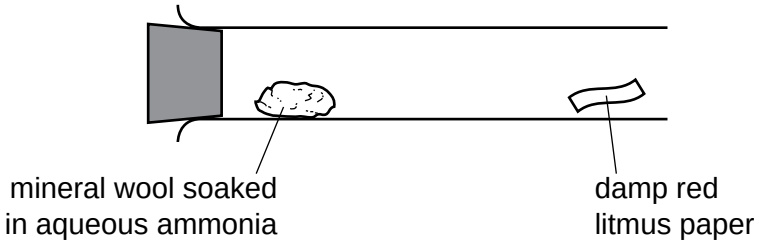
A $1\,cm^3$ of gas contains more particles than $1\,cm^3$ of liquid.

B A given mass of liquid has a fixed volume at room temperature.

C Particles in a liquid can easily be forced closer together.

D Particles in a liquid have fixed positions.

2 Mineral wool soaked in aqueous ammonia is placed in the apparatus shown.



After five minutes, the damp red litmus paper turns blue.

Which process led to this change?

A condensation

B crystallisation

C diffusion

D distillation

3 Which pair of atoms contains the same number of neutrons?

A $^{59}_{27}Co$ and $^{59}_{28}Ni$

B $^{64}_{29}Cu$ and $^{65}_{29}Cu$

C $^{64}_{29}Cu$ and $^{65}_{30}Zn$

D $^{65}_{29}Cu$ and $^{65}_{30}Zn$

4 Which statement describes the bonding in sodium chloride?

A A shared pair of electrons between two atoms leading to a noble gas configuration.

B A strong force of attraction between oppositely charged ions.

C A strong force of attraction between two molecules.

D A weak force of attraction between oppositely charged ions.

5 A covalent molecule M contains a total of four shared electrons.

What is M?

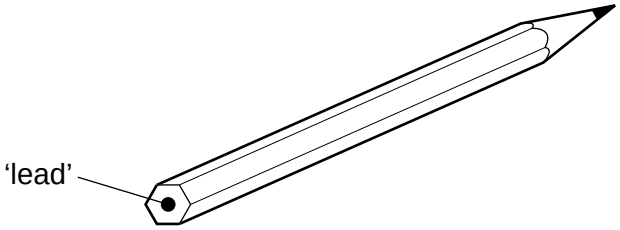
A ammonia, NH_3

B hydrogen chloride, HCl

C methane, CH_4

D water, H_2O

6 The 'lead' in a pencil is made of a mixture of graphite and clay.



When the percentage of graphite is increased, the pencil moves across the paper more easily.

Which statement explains this observation?

A Graphite has a high melting point.

B Graphite is a form of carbon.

C Graphite is a lubricant.

D Graphite is a non-metal.

7 A compound with the formula XO_2 has a relative formula mass of 64.

What is X?

A cadmium

B copper

C gadolinium

D sulfur

8 When molten lead(II) bromide is electrolysed using platinum electrodes, what is observed at each electrode?

	negative electrode	positive electrode
A	bubbles of a colourless gas	bubbles of a brown gas
B	bubbles of a colourless gas	bubbles of a colourless gas
C	shiny grey liquid	bubbles of a brown gas
D	shiny grey liquid	bubbles of a colourless gas

9 Aqueous nickel(II) sulfate is used as the electrolyte to electroplate a piece of steel with nickel.

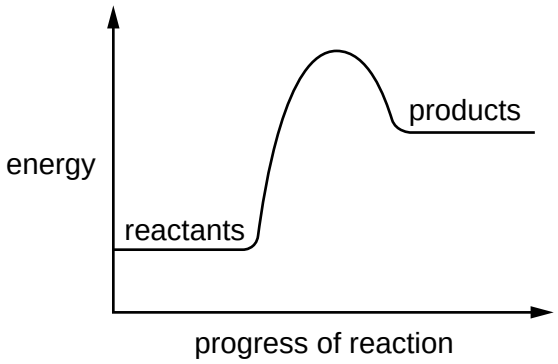
Which materials are used as the negative electrode and positive electrode?

	negative electrode	positive electrode
A	carbon	steel
B	nickel	steel
C	platinum	nickel
D	steel	nickel

10 Which row shows the waste products released from the exhaust of a vehicle powered using a hydrogen–oxygen fuel cell?

	carbon dioxide	oxides of nitrogen	water
A	✓	✓	✓
B	×	✓	✓
C	✓	×	×
D	×	×	✓

11 A reaction pathway diagram is shown.



Which statement about the reaction is correct?

A Heat is released.

B It is a combustion reaction.

C It is an endothermic reaction.

D The temperature increases.

12 Which changes are physical changes?

1 melting ice to form water

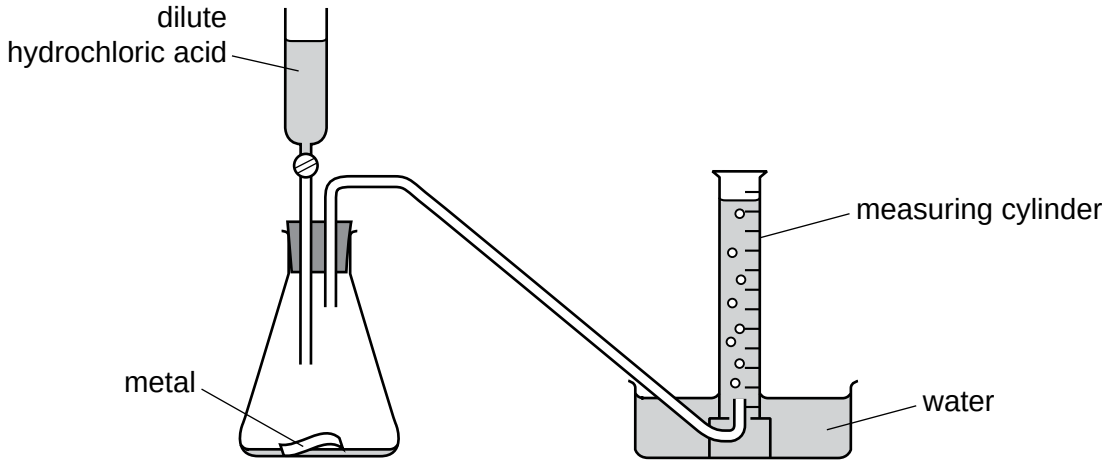
2 burning hydrogen to form water

3 adding sodium to water

4 boiling water to form steam

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

13 The diagram shows an experiment to measure the rate of a chemical reaction.



Which change decreases the rate of reaction?

A adding water to the flask

B heating the flask during the reaction

C using more concentrated acid

D using powdered metal

14 Which row correctly matches the experiment and observations to the identity of the underlined substance?

	experiment and observations	identity of the underlined substance
A	<u>Blue crystals</u> are heated. The crystals turn white and steam is given off.	hydrated cobalt(II) chloride
B	<u>Pink crystals</u> are heated. The crystals turn blue and steam is given off.	anhydrous cobalt(II) chloride
C	Water is added to a <u>blue solid</u>. The blue solid turns pink.	hydrated copper(II) sulfate
D	Water is added to a <u>white solid</u>. The white solid turns blue.	anhydrous copper(II) sulfate

15 Which equation shows an oxidation reaction?

A $C + O_2 \rightarrow CO_2$

B $CaCO_3 \rightarrow CaO + CO_2$

C $CaO + 2HCl \rightarrow CaCl_2 + H_2O$

D $N_2O_4 \rightarrow 2NO_2$

16 Farmers spread calcium hydroxide on their fields to neutralise soils that are too acidic for crops to grow well.

Which ion neutralises the acid in the soil?

A Ca^{2+} **B** H^{+} **C** O^{2-} **D** OH^{-}

17 Four different solutions, J, K, L and M, are tested with universal indicator.

solution	J	K	L	M
colour with universal indicator	green	red	purple	orange

Which solutions are acidic?

A J and M **B** K and M **C** K only **D** L only

18 Period 3 of the Periodic Table is shown.

Na	Mg	A*l*	Si	P	S	C*l*	Ar

What increases from Na to Ar across Period 3?

A density

B melting point

C non-metallic character

D the number of electron shells

19 Sodium and rubidium are elements in Group I of the Periodic Table.

Which statement is correct?

A Sodium atoms have more electrons than rubidium atoms.

B Sodium has a lower density than rubidium.

C Sodium has a lower melting point than rubidium.

D Sodium is more reactive than rubidium.

20 Chlorine, bromine and iodine are elements in Group VII of the Periodic Table.

Which statement about these elements is correct?

A The colour gets lighter down the group.

B The density decreases down the group.

C They are all gases at room temperature and pressure.

D They are all non-metals.

21 Which row describes the properties of a typical transition element?

	melting point	forms coloured compounds	can act as a catalyst
A	high	no	no
B	high	yes	yes
C	low	no	yes
D	low	yes	no

22 Which statement about the noble gases is correct?

A Noble gases are diatomic molecules.

B Noble gases are reactive gases.

C Noble gases have full outer electron shells.

D The noble gases are found on the left-hand side of the Periodic Table.

23 What is a property of **all** metals?

A conducts electricity

B hard

C low melting point

D reacts with water

24 Which statement explains why aluminium is used in the manufacture of aircraft?

A It conducts heat well.

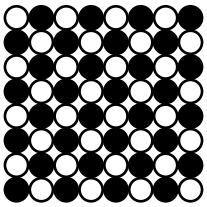
B It has a low density.

C It is a good insulator.

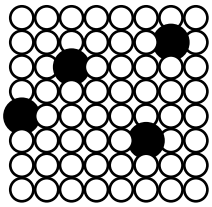
D It is easy to recycle.

25 Which diagram represents a solid alloy?

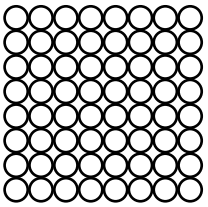
A



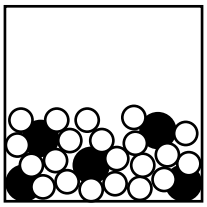
B



C



D



26 Metals W, X, Y and Z are reacted with dilute hydrochloric acid.

The oxides of metals W, X, Y and Z are heated with carbon.

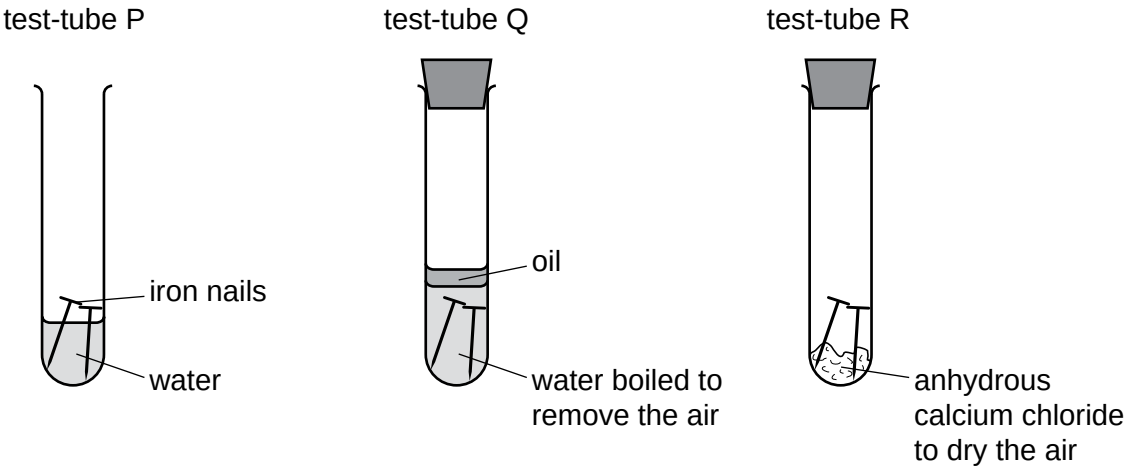
The results are shown.

reaction	W	X	Y	Z
metal + dilute hydrochloric acid	fizzing	fizzing	violent fizzing	no reaction
metal oxide + carbon and heat	no reaction	metal produced	no reaction	metal produced

What is the order of reactivity of the metals?

	most reactive → least reactive			
A	Y	W	X	Z
B	Y	X	W	Z
C	Z	W	X	Y
D	Z	X	W	Y

27 The diagrams show experiments involving the rusting of iron.



A student predicted the following results.

1 In test-tube P, the iron nails rust.

2 In test-tube Q, the iron nails do not rust.

3 In test-tube R, the iron nails do not rust.

Which predictions are correct?

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

28 Which statement about the extraction of iron in a blast furnace is correct?

A Calcium oxide reacts with basic impurities.

B Carbon is burnt to provide heat.

C Iron(III) oxide is reduced to iron by carbon dioxide.

D The raw materials are bauxite, limestone and coke.

29 Which process is used to convert calcium carbonate into calcium oxide?

A electrolysis

B fractional distillation

C incomplete combustion

D thermal decomposition

30 Which substance is beneficial to aquatic life?

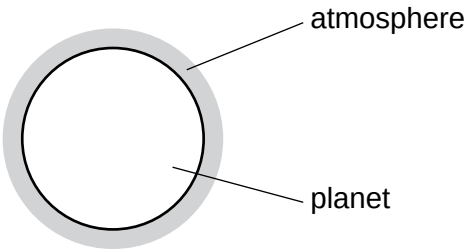
A dissolved oxygen

B phosphates

C plastics

D sewage

31 A new planet has been discovered and its atmosphere has been analysed.



The table shows the composition of its atmosphere.

gas	percentage by volume
carbon dioxide	4
nitrogen	72
oxygen	24

Which gases are present in the atmosphere of the planet in a higher percentage than they are in the Earth's atmosphere?

A carbon dioxide and oxygen

B carbon dioxide only

C nitrogen and oxygen

D nitrogen only

32 Which statement is correct?

A Atmospheric carbon dioxide is not a cause of climate change.

B Atmospheric carbon monoxide is produced by complete combustion of carbon-containing fuels.

C Burning natural gas decreases the level of carbon dioxide in the atmosphere.

D Decomposition of vegetation causes an increase in atmospheric methane.

33 A plastic combusts to form sulfur dioxide, SO_2, and hydrogen chloride, HC*l*.

How could both gases be removed from the air?

A Pass the gases over solid anhydrous cobalt(II) chloride.

B Pass the gases over solid damp calcium oxide.

C Pass the gases through a catalytic converter.

D Pass the gases through filter paper.

34 Limestone fizzes and dissolves in dilute hydrochloric acid.

What is the word equation for this reaction?

A calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide

B calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

C calcium hydroxide + hydrochloric acid → calcium chloride + hydrogen

D calcium oxide + hydrochloric acid → calcium chloride + water

35 Three equations involving organic compounds are shown.

$C_4H_{10} \rightarrow C_2H_4 + C_2H_6$

$C_2H_4 + H_2O \rightarrow C_2H_5OH$

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

How many different homologous series are shown in these equations?

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

36 Petroleum is a mixture of different hydrocarbons.

Which process is used to separate the petroleum into groups of similar hydrocarbons?

A combustion

B cracking

C fractional distillation

D reduction

37 Ethene is a hydrocarbon.

Which row shows the type of covalent bond between the carbon atoms in ethene and the effect of ethene on aqueous bromine?

	type of covalent bond	effect of ethene on aqueous bromine
A	single bond	colour changes from brown to colourless
B	single bond	colour changes from colourless to brown
C	double bond	colour changes from brown to colourless
D	double bond	colour changes from colourless to brown

38 Which statements about ethanoic acid are correct?

1 It turns universal indicator purple.

2 It reacts with magnesium to form hydrogen gas.

3 It reacts with calcium carbonate to form carbon dioxide gas.

4 It decolourises aqueous bromine.

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

39 Five steps in an acid–base titration are shown.

1 Slowly add the acid from a burette into a conical flask until the indicator becomes colourless.

2 Add thymolphthalein.

3 Use a volumetric pipette to add a fixed volume of alkali to a conical flask.

4 Read and record the initial volume of acid in the burette.

5 Read and record the final volume of acid in the burette.

What is the correct order of these steps to complete an acid–base titration?

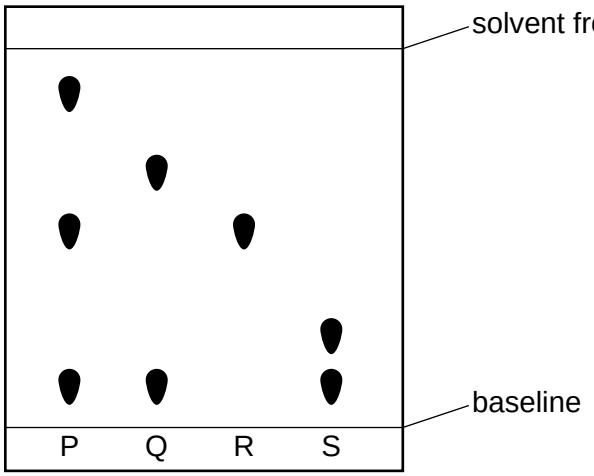
A 2 → 4 → 1 → 5 → 3

B 3 → 2 → 4 → 1 → 5

C 3 → 4 → 1 → 5 → 2

D 4 → 3 → 1 → 2 → 5

40 The chromatogram obtained from four mixtures of dyes, P, Q, R and S, is shown.



What is the total number of different dyes identified in the four mixtures?

A 3 **B** 4 **C** 5 **D** 8

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.).

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