CAMBRIDGE
International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3043433360

CHEMISTRY **5070/21**

Paper 2 Theory **May/June 2026**

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen. Do **not** use correction fluid or tape.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].
- The Periodic Table is printed in the question paper.

This document has **16** pages. Any blank pages are indicated.

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1 Choose from the following compounds to answer the questions.

$AlCl_3$

CH_4

C_2H_4

CO_2

KBr

NH_2OH

NO

Na_2O

SO_2

ZnO

Each compound can be used once, more than once or not at all.

State which compound:

(a) is amphoteric

..... [1]

(b) has a molecule with only three atoms

..... [1]

(c) has a molecule with only 18 electrons

..... [1]

(d) has an element with an oxidation number of +2

..... [1]

(e) is unsaturated.

..... [1]

[Total: 5]

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2 Sodium azide, NaN_3, decomposes when heated to make sodium and nitrogen.

$$2NaN_3(s) \rightarrow 2Na(s) + 3N_2(g)$$

(a) A sample of 13.6 g of sodium azide is fully decomposed.

Calculate the volume of nitrogen, measured at r.t.p., that is formed.

Give your answer to **three** significant figures.

volume of nitrogen = ... dm^3 [3]

(b) Sodium azide has a giant ionic lattice.

(i) Explain what is meant by the term giant ionic lattice.

.....

..... [1]

(ii) Predict **two** physical properties of sodium azide.

1 .....

2 .....

[2]

(iii) Deduce the formula of an azide ion.

..... [1]

(c) Describe the separation, arrangement and motion of the molecules in nitrogen gas.

.....

.....

.....

.....

.....

..... [3]

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(d) Draw a dot-and-cross diagram to show the electronic configuration in a molecule of nitrogen.

Show only the outer shell electrons.

[1]

(e) Explain why nitrogen has a very low boiling point.

.....

..... [1]

[Total: 12]

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3 Hydrogen reacts with oxygen to make water.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

Figure 3.1 shows the reaction pathway diagram for this reaction.

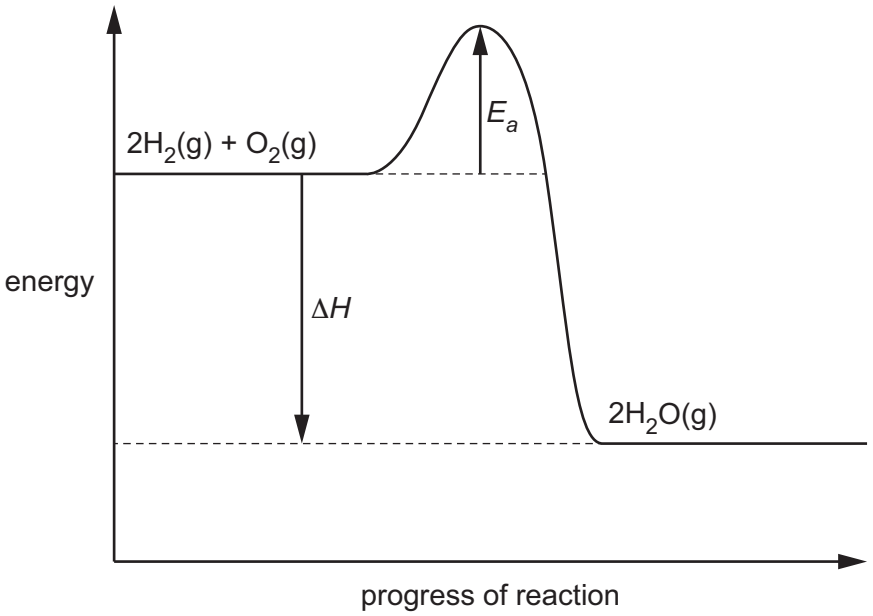

Figure 3.1

(a) The reaction is exothermic.

(i) Explain how the reaction pathway diagram shows that the reaction is exothermic.

.....

..... [1]

(ii) Explain why the reaction is exothermic.

Use ideas about bond breaking and bond making.

.....

.....

..... [2]

(b) Explain what is meant by the term activation energy, E_a, used in Figure 3.1.

.....

.....

..... [1]

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(c) The equation for the overall chemical reaction that takes place within a hydrogen–oxygen fuel cell is shown.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$$

Describe one advantage and one disadvantage of using a hydrogen–oxygen fuel cell to power a motor vehicle rather than using a gasoline engine.

advantage .....

.....

disadvantage .....

.....

[2]

(d) The rate of reaction between hydrogen gas and oxygen gas decreases when the pressure is decreased at constant temperature.

Explain why.

.....

.....

..... [2]

(e) The rate of reaction between hydrogen gas and oxygen gas decreases when the temperature is decreased at constant pressure.

Explain why.

.....

.....

..... [2]

[Total: 10]

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4 Potassium iodide is an ionic compound.

(a) Concentrated and dilute aqueous potassium iodide are separately electrolysed using graphite electrodes.

Complete Table 4.1 about the products of the two electrolysis reactions.

Table 4.1

	concentrated aqueous potassium iodide	**dilute aqueous potassium iodide**
product formed at anode		
product formed at cathode		

[4]

(b) Molten potassium iodide is electrolysed using graphite electrodes.

Construct ionic half-equations to show the reactions at the anode and at the cathode.

anode .....

cathode .....

[2]

(c) State **two** reasons why graphite is a suitable material for the electrodes used in electrolysis.

1 .....

2 .....

[2]

(d) The ionic equation for the reaction between aqueous potassium iodide and aqueous copper(II) chloride is shown.

$$4I^- + 2Cu^{2+} \rightarrow 2CuI + I_2$$

(i) State the oxidation number of copper in copper(II) chloride.

..... [1]

(ii) The reaction is an example of a redox reaction.

Explain how the equation shows that both oxidation and reduction take place during the reaction.

oxidation .....

.....

reduction .....

.....

[2]

[Total: 11]

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5 Aluminium sulfate is prepared by reacting excess aluminium with hot dilute sulfuric acid.

$$2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$$

(a) Use the equation to predict one observation made during this reaction.

..... [1]

(b) Explain why an excess of aluminium is used in this preparation.

..... [1]

(c) A sample of 3.24 g of aluminium is added to 50.0 cm^3 of 2.50 mol / dm^3 sulfuric acid.

Show by calculation that the aluminium is in excess.

[3]

(d) Describe how excess aluminium is removed from the reaction mixture.

..... [1]

(e) Describe how pure dry aluminium sulfate crystals are prepared from aqueous aluminium sulfate.

.....

.....

.....

.....

..... [3]

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(f) The formula of aluminium sulfate crystals is $Al_2(SO_4)_3 \bullet 16H_2O$.

Calculate the percentage by mass of water of crystallisation in these crystals.

percentage by mass = ... [3]

(g) Describe the effect of adding aqueous sodium hydroxide drop by drop until in excess to a sample of aqueous aluminium sulfate.

.....

.....

..... [2]

[Total: 14]

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6 Iron is a transition element.

Iron has good electrical conductivity.

(a) State **two** chemical properties that are typical of a transition element.

1 .....

2 .....
[2]

(b) Explain why iron has good electrical conductivity.

Use ideas about structure and bonding.

.....

..... [1]

(c) Iron is used to make stainless steel.

(i) Name **two** elements that are mixed with iron to make stainless steel.

1 .....

2 .....
[2]

(ii) Stainless steel is used to make cutlery because it is hard.

Explain why stainless steel is harder than pure iron.

Use ideas about structure and bonding.

.....

.....

.....

..... [2]

(iii) Describe the extraction of iron from hematite in the blast furnace.

You may include word equations in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 12]

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7 Proteins are natural condensation polymers.

Figure 7.1 shows a section of a protein.

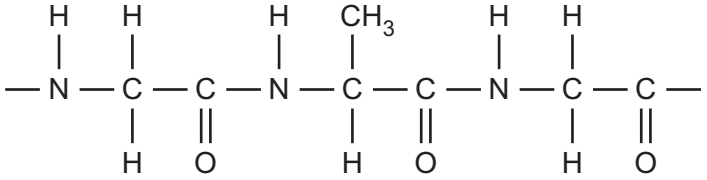

Figure 7.1

(a) Define the term condensation in the phrase condensation polymerisation.

.....

..... [1]

(b) **(i)** Name the type of monomer used to make proteins.

..... [1]

(ii) Draw the general structure of the monomer used to make proteins.

[1]

(iii) Proteins contain the amide linkage.

Circle an amide linkage on Figure 7.1. [1]

(c) Nylon is a synthetic polyamide.

(i) Name the **two** types of monomer that are used to make nylon.

..... and ..... [2]

(ii) Describe **one** environmental challenge caused by the disposal of plastics such as nylon.

..... [1]

[Total: 7]

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8 This question is about alcohols.

(a) Describe the manufacture of ethanol from ethene.

Include a symbol equation and the conditions for the manufacture.

.....

.....

.....

..... [3]

(b) Draw the displayed formula of butan-2-ol.

[1]

(c) Ethanol reacts with propanoic acid to form an ester.

(i) State the name of this ester.

..... [1]

(ii) Draw the structural formula of this ester.

[1]

(iii) State **one** condition needed for this esterification reaction.

..... [1]

(d) Deduce the molecular formula of an unbranched alcohol that has only eight carbon atoms in its molecule and only one alcohol functional group.

..... [2]

[Total: 9]

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The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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.).

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