



Cambridge O Level

CHEMISTRY

5070/11

Paper 1 Multiple Choice

October/November 2023

1 hour

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 In which changes do the particles move further apart?

- 1 A gas is heated from 0 °C to 25 °C.
- 2 Pressure is applied to a gas at a constant temperature.
- 3 Steam condenses to form water.
- 4 Water evaporates at room temperature.

A 1 and 2

B 1 and 4

C 2 and 3

D 3 and 4

2 Data about two compounds is given. Both compounds have a simple molecular structure.

compound	melting point / °C	boiling point / °C
H ₂ S	-85	-61
PCl ₃	-112	76

Two bottles are placed, close together, inside a large container at a temperature of 90 °C. One bottle contains 1.0 g of H₂S, the other bottle contains 1.0 g of PCl₃.

A detector is placed in the container 2.0 m away from the two bottles. The two bottles are opened at the same time.

Which row is correct?

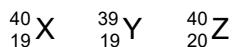
	compound that reaches detector first	explanation
A	H ₂ S	gases diffuse faster than liquids
B	H ₂ S	H ₂ S has a lower <i>M_r</i> than PCl ₃
C	PCl ₃	gases diffuse faster than liquids
D	PCl ₃	PCl ₃ has a lower <i>M_r</i> than H ₂ S

3 Substances can be elements, compounds or mixtures.

Which row is correct?

	element	compound	mixture
A	copper	brass	zinc
B	methane	carbon	petroleum
C	nitrogen	carbon dioxide	water vapour
D	oxygen	glucose	air

4 The letters X, Y and Z represent different atoms.



Which statement is correct?

- A X and Y are the same element.
- B X and Z are the same element.
- C X has more protons than Y.
- D Z has more neutrons than Y.

5 A student makes three statements.

- 1 Calcium ions have a 2+ charge and oxide ions have a 2– charge.
- 2 Magnesium ions and oxide ions have the same electronic configuration as neon.
- 3 Calcium ions have three full electron shells and magnesium ions have two full electron shells.

Which statements are correct?

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

6 Four statements about graphite, diamond and silicon(IV) oxide are listed.

- 1 Diamond and silicon(IV) oxide are both very hard and have similar structures.
- 2 In diamond, each carbon atom is joined to four other carbon atoms.
- 3 Silicon(IV) oxide forms a giant structure of silicon and oxygen atoms.
- 4 Diamond and graphite both conduct electricity because they are both forms of carbon.

Which statements are correct?

- A 1, 2 and 3
- B 1, 2 and 4
- C 1, 3 and 4
- D 2, 3 and 4

7 Which row is correct?

	compound	molecular formula
A	ammonia	NH_4
B	ethene	C_2H_6
C	methanol	CH_4O
D	propanoic acid	$\text{C}_3\text{H}_8\text{O}_2$

8 Compound Y is the only substance formed when 500 cm^3 of ammonia reacts with 250 cm^3 of carbon dioxide. All measurements are at r.t.p.

What is the formula of Y?

A $(\text{NH}_4)_2\text{CO}_3$
 B $\text{NH}_2\text{COONH}_4$
 C $(\text{NH}_2)_2\text{CO}$
 D $\text{NH}_4\text{COONH}_4$

9 How many sodium ions are there in 30 g of sodium sulfate?

A 1.52×10^{23} B 2.54×10^{23} C 6.02×10^{23} D 1.20×10^{24}

10 Three compounds are listed.

copper(II) nitrate, $\text{Cu}(\text{NO}_3)_2$

zinc sulfate, ZnSO_4

sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3$

Which row shows the element that is present in the greatest percentage by mass in each compound?

[relative formula masses, M_r : $\text{Cu}(\text{NO}_3)_2$, 188; ZnSO_4 , 161; $\text{Na}_2\text{S}_2\text{O}_3$, 158]

	copper(II) nitrate	zinc sulfate	sodium thiosulfate
A	copper	oxygen	oxygen
B	copper	oxygen	sulfur
C	oxygen	zinc	sodium
D	oxygen	zinc	sulfur

11 The complete combustion of 20 cm^3 of a gaseous alkane, X, requires 130 cm^3 of oxygen. Both volumes are measured at r.t.p.

What could be the identity of X?

A butane
 B ethane
 C methane
 D propane

12 Aqueous copper(II) sulfate is electrolysed with copper electrodes.

What is the equation for the reaction occurring at the anode?

- A $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
- B $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
- C $4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$
- D $2\text{SO}_4^{2-} + 2\text{H}_2\text{O} \rightarrow 2\text{H}_2\text{SO}_4 + \text{O}_2 + 4\text{e}^-$

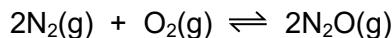
13 Three statements about fuel cells are given.

- 1 A hydrogen-oxygen fuel cell requires a continuous input of fuel and oxygen.
- 2 In a hydrogen-oxygen fuel cell, hydrogen is burned in oxygen to produce electricity.
- 3 When a hydrogen-oxygen fuel cell is operating, water is the only chemical product.

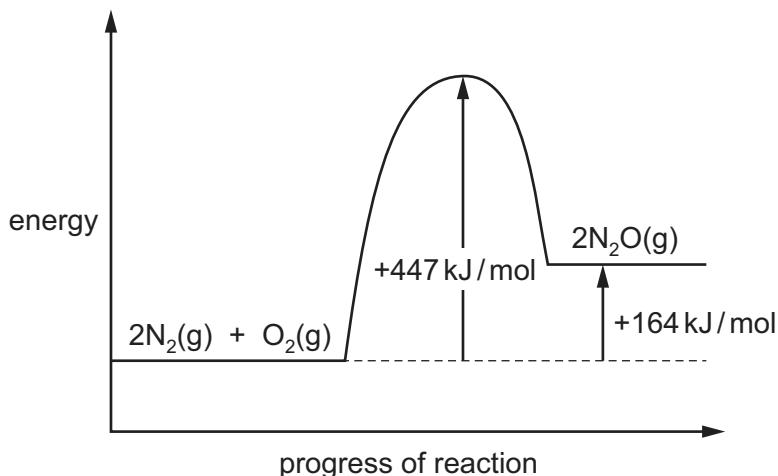
Which statements are correct?

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

14 Under certain conditions, nitrogen reacts with oxygen to form N_2O .



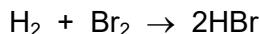
The reaction pathway diagram is shown.



What is the activation energy of the reverse reaction?

- A -447 kJ/mol
- B -283 kJ/mol
- C $+141.5 \text{ kJ/mol}$
- D $+283 \text{ kJ/mol}$

15 Hydrogen and bromine react to form hydrogen bromide.



Bond energy data is given in the table.

bond	bond energy in kJ/mol
H–H	436
Br–Br	193
H–Br	366

What is the enthalpy change, ΔH , for this reaction?

A -263 kJ/mol
 B -103 kJ/mol
 C $+103 \text{ kJ/mol}$
 D $+263 \text{ kJ/mol}$

16 Octane, C_8H_{18} , is a hydrocarbon.

When octane is mixed with an excess of oxygen, no change takes place unless energy is supplied.

If energy is supplied, in the form of heat or an electric spark, a change takes place quickly.

The products of this change include carbon dioxide.

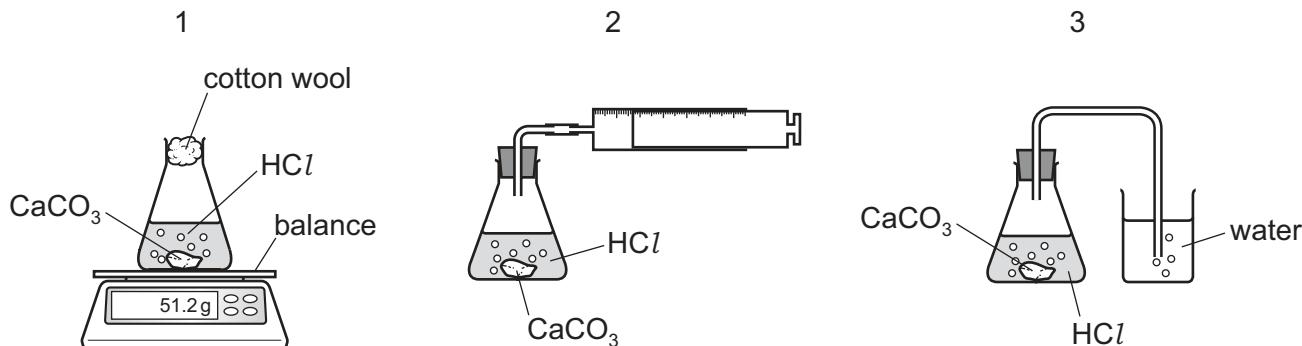
Which part of this description shows that the change is a **chemical** change?

A Octane is a hydrocarbon.
 B No change takes place unless energy is supplied.
 C The change takes place quickly.
 D Carbon dioxide is produced.

17 A student plans to investigate how the rate of the reaction changes when hydrochloric acid and calcium carbonate react.



Three methods are described.



Record the mass of the flask and contents every 30 seconds for 5 minutes.

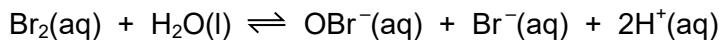
Measure and record the volume of gas in the syringe after 30 seconds.

Count and record the total number of bubbles of gas in the water every 30 seconds for 5 minutes.

Which methods could be used to measure how the rate of reaction changes?

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

18 Aqueous bromine is an equilibrium mixture.



Aqueous bromine is orange in colour. The species on the right-hand side of the equation are colourless.

Changes are made to three separate portions of the equilibrium mixture.

Which row shows how the colour of the mixture changes when a small amount of each substance is added?

	adding sulfuric acid	adding solid sodium bromide	adding water
A	darker orange	darker orange	darker orange
B	darker orange	darker orange	paler orange
C	darker orange	paler orange	darker orange
D	paler orange	darker orange	paler orange

19 In which substance does the nitrogen atom have the same oxidation number as the nitrogen atom in HNO_2 ?

Assume the following oxidation numbers for the other elements in these compounds: H, +1; F, -1; O, -2.

A NF_3 B NH_4^+ C NO D NO_2^+

20 Limewater is aqueous calcium hydroxide.

Which statement about limewater is correct?

A It has a pH below 7.
B It gives a blue-green colour in the flame test.
C It reacts with ammonia to form an ammonium salt.
D It turns yellow when methyl orange is added.

21 Which two oxides will both react with aqueous sodium hydroxide?

A calcium oxide and copper(II) oxide
B calcium oxide and zinc oxide
C copper(II) oxide and sulfur dioxide
D sulfur dioxide and zinc oxide

22 A solution of sodium carbonate is added to tap water.

A white precipitate forms.

Which ion present in the tap water causes the precipitate to form?

A chloride
B magnesium
C potassium
D sulfate

23 The characteristic properties of elements change from left to right across Period 2 of the Periodic Table.

On the left of the period, the charge on the ion formed by an element is:

- 1 the same as the group number
- 2 negative.

Which statements are correct?

A both 1 and 2

B 1 only

C 2 only

D neither 1 nor 2

24 Which statement about the Group VII halogens is correct?

A Bromine consists of Br_2 molecules at room temperature and pressure.

B Iodine will displace bromine from aqueous potassium bromide.

C The halogens become darker in colour as the relative molecular mass decreases.

D The halogens become more volatile as the relative molecular mass increases.

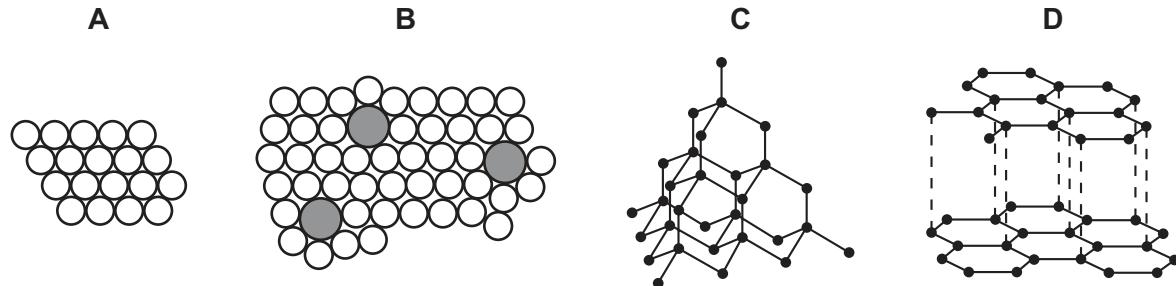
25 A power cable requires an element that:

- 1 conducts electricity
- 2 has a relatively low density
- 3 is ductile.

Which of these properties does aluminium have?

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

26 Which diagram represents the structure of an alloy?



27 Most metals react with oxygen in the air to form a metal oxide.

Which metal forms a metal oxide layer that reduces its apparent reactivity?

- A aluminium
- B copper
- C iron
- D silver

28 Which statement about corrosion of metals is correct?

- A A barrier method is needed to prevent the corrosion of stainless steel.
- B Iron corrodes to produce hydrated iron(I) oxide.
- C Sacrificial protection uses a less reactive metal attached to the metal object that is being protected.
- D When corrosion occurs, the metal loses electrons to become positive ions.

29 Some metals and the compounds in their ores are shown.

metal	Al	Ca	Pb	Na	Fe	Mg
compound in ore	Al_2O_3	$CaCO_3$	PbS	NaCl	Fe_2O_3	$MgCO_3$

Which type of reaction occurs in the extraction of each of these metals from its ore?

- A decomposition by heat
- B electrolysis
- C precipitation
- D reduction

30 Which statement about natural sources of water and the domestic water supply is correct?

- A Chlorine is used to remove tastes and odours in the treatment of the domestic water supply.
- B Metal compounds from detergents can deoxygenate natural sources of water.
- C Photosynthesis provides the oxygen needed for aquatic life in natural sources of water.
- D Sedimentation removes nitrates in the treatment of the domestic water supply.

31 Gases that may be present in the air are listed.

- 1 neon
- 2 carbon monoxide
- 3 nitrogen
- 4 methane

Which gases are atmospheric pollutants?

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

32 Which compounds are in the same homologous series?

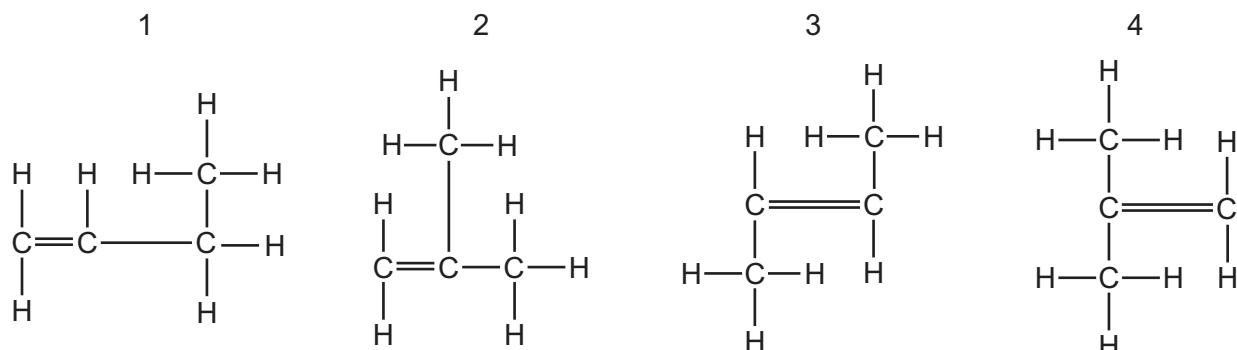
A $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$, $\text{CH}_3\text{CHCHCH}_3$ and $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_3$

B CH_2CHCH_3 , $\text{CH}_3\text{CH}_2\text{CHCH}_2$ and $\text{CH}_2\text{CHCH}_2\text{CH}_3$

C $\text{CH}_3\text{CHOHCH}_3$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{COOH}$

D $\text{CH}_3\text{CH}_2\text{CH}_3$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$ and $\text{CH}_2\text{CHCH}_2\text{CH}_2\text{CH}_3$

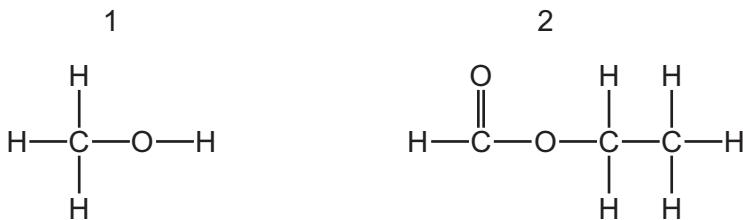
33 The diagrams show four structures of C_4H_8 .



Which structures represent the same molecule?

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

34 The displayed formulae of two organic compounds are shown.



What are the names of these compounds?

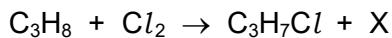
	compound 1	compound 2
A	methanoic acid	ethyl methanoate
B	methanoic acid	methyl ethanoate
C	methanol	ethyl methanoate
D	methanol	methyl ethanoate

35 Two products of the separation of petroleum are the lubricating oil fraction and the kerosene/paraffin fraction.

Which statement is correct?

- A** The lubricating oil fraction is more viscous than the kerosene/paraffin fraction.
- B** The lubricating oil fraction is more volatile than the kerosene/paraffin fraction.
- C** The lubricating oil fraction has lower boiling points than the kerosene/paraffin fraction.
- D** Molecules in the lubricating oil fraction have smaller chain lengths than molecules in the kerosene/paraffin fraction.

36 An incomplete equation for the reaction of propane with chlorine is shown.



A student writes three statements about this reaction.

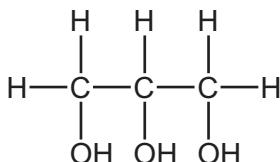
- 1 The activation energy for this reaction is provided by ultraviolet light.
- 2 $\text{C}_3\text{H}_7\text{Cl}$ has two different structural formulae.
- 3 X is an acidic gas.

Which statements are correct?

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

37 Glycerol is an alcohol with three –OH groups per molecule.

glycerol



What is the equation for the combustion of glycerol?

A $\text{C}_3\text{H}_8\text{O}_3 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$

B $2\text{C}_3\text{H}_8\text{O}_3 + 3\text{O}_2 \rightarrow 6\text{CO}_2 + 8\text{H}_2$

C $2\text{C}_3\text{H}_8\text{O}_3 + 7\text{O}_2 \rightarrow 6\text{CO}_2 + 8\text{H}_2\text{O}$

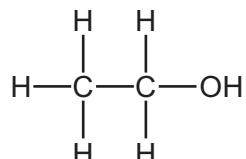
D $4\text{C}_3\text{H}_8\text{O}_3 + 11\text{O}_2 \rightarrow 12\text{CO}_2 + 10\text{H}_2\text{O}$

38 Compound X decolourises acidified aqueous potassium manganate(VII).

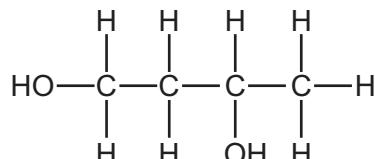
Compound X has the empirical formula $\text{C}_2\text{H}_5\text{O}$.

Some possible structures of X are shown.

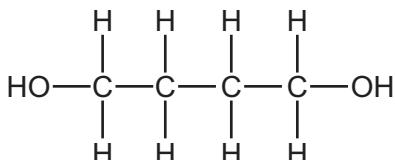
1



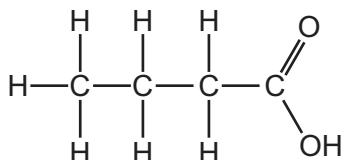
2



3



4



Which structures could be correct for compound X?

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

39 Which statement is correct?

A A filtrate is left on the filter paper during filtration.

B A saturated solution contains only substances with single bonds.

C A solute is a substance that dissolves a solvent.

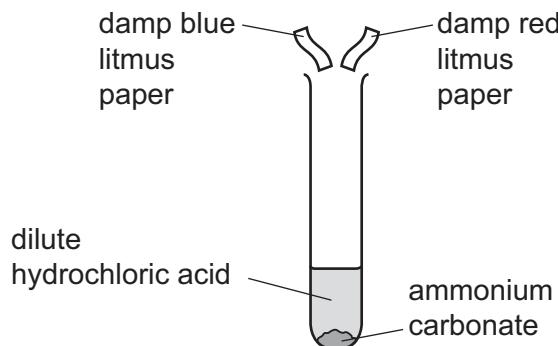
D A solution can never be described as pure.

40 A student does two experiments.

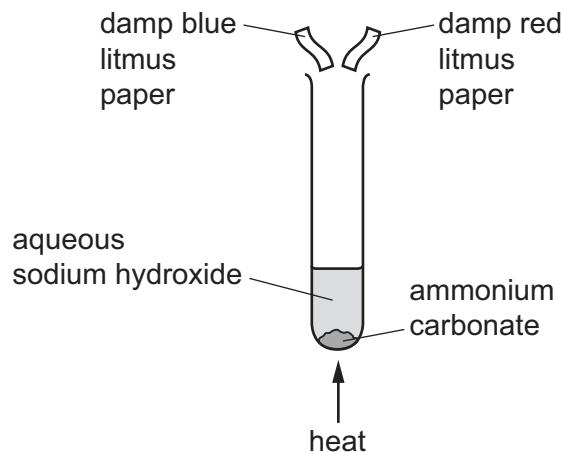
In experiment 1, ammonium carbonate is reacted with dilute hydrochloric acid.

In experiment 2, ammonium carbonate is heated with aqueous sodium hydroxide.

In each experiment, the gas evolved is tested with damp blue litmus paper and damp red litmus paper.



experiment 1



experiment 2

Which row correctly shows the colour of both pieces of litmus paper at the end of each experiment?

	experiment 1	experiment 2
A	blue	blue
B	blue	red
C	red	blue
D	red	red

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

The Periodic Table of Elements

I		II		Group																							
				I						II			III		IV		V		VI		VII		VIII				
3	Li	4	Be	5	Sc	6	Ti	7	V	8	Cr	9	Mn	10	Fe	11	Co	12	H	13	B	14	C	15	He	16	
lithium		beryllium		scandium	45	titanium	48	vanadium	51	chromium	52	manganese	55	iron	56	nickel	59	cobalt	59	hydrogen	1	boron	11	carbon	12	helium	4
7		9																									
11	Na	12	Mg	19	Ca	20	Sc	21	Ti	22	V	23	Cr	24	Mn	25	Fe	26	Co	27	Ni	28	Zn	29	Ge	30	
sodium		magnesium		calcium	40	strontium	39	yttrium	40	zirconium	41	niobium	42	mo	43	ruthe	44	Rh	45	Pd	46	Ag	47	Cd	48	As	49
23				potassium																							
39				rubidium	85	Y	89	yttrium	89	zirconium	91	niobium	93	molybdenum	96	technetium	—	Ru	101	Rhodium	103	Pd	106	Ag	108	Ge	111
				cesium	133	56	57-71	lanthanoids	72	73	Ta	74	W	75	Re	76	Os	77	Ir	78	Pt	79	Au	80	Hg	81	
				francium	—			lanthanoids		hafnium	178	tantalum	181	tungsten	184	rhenium	186	osmium	190	iridium	192	platinum	195	gold	197	mercury	201
87	Fr	88	Ra	89-103	Rf	104	Db	105	Sg	106	Bh	107	Hs	108	Mt	109	Ds	110	Rg	111	Cn	112	Nh	113	F	114	
francium		radium		actinoids		rutherfordium		dubnium		seaborgium		bohrium		—		meitnerium	—	darmstadtium	—	roentgenium	—	copernicium	—	nilonium	—	fermium	—
—		—																									

16

57	La	58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Ho	68	Er	69	Tm	70	Yb	71	Lu		
lanthanum	139		cerium	140	praseodymium	141	neodymium	144	promethium	—	europium	152	gadolinium	157	terbium	159	dysprosium	163	erbium	167	holmium	165	thulium	169	ytterbium	173	lutetium	175	—		
89	Ac	90	Th	91	Pa	92	U	93	Np	94	Am	95	Cm	96	Bk	97	Cf	98	Fm	99	Es	100	Md	101	No	102	Os	103	Fr	104	—
actinium	—		thorium	232	protactinium	231	uranium	238	neptunium	—	plutonium	—	curium	—	berkelium	—	californium	—	einsteinium	—	fermium	—	mendelevium	—	neobrium	—	—	—	lawrencium	—	—

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).