Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/11**

Paper 1 Multiple Choice **May/June 2021**

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.

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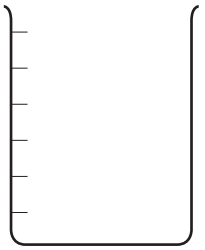
[Turn over

1 A student has to measure 28.2 cm^3 of aqueous sodium bromide.

Which piece of apparatus should the student select?

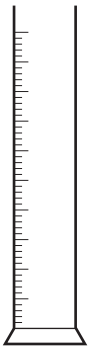
A



B

C

D



2 Which property of a liquid ester can be used to check its purity before use as a food flavouring?

A boiling point

B colour

C smell

D solubility in water

3 Which sequence of procedures is used to separate a pure, dry sample of hydrated copper(II) sulfate, $CuSO_4 \cdot 5H_2O$, from a mixture containing hydrated copper(II) sulfate and calcium carbonate, $CaCO_3$?

A dissolve in water → distillation → crystallisation

B dissolve in water → filtration → crystallisation

C distillation → crystallisation → heating to remove all water

D fractional distillation → filtration → heating to remove all water

4 J is an aqueous solution.

On addition of aqueous sodium hydroxide to J a green precipitate is formed.

The resulting mixture is heated and no gas is formed.

Aluminium foil is added to the warmed mixture. A gas is formed that turns damp red litmus paper blue.

Which ions could be present in J?

A Fe^{3+} and NH_4^+

B Fe^{3+} and NO_3^-

C Fe^{2+} and NH_4^+

D Fe^{2+} and NO_3^-

5 Gas X has the following properties.

1 colourless

2 no effect on either damp red or blue litmus papers

3 no effect on limewater

4 flammable

What is gas X?

A ammonia

B chlorine

C hydrogen

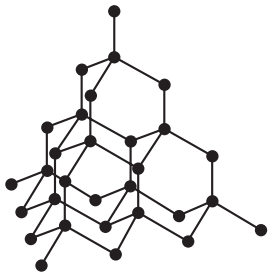
D oxygen

6 Which particle contains most electrons?

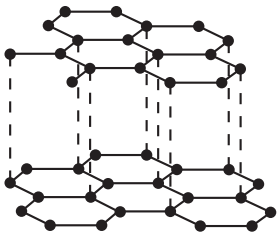
A O^{3-} **B** Ne **C** Na^- **D** Mg^{3+}

[Turn over

7 The diagrams show the structures of two solids, P and Q.



P



Q

Which row is correct?

	has covalent bonding	conducts electricity
A	P only	P only
B	P only	Q only
C	both P and Q	P only
D	both P and Q	Q only

8 What is a covalent bond?

A a pair of electrons shared by two non-metallic atoms

B electrons being shared by a lattice of positively charged ions

C elements losing electrons to achieve a noble gas structure

D oppositely charged particles strongly attracting each other

9 The empirical formula of compound X is CH_2 and the relative molecular mass, M_r, of X is 70.

What is the molecular formula of X?

A CH_2 **B** C_2H_4 **C** C_5H_{10} **D** C_nH_{2n}

10 A chemist wants to make calcium nitrate. They start with 8.00 g of pure calcium oxide and an excess of dilute nitric acid. They produce 12.65 g of pure, dry anhydrous calcium nitrate crystals.

What is the percentage yield of calcium nitrate?

[relative atomic masses, A_r: Ca, 40; N, 14; H, 1; O, 16]

A 54.0 **B** 63.2 **C** 67.1 **D** 86.8

11 The relative formula masses of four compounds are given.

A student has a 1.0 g sample of each compound.

Which sample contains the highest number of moles of oxygen atoms?

	compound	relative formula mass
A	Al_2O_3	102
B	CuO	80
C	H_2SO_4	98
D	HNO_3	63

12 How many elements combine to form the compound ammonium sulfate?

A 2 **B** 4 **C** 10 **D** 15

13 An aqueous mixture of copper(II) nitrate and silver nitrate is electrolysed with pure copper electrodes.

Which half-equation correctly describes the change occurring at the anode?

A $Cu \rightarrow Cu^{2+} + 2e^-$

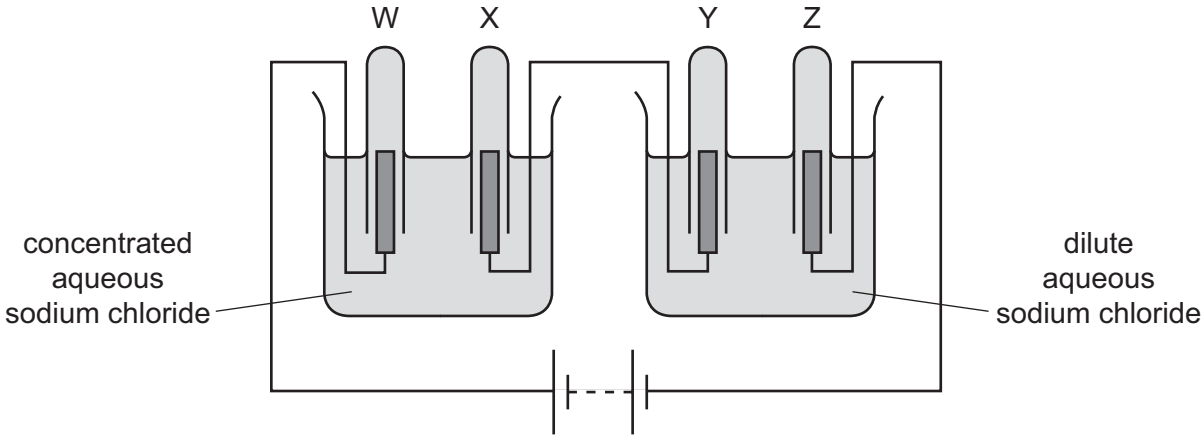
B $Cu^{2+} + 2e^- \rightarrow Cu$

C $Ag \rightarrow Ag^+ + e^-$

D $Ag^+ + e^- \rightarrow Ag$

[Turn over

14 The diagram shows the electrolysis of concentrated and dilute aqueous sodium chloride using inert electrodes. Gases are produced and collected in each of the test-tubes W, X, Y and Z.



Which statements are correct?

1 Approximately equal volumes of gas are produced and collected in test-tubes W and X.

2 Approximately equal volumes of gas are produced and collected in test-tubes Y and Z.

3 Three different gases are produced in the experiment.

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

15 Which positive ions are present in aqueous copper(II) sulfate?

A copper(II) ions only

B copper(II) ions and hydrogen ions

C sulfate ions only

D sulfate ions and hydroxide ions

16 These statements refer to hydrogen and its use as a fuel.

1 Both water and hydrocarbons can be used as a source of hydrogen.

2 In a fuel cell hydrogen reacts with oxygen to generate electricity.

3 The reaction taking place in a fuel cell is a redox reaction.

Which statements are correct?

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

17 Ethanol is produced by the fermentation of glucose from sugar cane. In some countries ethanol is used as a fuel.

Which statements are correct?

1 Sugar cane is a non-renewable (finite) resource.

2 When sugar cane is growing it removes carbon dioxide from the atmosphere.

A 1 only

B 2 only

C both 1 and 2

D neither 1 nor 2

18 Which changes will speed up a chemical reaction?

1 decreasing the pressure in a reaction between gases

2 increasing the size of the solid particles in a reaction involving solids

3 increasing the temperature of any reaction

4 increasing the concentration of a solution

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

[Turn over

19 Magnesium reacts with dilute sulfuric acid.

$$Mg(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2(g)$$

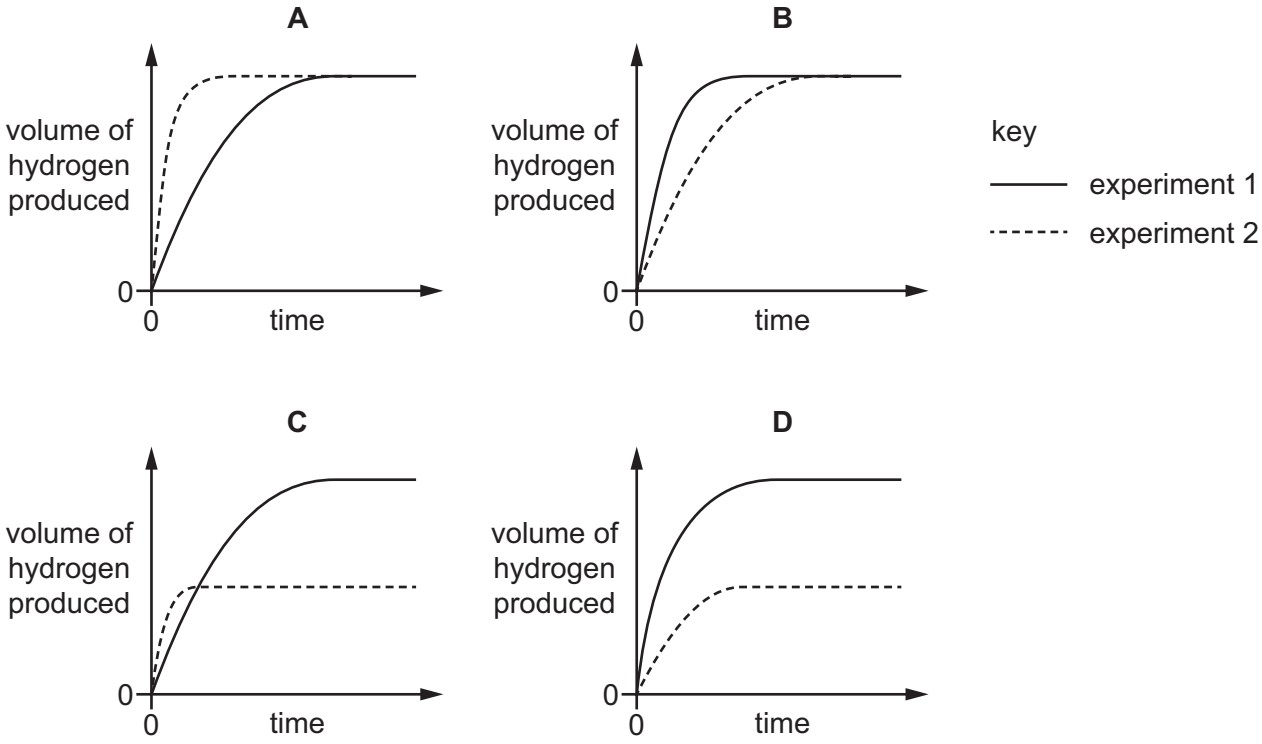
Two experiments are carried out at 25 °C.

experiment 1 24.0 g of powdered magnesium is reacted with 100 cm^3 of 1.0 mol/dm^3 sulfuric acid.

experiment 2 24.0 g of powdered magnesium is reacted with 50 cm^3 of 2.0 mol/dm^3 sulfuric acid.

During each experiment the volume of hydrogen produced is measured. The results are plotted on a graph.

Which graph is correct?



20 In which equations is the change in the underlined species correct?

1 $\underline{C}H_4 + 2O_2 \rightarrow \underline{C}O_2 + 2H_2O$ (oxidation)

2 $2H_2\underline{S} + SO_2 \rightarrow 3\underline{S} + 2H_2O$ (reduction)

3 $BrO_3^- + 5\underline{Br}^- + 6H^+ \rightarrow 3\underline{Br}_2 + 3H_2O$ (reduction)

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

21 The Haber process converts nitrogen and hydrogen into ammonia.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Which row is correct?

	change in condition	position of equilibrium
A	pressure is increased	moves to the left
B	pressure is reduced	no change
C	catalyst present	moves to the right
D	catalyst present	no change

22 Which row shows the pH values for $0.1\,mol/dm^3$ solutions of ammonia, hydrochloric acid, sodium chloride and sodium hydroxide?

	pH values			
	NH_3	HCl	$NaCl$	NaOH
A	1	7	13	11
B	7	1	11	13
C	11	1	7	13
D	13	11	7	1

23 The water in a lake is acidic and the fish are dying. The water in the lake needs to be neutralised.

Which compound can be added in excess to neutralise the water in the lake?

A calcium carbonate

B phosphoric acid

C potassium hydroxide

D sodium nitrate

[Turn over

24 Two incomplete statements about the preparation of an insoluble salt are given.

.....1..... can be used to prepare insoluble salts, such as .....2..... .

The salt is collected by ..... 3..... and it is then .....4..... .

Which words correctly complete gaps 1–4?

	1	2	3	4
A	precipitation	barium nitrate	filtration	evaporated
B	precipitation	lead sulfate	evaporation	washed and dried
C	precipitation	lead sulfate	filtration	washed and dried
D	titration	barium nitrate	evaporation	washed and dried

25 The Haber process is used to make ammonia at a temperature of 400 °C and a pressure of 20 000 kPa. The temperature is changed to 500 °C but the pressure is kept the same.

What will be the effects of this change on the production of ammonia?

A It is made at an increased rate and the position of the equilibrium moves to the left.

B It is made at an increased rate and the position of the equilibrium moves to the right.

C It is made at a decreased rate and the position of the equilibrium moves to the left.

D It is made at a decreased rate and the position of the equilibrium moves to the right.

26 Some properties which indicate the differences in elements are listed.

1 metallic character

2 number of electron shells in an atom

3 number of protons in an atom

4 total number of electrons in an atom

Which two properties increase across a period of the Periodic Table?

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

27 Elements X and Y combine to form an ionic compound.

Atoms of X have more protons than atoms of Y.

Atoms of Y have more valence electrons than atoms of X.

Which statement is correct?

A Ions of X are negatively charged.

B Atoms of X have more electron shells than atoms of Y.

C X and Y are in the same period of the Periodic Table.

D X and Y are in the same group of the Periodic Table.

28 The elements in Group I of the Periodic Table show trends in both their reactivities and their melting points. Rubidium is in Group I.

Which statement about rubidium is correct?

A It has a higher melting point than potassium.

B It reacts with water to produce an acidic solution.

C It reacts with water to produce oxygen gas.

D It is more reactive than potassium.

29 The properties of four substances are shown.

Which substance is a metal?

A It conducts electricity when dissolved in water but not when solid.

B It has a high melting point and conducts heat when solid.

C It has a low melting point and is brittle.

D It has a giant covalent structure with a high melting point.

[Turn over

30 Group I elements and transition elements are metals.

Student X suggests that the Group I elements are above hydrogen in the metal reactivity series but that not all transition elements are.

Student Y suggests that the densities of Group I elements are lower than those of the transition elements.

Which students are correct?

A both X and Y

B X only

C Y only

D neither X nor Y

31 Tin is more reactive than lead but less reactive than iron.

Which method would be most suitable for extracting tin from its ore?

A electrolysis

B heating alone

C heating with carbon

D reacting with hydrogen

32 Attaching pieces of magnesium to underground iron pipes can protect the iron from corrosion.

Which reaction protects the iron from corrosion?

A $Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$

B $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

C $Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$

D $Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$

33 Which reactions take place during the extraction of aluminium from aluminium oxide using carbon electrodes?

1 $2O^{2-} \rightarrow O_2 + 4e^-$

2 $C + O_2 \rightarrow CO_2$

3 $Al^{2+} + 2e^- \rightarrow Al$

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

34 Which statement about gases in the atmosphere is correct?

A Carbon monoxide is a pollutant which causes acid rain.

B Catalytic converters reduce carbon monoxide to carbon dioxide.

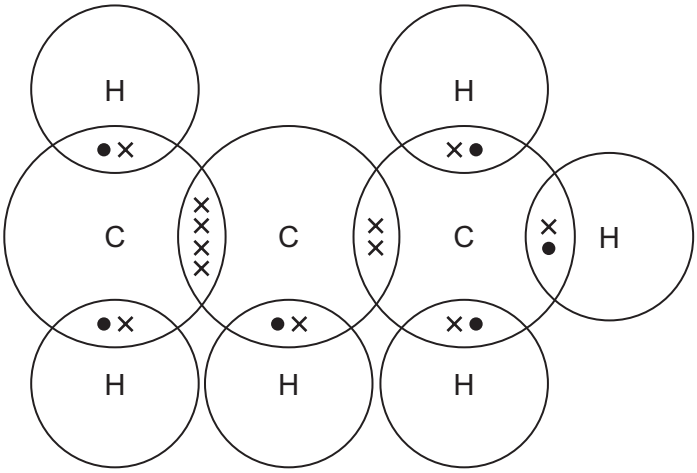
C Methane in the atmosphere depletes the ozone layer.

D Photosynthesis adds oxygen to the atmosphere.

35 How many moles of hydrogen chloride are formed when one mole of methane reacts with a large excess of chlorine in sunlight?

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

36 Compound X is shown in the dot-and-cross diagram.



Which statement about compound X is correct?

A It is a saturated hydrocarbon.

B It is an isomer of butene.

C It will decolourise bromine water.

D Its name is propane.

37 Which statements about alcohols are correct?

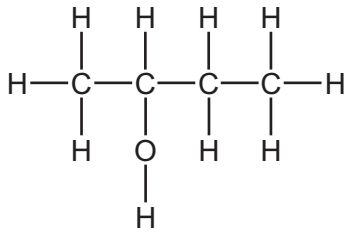
1 All alcohols contain the hydroxide ion, OH^-.

2 Ethanol can be formed from ethene using a reaction catalysed by yeast.

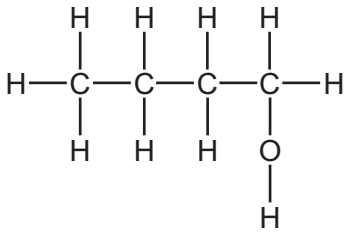
3 Methanol can be oxidised to methanoic acid.

4 The alcohols X and Y shown are isomers.

X



Y



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

38 An ester has the formula $C_2H_5COOC_2H_5$.

Which pair of compounds would react together to form this ester?

A ethanoic acid and ethanol

B ethanol and propanoic acid

C propanoic acid and propanol

D propanol and ethanoic acid

39 Which statement about polymers is correct?

A Nylon and *Terylene* are both polyesters.

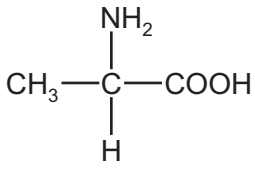
B Proteins and nylon have the same monomer units.

C Proteins have the same amide linkages as nylon.

D *Terylene* and fats are esters but with different linkages.

40 X is a polymer.

When X is hydrolysed one of the products is substance Y.



Y

Which type of polymer is X?

A a complex carbohydrate

B a fat

C a protein

D an addition polymer

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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).