Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

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)

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.

[Turn over

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 $^{18}_{8}O^{2-}$?

	protons	neutrons	electrons
A	10	8	8
B	8	10	8
C	10	8	10
D	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
A	✓	✓	✗
B	✗	✓	✓
C	✓	✗	✗
D	✗	✗	✓

key

✓ = same

✗ = different

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 CH_4, NH_3 and H_2O 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	$PbBr_2$	C_4H_8
B	$PbBr_2$	C_4H_{10}
C	Pb_2Br	C_4H_8
D	Pb_2Br	C_4H_{10}

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

$$\boldsymbol{x}\,CaCl_2 + \boldsymbol{y}\,Na_3PO_4 \rightarrow 2Ca_3(PO_4)_2 + 12NaCl$$

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.

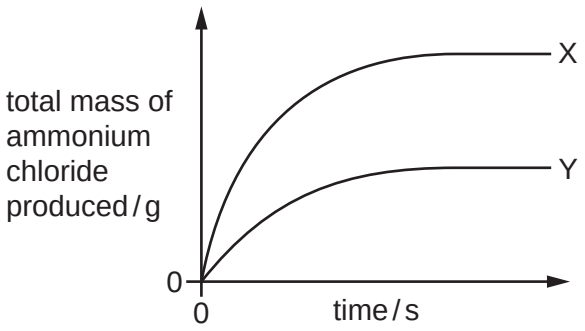
Line X shows the total mass of ammonium chloride produced over time.

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?

A



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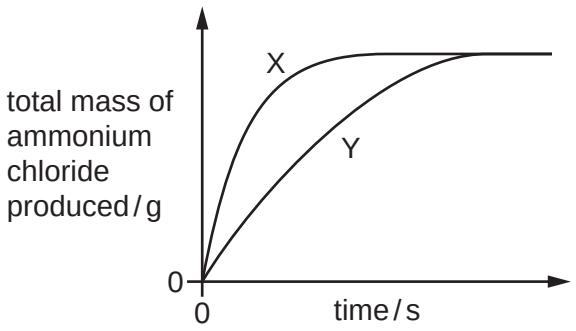

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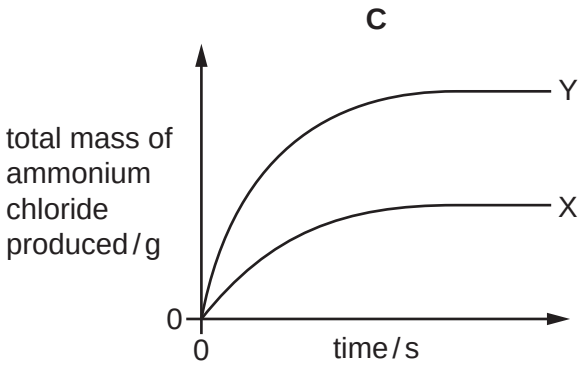

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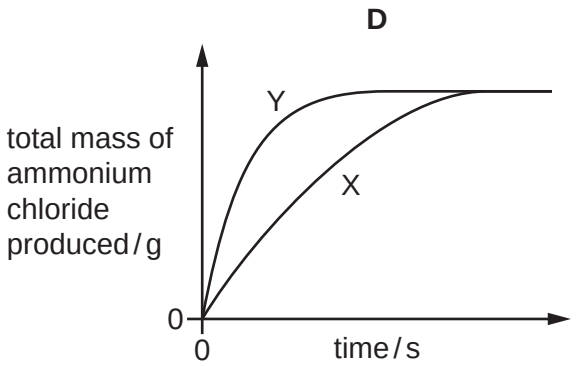


18 The equation for the hydration of anhydrous copper(II) sulfate is shown.

$$CuSO_4 + 5H_2O \rightarrow CuSO_4 \bullet 5H_2O$$

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 $\underline{CuO} + H_2 \rightarrow Cu + H_2O$

2 $\underline{2Mg} + O_2 \rightarrow 2MgO$

3 $MgO + \underline{2HCl} \rightarrow MgCl_2 + H_2O$

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.

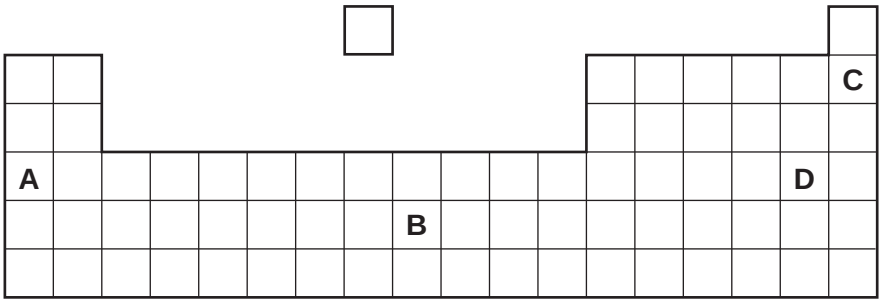
2 The metallic character of the elements decreases.

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
A	4	higher
B	4	lower
C	5	higher
D	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
A	−107	diatomic
B	−107	monatomic
C	107	diatomic
D	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 $(NH_4)_3PO_4$

B KNO_3

C K_3PO_4

D $CO(NH_2)_2$

32 Four gases found in air are listed.

1 carbon dioxide

2 carbon monoxide

3 methane

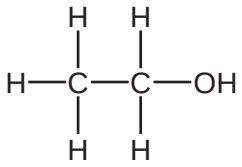
4 sulfur dioxide

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.

1



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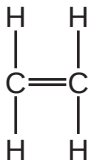

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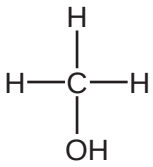

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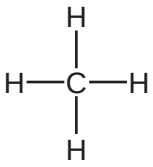

Which compounds are members of the same homologous series?

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.

$$\text{ethene} + \text{steam} \rightarrow \text{ethanol}$$

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 cm^3 of water?

A a 25 cm^3 beaker

B a 25 cm^3 pipette

C a 50 cm^3 burette

D a 50 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

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.).