Smart Edge!
More Than Knowledge

EDEXCEL · GCSE CHEMISTRY 1CH0

Higher Tier — Paper 1

June 2025 exam series

QUESTION PAPER

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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Monday 19 May 2025

Morning (Time: 1 hour 45 minutes)

Paper reference **1CH0/1H**

Chemistry

PAPER 1

Higher Tier

You must have:
Calculator, ruler, Periodic Table (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

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Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) Figure 1 shows a chemical cell.

The chemical cell contains two metal electrodes placed into an electrolyte and connected in a circuit with a voltmeter.

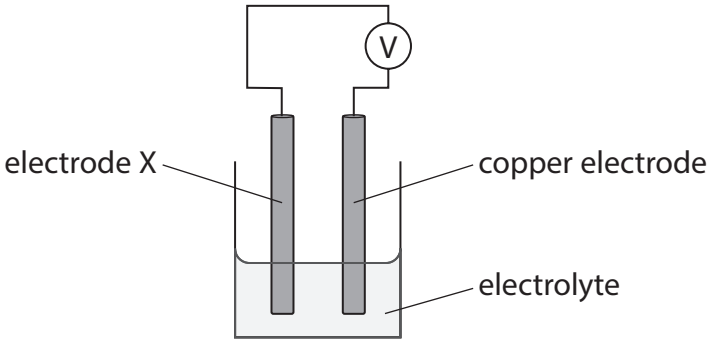

Figure 1

(i) State what type of compound must be present in the electrolyte.

(1)

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.....

(ii) When the two metal electrodes are placed in the electrolyte, a voltage is produced.

The bigger the difference in reactivity of the metals, the larger the voltage produced.

Which metal, when used for electrode X in Figure 1, would give the largest voltage?

(1)

☒ **A** copper

☒ **B** gold

☒ **C** magnesium

☒ **D** zinc

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(iii) State what happens to the voltage when one of the reactants is used up.

(1)

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(b) Hydrogen-oxygen fuel cells can also be used to produce a voltage.

(i) Draw the dot and cross diagram for a molecule of oxygen, O_2.

An atom of oxygen has the electronic configuration of 2.6.

Show outer electrons only.

(2)

(ii) Hydrogen-oxygen fuel cells are used in spacecraft.

Suggest **one advantage** of using fuel cells rather than chemical cells in spacecraft.

(1)

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(Total for Question 1 = 6 marks)

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2 (a) Atoms of neon are made up of subatomic particles.

(i) Figure 2 shows some information about the subatomic particles in neon atoms.

Complete Figure 2 with the missing information.

(3)

subatomic particle	relative charge	relative mass
proton	.....	1
neutron	0	.....
electron	.....	negligible

Figure 2

(ii) All atoms of neon have an atomic number of 10.

Describe what information about the number of subatomic particles can be obtained from the atomic number of neon.

(2)

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(iii) Explain why atoms of neon are electrically neutral.

(2)

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(b) A sample of neon contains three isotopes

90.48% of neon-20

0.27% of neon-21

9.25% of neon-22

Using this information, calculate the relative atomic mass of this sample of neon.

(2)

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relative atomic mass = ...

(Total for Question 2 = 9 marks)

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3 Silver nitrate and potassium chloride are ionic compounds that are soluble in water.

(a) When potassium chloride solution is added to a solution of silver nitrate, a white precipitate forms.

(i) Complete the equation for this reaction, including the missing state symbol.

(2)

$AgNO_3(aq) + KCl(.....) \rightarrow AgCl(s) + ... (aq)$

(ii) Give the name of the white precipitate that forms.

(1)

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(iii) State and explain how the white precipitate can be separated from the reaction mixture.

(3)

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(b) Silver nitrate solution conducts electricity.
Solid silver also conducts electricity.

Describe how silver nitrate solution conducts electricity and how solid silver conducts electricity.

(3)

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(Total for Question 3 = 9 marks)

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4 Phosphoric acid is important in the production of fertilisers.

(a) (i) A few drops of litmus solution are added to a sample of dilute phosphoric acid.

What is the colour of the mixture formed?

(1)

- ☒ **A** colourless
- ☒ **B** green
- ☒ **C** purple
- ☒ **D** red

(ii) State why litmus cannot be used to measure pH.

(1)

.....

.....

(b) Phosphoric acid can react to form phosphate salts which are used in fertilisers.

Give **two** reasons why farmers use fertilisers on their fields.

(2)

1 .....

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2 .....

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(c) An experiment was carried out to produce phosphoric acid.

(i) The actual yield for the experiment was 18.62 g.

The theoretical yield for the experiment is 24.50 g.

$$\text{percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

Calculate the percentage yield of this experiment.

(2)

percentage yield = ...

(ii) The equation for a reaction to make phosphoric acid, H_3PO_4, is

$$Ca_5(PO_4)_3OH + 5H_2SO_4 \rightarrow 3H_3PO_4 + 5CaSO_4 + H_2O$$

Calculate the atom economy for the production of phosphoric acid in this reaction.

$$\text{atom economy (\%)} = \frac{\text{total formula mass of desired product}}{\text{total formula mass of all reactants or products}} \times 100$$

(relative formula masses: $Ca_5(PO_4)_3OH = 502$, $H_2SO_4 = 98$, $H_3PO_4 = 98$, $CaSO_4 = 136$, $H_2O=18$)

(3)

atom economy = ... %

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(iii) The equation for a reaction to produce phosphoric acid is

$$Ca_5(PO_4)_3OH + 5H_2SO_4 \rightarrow 3H_3PO_4 + 5CaSO_4 + H_2O$$

Explain how the atom economy of the reaction can be increased.

(2)

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(Total for Question 4 = 11 marks)

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5 Nitrogen, N_2, oxygen, O_2 and fluorine F_2 are all gases.

(a) Nitrogen, oxygen and fluorine are in the same period of the periodic table.

Explain, in terms of electronic configuration, in which period of the periodic table nitrogen, oxygen and fluorine are located.

(2)

(b) Fluorine has a boiling point of –188 °C.

(i) Explain why fluorine has a low boiling point.

(3)

(ii) A mixture of nitrogen and oxygen becomes a liquid when cooled to –200 °C.

Which row shows the changes in energy and movement of the molecules as they are cooled from room temperature to –200 °C?

(1)

		movement of molecules	energy of molecules
☒	**A**	less	more
☒	**B**	more	less
☒	**C**	less	less
☒	**D**	more	more

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(iii) The mixture of liquid nitrogen and liquid oxygen can be separated.

Which process could be used to separate a mixture of liquid nitrogen and liquid oxygen?

(1)

☒ **A** paper chromatography

☒ **B** fractional distillation

☒ **C** filtration

☒ **D** crystallisation

(c) At high temperatures, nitrogen, N_2, can react with oxygen, O_2, to form nitrogen dioxide only.

Write the balanced equation for this reaction.

(2)

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(Total for Question 5 = 9 marks)

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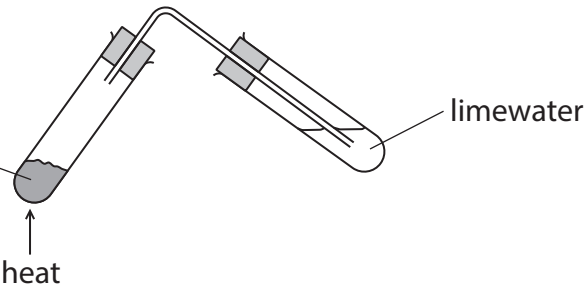
6 Malachite, $Cu_2CO_3(OH)_2$, is a mineral containing copper.

(a) When heated, malachite decomposes to form copper oxide, carbon dioxide and water.

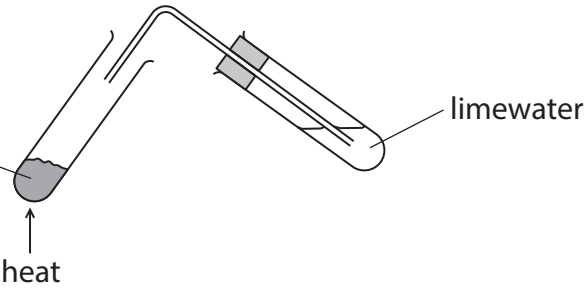
(i) Which apparatus should be used to heat the malachite and test for carbon dioxide?

(1)

☒ **A**



☒ **B**



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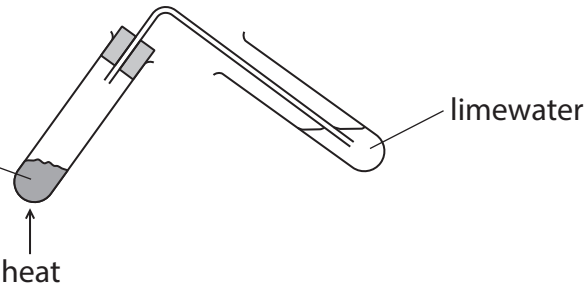
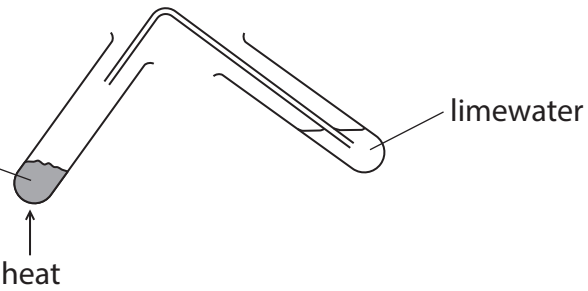


☒ **D**



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(ii) When carbon dioxide is bubbled through limewater, a precipitate forms. This precipitate solid makes the limewater cloudy.

Name the precipitate that makes the limewater cloudy.

(1)

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(iii) The equation for the decomposition of malachite when it is heated is

$$Cu_2CO_3(OH)_2 \rightarrow 2CuO + CO_2 + H_2O$$

Calculate the maximum mass of copper oxide that can be formed when 22.1 g of malachite is decomposed completely.

(relative atomic masses: Cu = 63.5, O = 16.0, C = 12.0, H = 1.0)

(4)

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maximum mass of CuO = ... g

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(b) Copper can be extracted from copper oxide by heating the copper oxide with carbon.

A student investigated two methods to extract the maximum mass of copper from copper oxide.

Figure 3 shows the two methods.

method 1	method 2
step 1 place one spatula measure of copper oxide into a beaker **step 2** mix the copper oxide thoroughly with carbon powder **step 3** place the mixture into a metal crucible and heat the mixture with a roaring Bunsen flame	**step 1** place one spatula measure of copper oxide into a glass test tube **step 2** carefully add carbon powder on top of the copper oxide **step 3** heat the two layers with a roaring Bunsen flame

Figure 3

Comment on the strengths and weaknesses of these two methods.

(3)

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(Total for Question 6 = 9 marks)

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7 Copper, iron, nickel and zinc are all metallic elements.

(a) Which row of the table applies to copper?

(1)

	type of metal	property
☒ **A**	it is an alkali metal	it has a low melting point
☒ **B**	it is an alkali metal	it forms coloured compounds
☒ **C**	it is a transition metal	it has a high melting point
☒ **D**	it is a transition metal	it forms coloured compounds

(b) Many ships are made of steel.
Steel is an alloy that contains iron.
Figure 4 shows blocks of zinc attached to a steel ship.

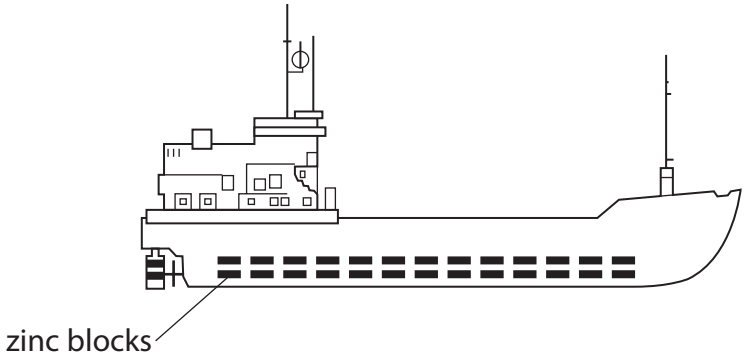

Figure 4

Explain how iron is protected from rusting by the zinc blocks.

(3)

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(c) Alloys of copper and nickel are used for some coins.

Figure 5 shows the relative strengths of copper and nickel and some of their alloys.

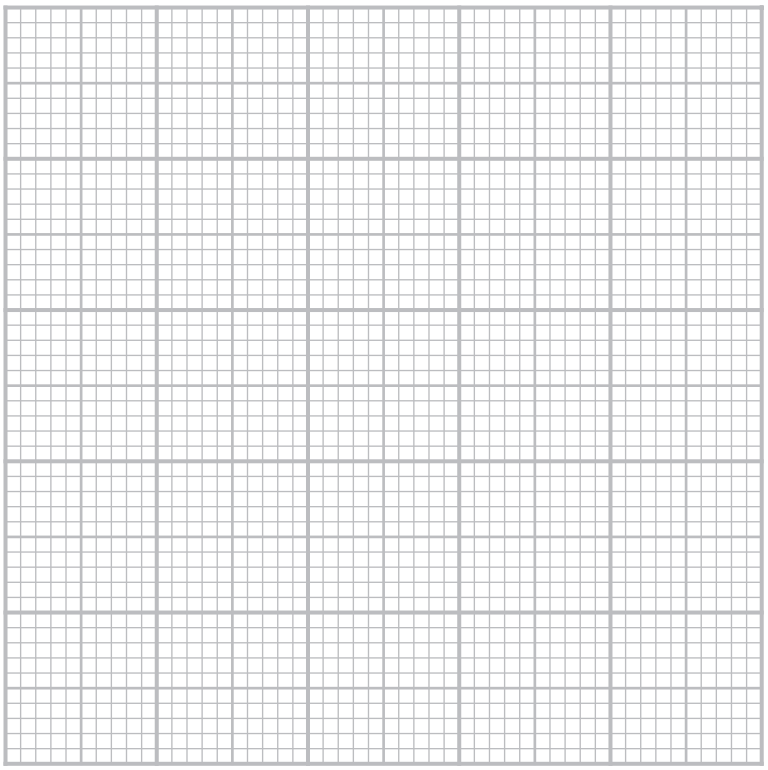
percentage of nickel	relative strength
0	1.00
20	1.52
35	1.77
65	1.90
80	1.78
100	1.56

Figure 5

(i) On Figure 6
- add suitable scales to the vertical and horizontal axes
- plot a graph of relative strength against percentage of nickel
- draw a curve of best fit.

(4)

relative strength



percentage of nickel

Figure 6

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(ii) A coin is made from an alloy that contains 70% copper and 30% nickel.

Determine the relative strength of this coin from your graph on Figure 6.

(1)

relative strength of the coin = ...

(iii) Explain, using Figure 6, how the percentage of nickel affects the relative strength of the alloys of copper and nickel.

(3)

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(Total for Question 7 = 12 marks)

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8 Magnesium sulfate is an ionic compound.

(a) A student adds magnesium sulfate to water to form a solution.

Which of these will also form a solution when added to water?

(1)

- ☒ **A** barium sulfate
- ☒ **B** calcium sulfate
- ☒ **C** lead sulfate
- ☒ **D** sodium sulfate

(b) (i) Calculate the percentage by mass of oxygen in magnesium sulfate, $MgSO_4$.

(relative atomic mass: O = 16.0
relative formula mass: $MgSO_4$ = 120)

Give your answer to 3 significant figures.

(3)

percentage by mass = ...

(ii) Calculate the number of oxygen atoms in 7.20 g of $MgSO_4$.

(relative formula mass: $MgSO_4$ = 120
Avogadro constant = 6.02×10^{23})

(3)

number of oxygen atoms = ...

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*(c) Magnesium sulfate solution can be electrolysed using the apparatus shown in Figure 7.

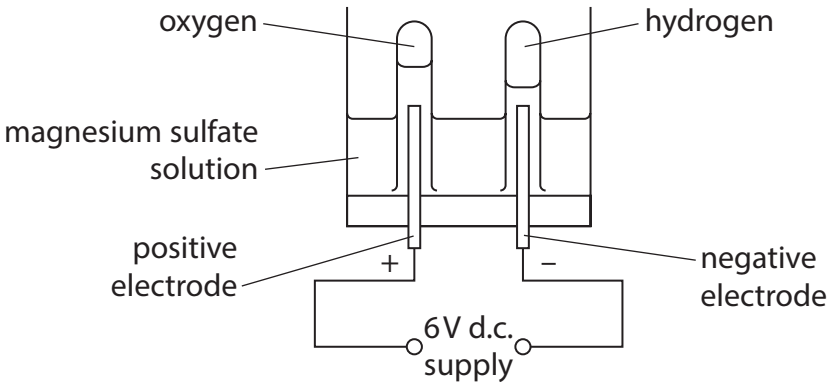

Figure 7

Explain how the products are formed at the electrodes in terms of

- the ions present in the solution
- the oxidation and reduction reactions that take place at the electrodes.

You should include ionic equations as part of your answer.

(6)

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(Total for Question 8 = 13 marks)

9 This question is about ammonia.

(a) Ammonia is a gas.

Suggest why the litmus paper used to test for ammonia gas has to be damp.

(2)

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(b) Ammonia can be made on an industrial scale using the Haber process.

The equation for the reaction is

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

The reaction can reach a dynamic equilibrium.

(i) Explain what happens when the reaction reaches dynamic equilibrium

(2)

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(ii) Figure 8 shows the changes in percentage yield of ammonia at equilibrium as temperature increases, at a pressure of 300 atmospheres and at a pressure of 1000 atmospheres.

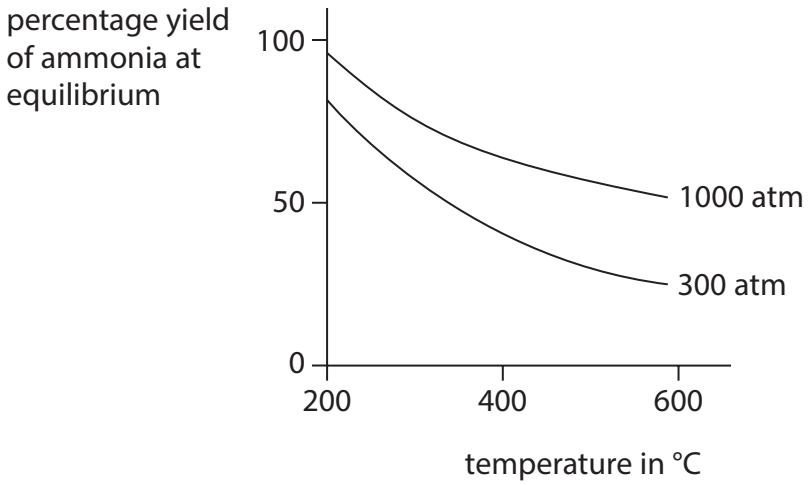

Figure 8

Which row of the table will give the highest percentage yield of ammonia at equilibrium?

(1)

		temperature in °C	pressure in atm
☒	**A**	200	1000
☒	**B**	300	1000
☒	**C**	600	300
☒	**D**	600	1000

(iii) In industry, a pressure of 200 atmospheres is used for the Haber process.

Using Figure 8, explain what happens to the position of dynamic equilibrium if the process is carried out at 100 atmospheres.

(2)

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(c) Ammonia can also be made by heating ammonium chloride.

$$NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$$

A sample of solid ammonium chloride is heated in a boiling tube.

After a few minutes ammonium chloride, a white solid, is also seen at the top of the boiling tube, as shown in Figure 9.

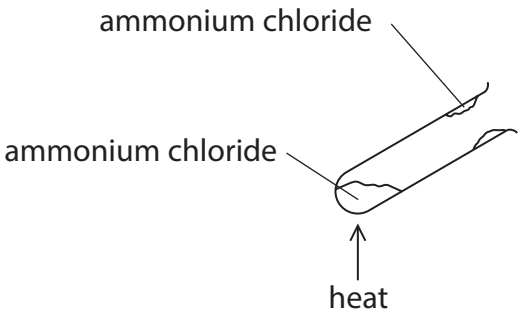

Figure 9

Explain how ammonium chloride is formed at the top of the boiling tube.

(4)

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(Total for Question 9 = 11 marks)

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10 A student is asked to carry out a titration to find the concentration of a sodium hydroxide solution.

(a) A teacher dilutes some sulfuric acid with distilled water to make a solution with a concentration of 0.250 mol dm^{-3} for the student to use.

(i) What effect does diluting the sulfuric acid with distilled water have on the pH of the solution and the concentration of the H^+ ions?

(1)

		concentration of the H^+ ions	pH of the solution
☒	**A**	decreased	decreased
☒	**B**	increased	increased
☒	**C**	increased	decreased
☒	**D**	decreased	increased

(ii) What is the concentration, in g dm^{-3}, of a 0.250 mol dm^{-3} solution of H_2SO_4?

(relative formula mass: H_2SO_4 = 98.0)

(1)

☒ **A** 0.00245

☒ **B** 0.394

☒ **C** 24.5

☒ **D** 394

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(b) The student uses the apparatus shown in Figure 10 to carry out the titration.

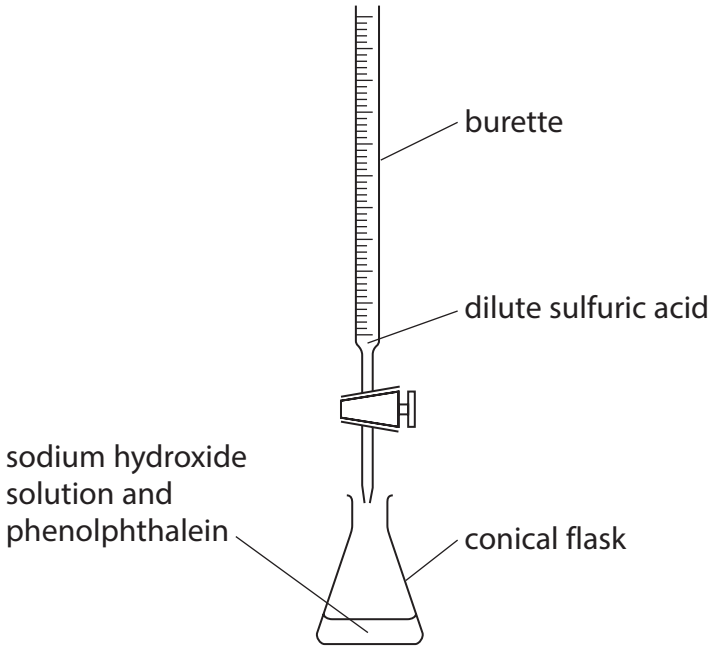

Figure 10

Before using the apparatus, the student rinses the burette with distilled water.

This is an error.

(i) Explain what effect this error has on the result of the titration.

(2)

(ii) State what the student should do to correct the error.

(1)

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*(c) The equation for the reaction in the titration is

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

Explain how the equation for the reaction and the apparatus in Figure 10 can be used to find the concentration of 25.0 cm^3 of sodium hydroxide solution using the 0.250 mol dm^{-3} sulfuric acid.

(6)

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Monday 19 May 2025

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Chemistry

PAPER 1

Higher Tier

Periodic Table Insert

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The periodic table of the elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.