Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CHEMISTRY **0971/12**

Paper 1 Multiple Choice (Core) **May/June 2023**

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 Four physical changes of ethanol are listed.

1 condensation

2 evaporation

3 freezing

4 boiling

In which changes do the particles move further apart?

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

2 Which statement explains why water is a compound?

A The hydrogen and oxygen atoms in a molecule of water can only be separated by chemical means.

B The hydrogen and oxygen atoms in a molecule of water can be separated using physical means.

C The number of hydrogen and oxygen atoms in a molecule of water is variable.

D Water has the same chemical properties as both hydrogen and oxygen.

3 An atom of element X contains:

- 5 protons
- 6 neutrons
- 5 electrons.

Which statements about element X are correct?

1 X has an atomic number of 6.

2 X has a nucleon number of 11.

3 X is in Group II of the Periodic Table.

4 X is in the second period of the Periodic Table.

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

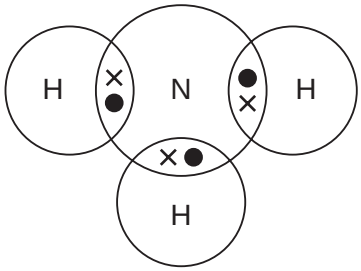
4 Which row describes properties of lithium fluoride?

	electrical conductivity when solid	electrical conductivity when molten	melting point
A	does not conduct	conducts	high
B	does not conduct	does not conduct	low
C	conducts	conducts	high
D	conducts	does not conduct	low

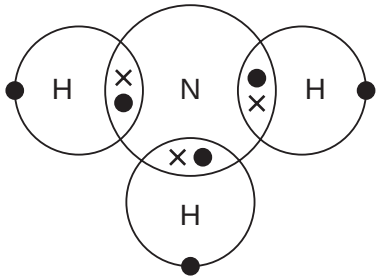
5 Ammonia, NH_3, is a covalent molecule.

Which diagram shows the outer-shell electron arrangement in a molecule of ammonia?

A



B



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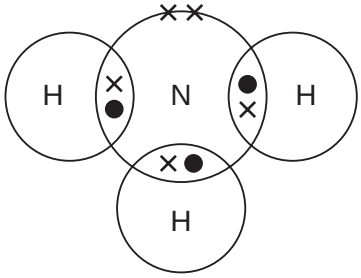
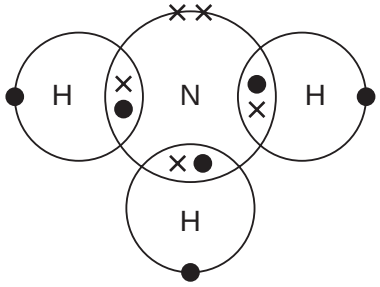


D



6 Which substance has a giant covalent structure?

A ethanol

B graphite

C methane

D sodium chloride

7 Sodium burns in oxygen to form sodium oxide.

What is the balanced equation for the reaction?

A $4Na + 2O \rightarrow 2Na_2O$

B $4Na + O_2 \rightarrow 2Na_2O$

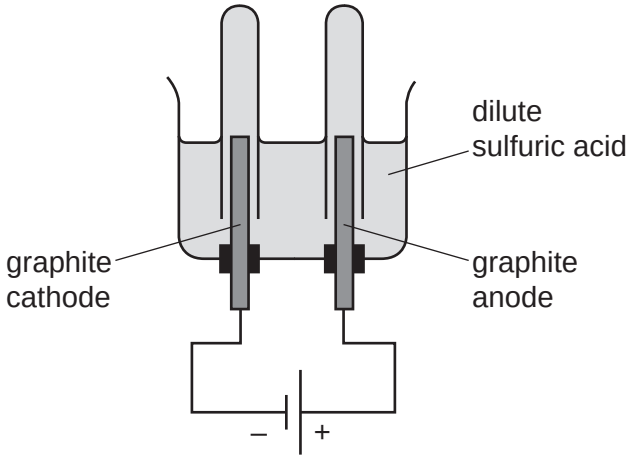
C $2Na_2 + O_2 \rightarrow 2Na_2O$

D $2Na_2 + 2O \rightarrow 2Na_2O$

8 What is the relative formula mass of $Mg(OH)_2$?

A 21 **B** 30 **C** 42 **D** 58

9 Dilute sulfuric acid is electrolysed using inert electrodes. The apparatus is set up as shown.



30 cm^3 of a gas is collected at the cathode. A different gas is collected at the anode.

Which row is correct?

	gas at cathode	gas at anode	volume of gas collected at anode / cm^3
A	hydrogen	oxygen	15
B	hydrogen	oxygen	30
C	oxygen	hydrogen	15
D	oxygen	hydrogen	30

10 Four statements about hydrogen fuel cells are listed.

1 The fuel cell converts chemical energy into electrical energy.

2 In the fuel cell, hydrogen combines with oxygen.

3 Carbon dioxide and water are produced in the fuel cell.

4 The hydrogen fuel is extracted from the air.

Which statements are correct?

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

11 5 g of four different fuels are set alight and placed under a beaker containing 50 cm^3 of water.

The temperature of the water is taken at the start and after five minutes.

Which fuel releases the most energy?

	temperature at start / °C	temperature after five minutes / °C
A	15	23
B	21	31
C	28	47
D	30	48

12 Which changes increase the rate of reaction?

1 increasing the concentration of the reactants

2 increasing the particle size of a solid reactant

3 increasing the temperature

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

13 Which reaction is reversible?

A an iron nail rusting when left in moist air

B limestone reacting with an acid to form carbon dioxide gas

C magnesium burning in air to produce a white ash

D white anhydrous copper(II) sulfate turning blue when water is added

14 The equation for the reaction between iron(III) oxide and carbon is shown.

$$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$$

Which type of reaction does iron(III) oxide undergo?

A reduction

B precipitation

C oxidation

D combustion

15 Copper(II) chloride is made when copper(II) carbonate reacts with dilute hydrochloric acid.

What are the other products in this reaction?

A water and carbon dioxide

B carbon dioxide only

C water and hydrogen

D hydrogen only

16 Rubidium is in Group I and strontium is in Group II of the Periodic Table.

Which row describes the nature of rubidium oxide, Rb_2O, and strontium oxide, SrO?

	Rb_2O	SrO
A	acidic	acidic
B	acidic	basic
C	basic	acidic
D	basic	basic

17 Magnesium sulfate is a soluble solid which is formed when insoluble magnesium oxide reacts with dilute sulfuric acid.

Which method is used to prepare solid magnesium sulfate?

A Excess sulfuric acid is reacted with magnesium oxide. The mixture is evaporated to dryness.

B Excess sulfuric acid is reacted with magnesium oxide. The precipitate is filtered, washed and dried.

C Sulfuric acid is reacted with excess magnesium oxide. The mixture is filtered and the filtrate is evaporated to dryness.

D Sulfuric acid is reacted with excess magnesium oxide. The precipitate is filtered, washed and dried.

18 Q and R are elements in the same period of the Periodic Table.

Q has 7 electrons in its outer shell and R has 2 electrons in its outer shell.

Which statement about Q and R is correct?

A Q is a metal and R is a non-metal.

B Q and R have different numbers of electron shells.

C R is found to the right of Q in the Periodic Table.

D The proton number of R is less than the proton number of Q.

19 Which statement about alkali metals is correct?

A Lithium is more dense than sodium.

B Sodium is more reactive than potassium.

C Sodium has a higher melting point than potassium.

D They are in Group II of the Periodic Table.

20 Aqueous bromine is added to aqueous sodium iodide.

bromine + sodium iodide → .....1..... + ...2.....

What are the products of this reaction?

	1	2
A	iodide	sodium bromide
B	iodide	sodium bromine
C	iodine	sodium bromide
D	iodine	sodium bromine

21 Which row describes the properties of a transition element?

	melting point	density	forms coloured compounds
A	high	low	no
B	high	high	yes
C	low	low	no
D	low	low	yes

22 Which row describes the properties of argon?

	property 1	property 2
A	inert	diatomic
B	inert	monatomic
C	reactive	diatomic
D	reactive	monatomic

23 Which row identifies the properties of zinc?

	thermal conductivity	reacts with dilute acid
A	good	yes
B	good	no
C	poor	yes
D	poor	no

24 Uses of metals depend on their properties.

Which property is necessary for the use given?

	use of the metal	property of the metal
A	car bodies	ductile
B	cutlery	conducts heat
C	food containers	resists corrosion
D	overhead electrical cables	high density

25 Which compounds **both** contribute to acid rain?

A carbon monoxide and carbon dioxide

B carbon monoxide and oxides of nitrogen

C oxides of nitrogen and sulfur dioxide

D sulfur dioxide and carbon dioxide

26 P, Q, R and S are metals.

P reacts with dilute hydrochloric acid, forming hydrogen.

Q reacts violently with water.

R reacts with water to give hydrogen.

S is formed by heating its oxide with carbon.

Which row identifies the metals?

	P	Q	R	S
A	copper	sodium	potassium	iron
B	zinc	magnesium	calcium	iron
C	zinc	sodium	calcium	magnesium
D	iron	potassium	sodium	zinc

27 Which compound is formed when iron rusts?

A anhydrous iron(II) oxide

B anhydrous iron(III) oxide

C hydrated iron(III) hydroxide

D hydrated iron(III) oxide

28 Which reaction in the blast furnace releases heat energy?

A $C + O_2 \rightarrow CO_2$

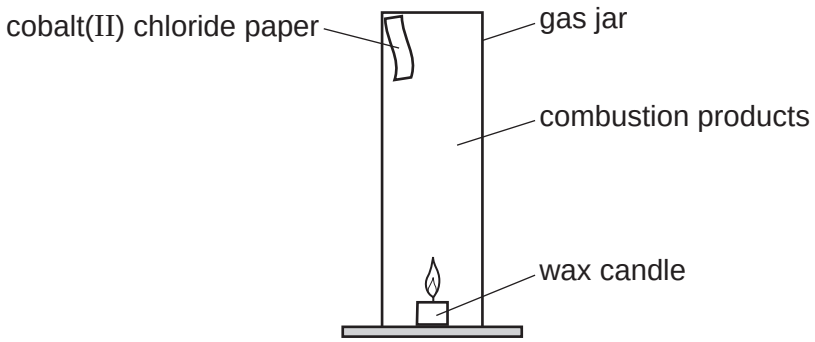
B $CaCO_3 \rightarrow CaO + CO_2$

C $CO_2 + C \rightarrow 2CO$

D $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

29 A wax candle is made from a mixture of hydrocarbons.

The candle is lit and placed in a gas jar along with a strip of cobalt(II) chloride test paper as shown.



After a short time, the oxygen in the jar is used up and the candle flame goes out.

Which substance does the cobalt(II) chloride paper identify?

A carbon dioxide

B carbon monoxide

C sulfur dioxide

D water

30 Urea, $CO(NH_2)_2$, is used as a fertiliser.

Which element that plants need for improved plant growth is provided by urea?

A carbon

B hydrogen

C nitrogen

D oxygen

31 The percentage composition of gases on Neptune is shown.

gas	percentage composition / %
hydrogen	80
helium	18
methane	1.5
other gases	0.5

Which statement about the atmospheres on Neptune and on the Earth is correct?

A There is more helium on Neptune than oxygen on the Earth.

B There is less methane on Neptune than carbon dioxide on the Earth.

C There is less hydrogen on the Earth than on Neptune.

D There is more helium on the Earth than on Neptune.

32 Which row shows the general formula for alkenes and for alcohols?

	alkenes	alcohols
A	C_nH_{2n}	$C_nH_{2n+1}COOH$
B	C_nH_{2n}	$C_nH_{2n+1}OH$
C	C_nH_{2n+2}	$C_nH_{2n+1}COOH$
D	C_nH_{2n+2}	$C_nH_{2n+1}OH$

33 A molecule has the formula C_2H_5Cl.

What is its chemical name?

A chloroethane

B chloroethanol

C chloroethene

D chloromethanol

34 Which compound rapidly decolourises aqueous bromine?

A ethane

B ethanoic acid

C ethanol

D ethene

35 Compound Z has the molecular formula C_2H_6O.

Which statement about compound Z is correct?

A Z is unsaturated.

B Z is a carboxylic acid.

C Z is formed by the reaction of ethane with steam.

D Z is used as a fuel.

36 What is the formula of the salt formed when aqueous ethanoic acid reacts with calcium carbonate?

A $Ca(CH_3COOH)_2$

B $Ca(CH_3COO)_2$

C Ca_2CH_3COOH

D Ca_2CH_3COO

37 Rock salt is a mixture of salt and sand.

The method used to separate the sand from the salt is listed.

step 1 Crush the rock salt, add to warm water and stir.

step 2 Pour the mixture through a filter paper held in a funnel.

step 3 Evaporate the water to crystallise the salt.

Which statement about the method is correct?

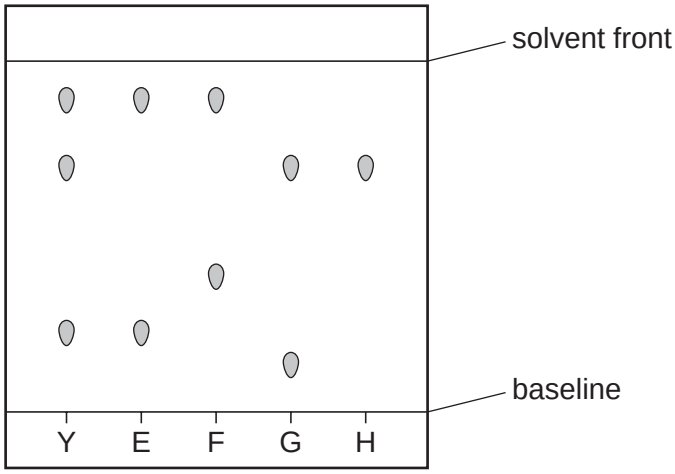
A The filtrate in step 2 is pure water.

B The residue in step 2 is pure crystals of salt.

C The solute is salt.

D The solvent is a mixture of salt and water.

38 Chromatography is carried out on mixture Y and dyes E, F, G and H. The chromatogram is shown.



Which dyes are present in mixture Y?

A E and G **B** E and H **C** F and G **D** F and H

39 A fractionating column is used to separate the hydrocarbon fractions in petroleum by fractional distillation.

Which row describes the properties of the fractions that condense at the top of the fractionating column?

	size of molecule	boiling point
A	large	high
B	large	low
C	small	high
D	small	low

40 When acid is added to salt X, a gas is produced which turns limewater milky.

When sodium hydroxide is added to salt X, a gas is produced which turns litmus paper blue.

What is X?

A $CaCO_3$ **B** $(NH_4)_2CO_3$ **C** NH_4NO_3 **D** $ZnCO_3$

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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.).