Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/13**

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.

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[Turn over

1 Nitrogen is heated in a balloon, which expands slightly.

Which statements about the molecules of nitrogen are correct?

1 They move further apart.

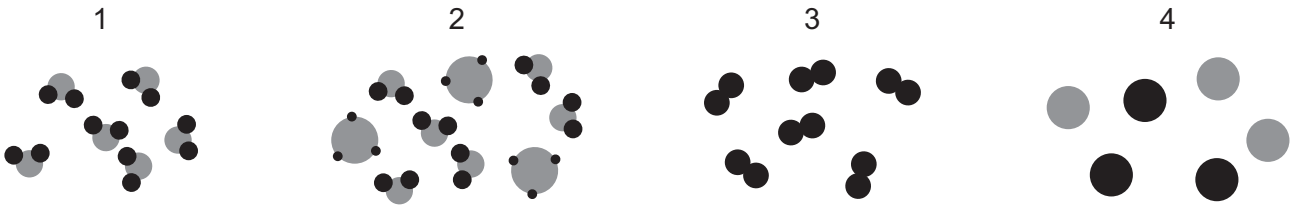
2 They move more quickly.

3 They remain the same distance apart.

4 Their speed remains unchanged.

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

2 The diagrams represent some elements, compounds and mixtures.



Which row describes the numbered substances?

	1	2	3	4
A	element	mixture of compounds	compound	mixture of elements
B	compound	mixture of compounds	element	mixture of elements
C	element	mixture of elements	compound	mixture of compounds
D	compound	mixture of elements	element	mixture of compounds

3 Two atoms, X and Y, have the same mass number but different atomic numbers.

Which statement about X and Y is correct?

A They have the same number of protons.

B They have the same number of electrons.

C They are in the same group of the Periodic Table.

D They have different numbers of neutrons.

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4 The symbols for two different isotopes of element S are shown.

$$^{m}_{n}S \qquad ^{p}_{q}S$$

The letters m, n, p and q represent whole numbers.

Which statements about the values of m, n, p and q are correct?

1 m = p

2 n = q

3 m > q

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

5 Which statement about potassium fluoride is correct?

A It can conduct electricity when it is solid.

B It dissolves in water.

C It has a low melting point.

D It is a molecule.

6 In which molecule are all the outer-shell electrons involved in covalent bonding?

A Cl_2 **B** CH_4 **C** HCl **D** NH_3

7 What is the formula of potassium oxide?

A P_2O **B** PO_2 **C** KO **D** K_2O

8 The compound magnesium nitrate has the formula $Mg(NO_3)_2$.

What is the relative formula mass of magnesium nitrate?

A 86 **B** 134 **C** 148 **D** 172

9 Dilute sulfuric acid is electrolysed using inert electrodes.

What is produced at the anode?

A hydrogen

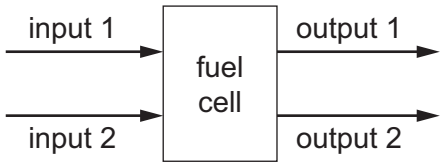
B oxygen

C sulfur

D sulfur dioxide

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10 The flow diagram represents a hydrogen–oxygen fuel cell.



Which row shows the inputs and outputs?

	input 1	input 2	output 1	output 2
A	electricity	electrolyte	hydrogen	oxygen
B	electricity	water	hydrogen	oxygen
C	fuel	hydrogen	water	electricity
D	fuel	oxygen	water	electricity

11 Which statement describes an exothermic reaction?

A Thermal energy is transferred to the surroundings leading to a decrease in the temperature of the surroundings.

B Thermal energy is transferred to the surroundings leading to an increase in the temperature of the surroundings.

C Thermal energy is taken in from the surroundings leading to an increase in the temperature of the surroundings.

D Thermal energy is taken in from the surroundings leading to a decrease in the temperature of the surroundings.

12 Which row shows the changes that **all** increase the rate of a chemical reaction?

	concentration of reactants	temperature	particle size
A	decrease	decrease	decrease
B	decrease	increase	increase
C	increase	decrease	increase
D	increase	increase	decrease

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13 A student heats hydrated copper(II) sulfate. The blue crystals change to a white powder.

How can the student reverse this reaction?

A Add anhydrous copper(II) sulfate to the white powder.

B Add water to the white powder.

C Cool the white powder.

D Reheat the white powder.

14 Acidified aqueous potassium manganate(VII) is a purple solution.

What does the (VII) in the name potassium manganate(VII) represent?

A the charge on the potassium ion

B the charge of the manganate ion

C the number of ions in the compound

D the oxidation number of manganese

15 Excess hydrochloric acid is added to aqueous sodium hydroxide containing thymolphthalein.

Which colour change is observed?

A blue to colourless

B colourless to blue

C red to yellow

D yellow to red

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16 Information about four oxides, J, K, L and M, is listed.

J releases ammonia when added to aqueous ammonium chloride.

K reacts with aqueous sodium hydroxide.

L is the oxide of a Group I element.

M is an oxide of an element in the top right section of the Periodic Table.

Which row is correct?

	acidic oxides	basic oxides
A	J and K	L and M
B	L and M	J and K
C	K and M	J and L
D	J and L	K and M

17 Three methods of preparing salts are listed.

1 acid + metal

2 acid + metal carbonate

3 acid + metal oxide

Which methods can be used to make copper(II) chloride?

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

18 Which set of elements shows the change from metallic to non-metallic character across a period of the Periodic Table?

A beryllium → magnesium → calcium

B fluorine → bromine → iodine

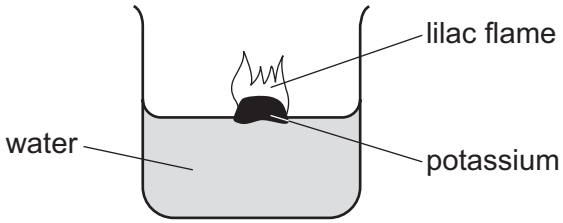
C oxygen → boron → lithium

D sodium → silicon → chlorine

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19 The diagram shows the reaction that occurs when potassium is dropped into water.

$$2K + 2H_2O \rightarrow 2KOH + H_2$$



Which row is correct?

	density of potassium	pH of resulting solution
A	high	above 7
B	high	below 7
C	low	above 7
D	low	below 7

20 Which statement about bromine is correct?

A Bromine has a greater density than chlorine.

B Bromine is a gas at room temperature and pressure.

C Bromine has a grey-black colour.

D Bromine is less reactive than iodine.

21 What is a typical property of transition elements?

A can act as catalysts

B poor electrical conductivity

C low melting point

D low density

22 Which description of elements in Group VIII of the Periodic Table is correct?

A They are diatomic.

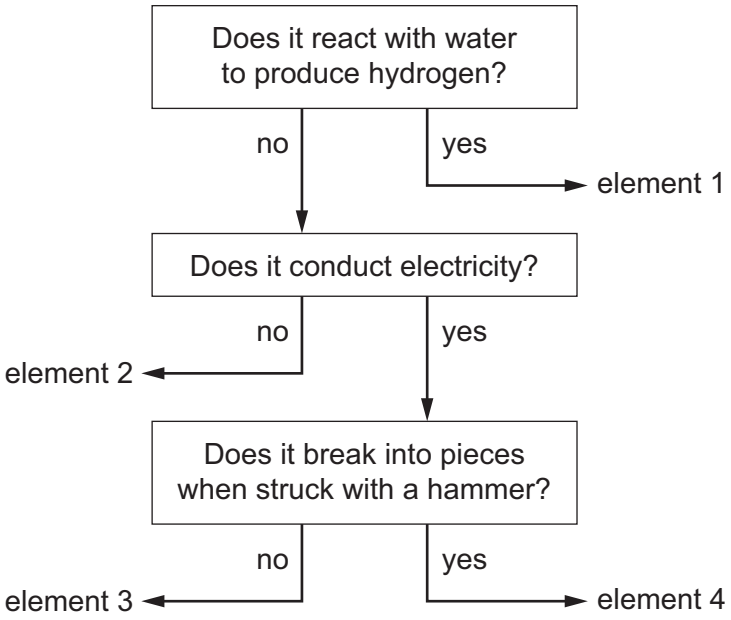
B All atoms have eight outer electrons.

C They have high melting points.

D They are unreactive.

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23 The flow chart shows some properties of four solid elements.



Which elements are non-metals?

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

24 Which statement about copper or aluminium is correct?

A Aluminium is more dense than copper.

B Aluminium is less reactive than copper.

C Copper has high ductility.

D Copper has poor electrical conductivity.

25 Water from a reservoir flows to the water works where purification process 1 takes place followed by process 2.

What are processes 1 and 2?

	process 1	process 2
A	chlorination	filtration
B	filtration	chlorination
C	fractional distillation	filtration
D	filtration	fractional distillation

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26 Calcium reacts with cold water to produce hydrogen.

Lead reacts slowly when heated in air to form an oxide but has almost no reaction with steam.

Silver does not react with either air or water.

Zinc reacts when heated with steam to produce hydrogen.

What is the order of reactivity starting with the least reactive?

	least reactive → most reactive			
A	calcium	lead	zinc	silver
B	calcium	zinc	lead	silver
C	silver	lead	zinc	calcium
D	silver	zinc	lead	calcium

27 Which statement about rusting is correct?

A Rust is anhydrous iron(II) oxide.

B Oxygen is required for iron to rust.

C Iron covered in grease rusts more quickly.

D Iron rusts more quickly in the absence of air.

28 Which statements about the extraction of iron in a blast furnace are correct?

1 The temperature inside the blast furnace is increased by burning carbon.

2 Iron(III) oxide is reduced to iron by carbon monoxide.

3 The thermal decomposition of calcium carbonate forms slag.

4 Slag reacts with acidic impurities.

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

29 Which statements about water are correct?

1 Tap water has fewer impurities than distilled water.

2 Tap water will turn anhydrous cobalt(II) chloride pink.

3 The domestic water supply is treated with carbon to kill microbes.

4 Phosphates from fertilisers can cause deoxygenation of water.

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

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30 Which substance is used by farmers to improve plant growth?

A ammonium nitrate

B phosphoric acid

C potassium

D sodium oxide

31 Three air pollutants, X, Y and Z, are described.

X is a toxic gas formed by the incomplete combustion of an alkane.

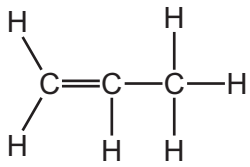
Y is formed by decomposing vegetation and increases global warming.

Z is a cause of breathing problems and acid rain.

Which pollutants are X, Y and Z?

	X	Y	Z
A	carbon monoxide	methane	oxides of nitrogen
B	carbon monoxide	particulates	carbon dioxide
C	sulfur dioxide	methane	oxides of nitrogen
D	sulfur dioxide	particulates	carbon dioxide

32 The displayed formula of an organic compound is shown.



To which homologous series does this compound belong?

A alcohols

B alkanes

C alkenes

D carboxylic acids

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33 Kerosene is one of the fractions of petroleum.

What is kerosene used for?

A jet fuel

B petrol

C road making

D waxes

34 A hydrocarbon P is cracked to make compound Q and hydrogen.

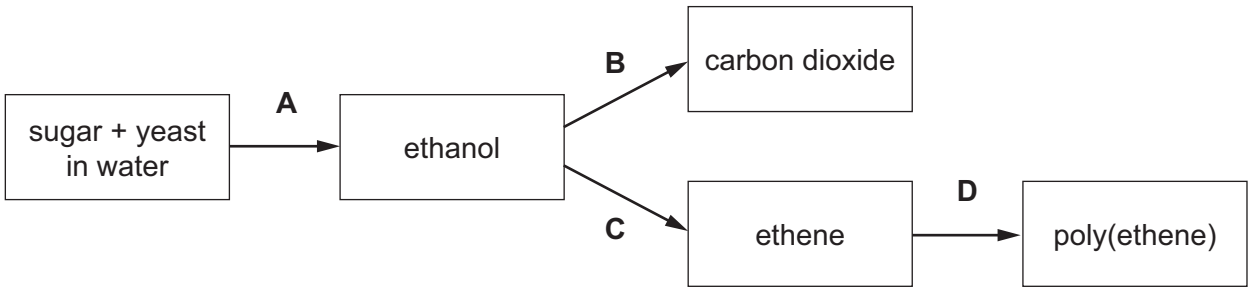
Compound R is formed by the addition polymerisation of compound Q.

To which homologous series do P, Q and R belong?

	alkene	alkane
A	P only	Q and R
B	Q only	P and R
C	P and Q	R only
D	P and R	Q only

35 Which process involves combustion?

(Some of the reaction products are **not** shown on the diagram.)



36 What are the products when ethanoic acid reacts with aqueous sodium hydroxide?

A carbon dioxide and water

B carbon dioxide and sodium ethanoate

C sodium ethanoate and hydrogen

D sodium ethanoate and water

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37 Which statements are correct?

1 The polymer of ethene is poly(ethane).

2 Monomers are small molecules.

3 Monomers join together to form polymers.

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

38 Dilute hydrochloric acid is titrated into a conical flask containing sodium hydroxide solution and a few drops of methyl orange indicator.

Which piece of apparatus is used to add the hydrochloric acid?

A beaker

B burette

C measuring cylinder

D pipette

39 What could be the melting point and boiling point of water containing a dissolved impurity?

	melting point / °C	boiling point / °C
A	+3	96
B	+3	104
C	–3	96
D	–3	104

40 Element X burns in air to form an acidic gas that decolourises potassium manganate(VII).

What is X?

A carbon

B nitrogen

C magnesium

D sulfur

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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.).