OXFORD

INTERNATIONAL AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

INTERNATIONAL GCSE

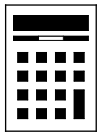
CHEMISTRY

Paper 2

Thursday 14 November 2019 07:00 GMT Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a pencil and a ruler
- a scientific calculator
- the Periodic Table (enclosed).



Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show all your working.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a scientific calculator where appropriate.
- A Periodic Table is provided as a loose insert.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

Answer **all** questions in the spaces provided.

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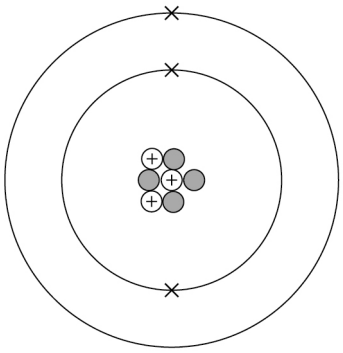
0 1 **Figure 1** shows a lithium atom.

Figure 1



0 1 . 1 Which particle in **Figure 1** has no charge?

Tick (✓) **one** box.

[1 mark]

Electron ☐

Neutron ☐

Proton ☐

0 1 . 2 Which particle in **Figure 1** has the lowest mass?

Tick (✓) **one** box.

[1 mark]

Electron ☐

Neutron ☐

Proton ☐

Do not write outside the box

0 1 . 3 What is the mass number of the lithium atom in **Figure 1**?

Tick (✓) **one** box.

[1 mark]

3 ☐

4 ☐

7 ☐

10 ☐

0 1 . 4 Which group of the Periodic Table is lithium in?

[1 mark]

---

0 1 . 5 A lithium atom loses an electron to form a lithium ion.

What charge will the ion have?

Tick (✓) **one** box.

[1 mark]

–2 ☐

–1 ☐

+1 ☐

+2 ☐

Question 1 continues on the next page

Do not write outside the box

Lithium chloride is an ionic compound.

0 1 . 6 What type of structures are formed by ionic compounds?

Complete the sentence.

[1 mark]

Ionic compounds have _____ ionic structures.

0 1 . 7 Which is a property of an ionic compound?

Tick (✓) **one** box.

[1 mark]

Can be bent into shape ☐

Conducts electricity when solid ☐

High melting point ☐

Low boiling point ☐

7

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 2 **Table 1** shows some properties of four types of steel.

Table 1

Type of steel	Relative strength	Density in g/cm^3	Resistance to corrosion
A	386	7.85	Low
B	675	7.90	Low
C	515	7.80	High
D	312	7.81	High

0 2 . 1 Which type of steel in **Table 1** is the most suitable to make a kitchen knife?

Tick (✓) **one** box.

Explain your answer.

[3 marks]

A ☐ **B** ☐ **C** ☐ **D** ☐

Explanation _____

_____

_____

_____

_____

Do not write outside the box

0 2 . 2 Steel is an alloy of iron.

Which other element is always contained in steel?

Tick (✓) **one** box.

[1 mark]

Carbon ☐

Copper ☐

Hydrogen ☐

Oxygen ☐

0 2 . 3 Suggest why the steel alloys in **Table 1** have different properties.

[1 mark]

Question 2 continues on the next page

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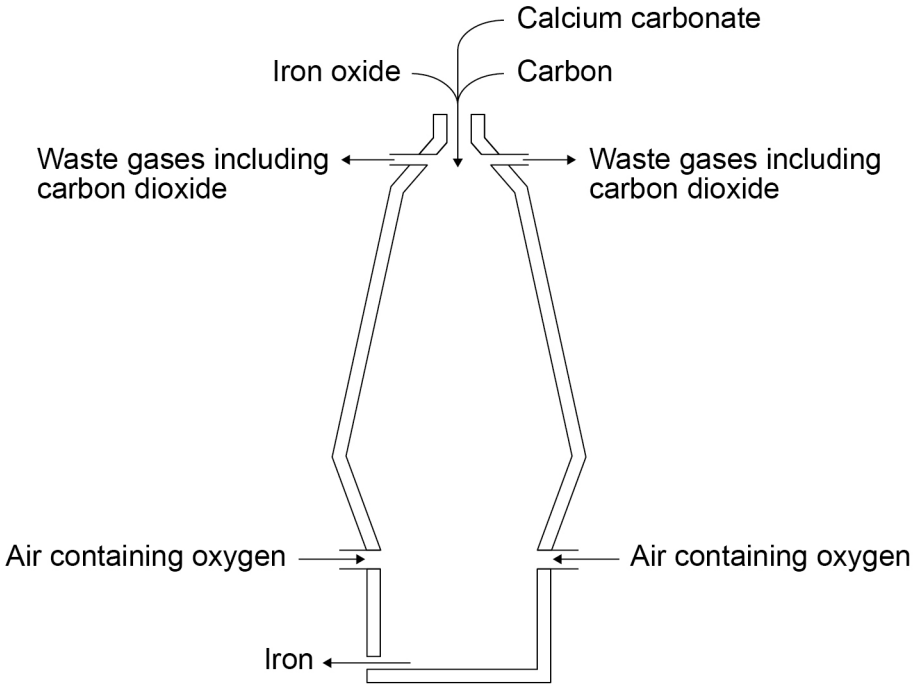
A blast furnace is used to extract iron from iron oxide.

Figure 2 shows a blast furnace.

Figure 2



0 2 . 4 Carbon and oxygen react together to produce carbon monoxide inside the blast furnace.

Which of the following equations is correct?

Tick (✓) **one** box.

[1 mark]

$2\,C + 2\,O \rightarrow 2\,CO$ ☐

$2\,C + O_2 \rightarrow 2\,CO$ ☐

$C + 2\,O_2 \rightarrow 2\,CO$ ☐

$C_2 + O_2 \rightarrow 2\,CO$ ☐

Do not write outside the box

0 2 . 5 The carbon monoxide reacts with the iron oxide.

$$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$$

Iron oxide is reduced in this reaction to produce iron.

What does 'reduced' mean in this reaction?

[1 mark]

0 2 . 6 Calcium carbonate decomposes in the furnace to produce calcium oxide.

Complete the equation for the reaction.

[2 marks]

$$\_\_\_\_\_ \longrightarrow CaO + \_\_\_\_\_$$

9

Turn over for the next question

Do not write outside the box

0 3 Sodium thiosulfate solution reacts with dilute hydrochloric acid.

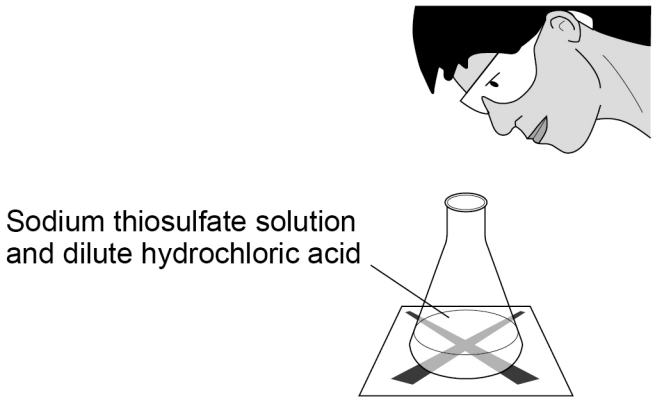
$$Na_2S_2O_3(aq) + 2HCl(aq) \longrightarrow 2NaCl(aq) + H_2O(l) + SO_2(g) + S(s)$$

A student investigated the effect of changing the concentration of sodium thiosulfate solution on the rate of the reaction.

This is the method used.

1 Measure 25.0 cm^3 of sodium thiosulfate solution of concentration 0.20 mol/dm^3 into a conical flask.
2 Put the conical flask on a piece of paper with a cross drawn on it.
3 Add 10.0 cm^3 of dilute hydrochloric acid to the flask.
4 Time how long it takes for the cross to disappear.
5 Repeat steps 1–4 with different concentrations of sodium thiosulfate solution.

Figure 3



0 3 . 1 Give **two** control variables in this investigation.

[2 marks]

1 _____

2 _____

0 3 . 2 The sulfur dioxide gas released during the reaction can cause breathing difficulties.

Suggest how the risk of breathing difficulties can be reduced.

[1 mark]

_____

_____

Do not write outside the box

0 3 . 3 One mole of sodium thiosulfate solution produces one mole of sulfur dioxide (SO_2).

Calculate the maximum mass of sulfur dioxide produced from 25.0 cm^3 of 0.20 mol/dm^3 sodium thiosulfate solution.

Relative atomic masses (A_r): S = 32 O = 16

[3 marks]

Maximum mass of sulfur dioxide = _____ g

Question 3 continues on the next page

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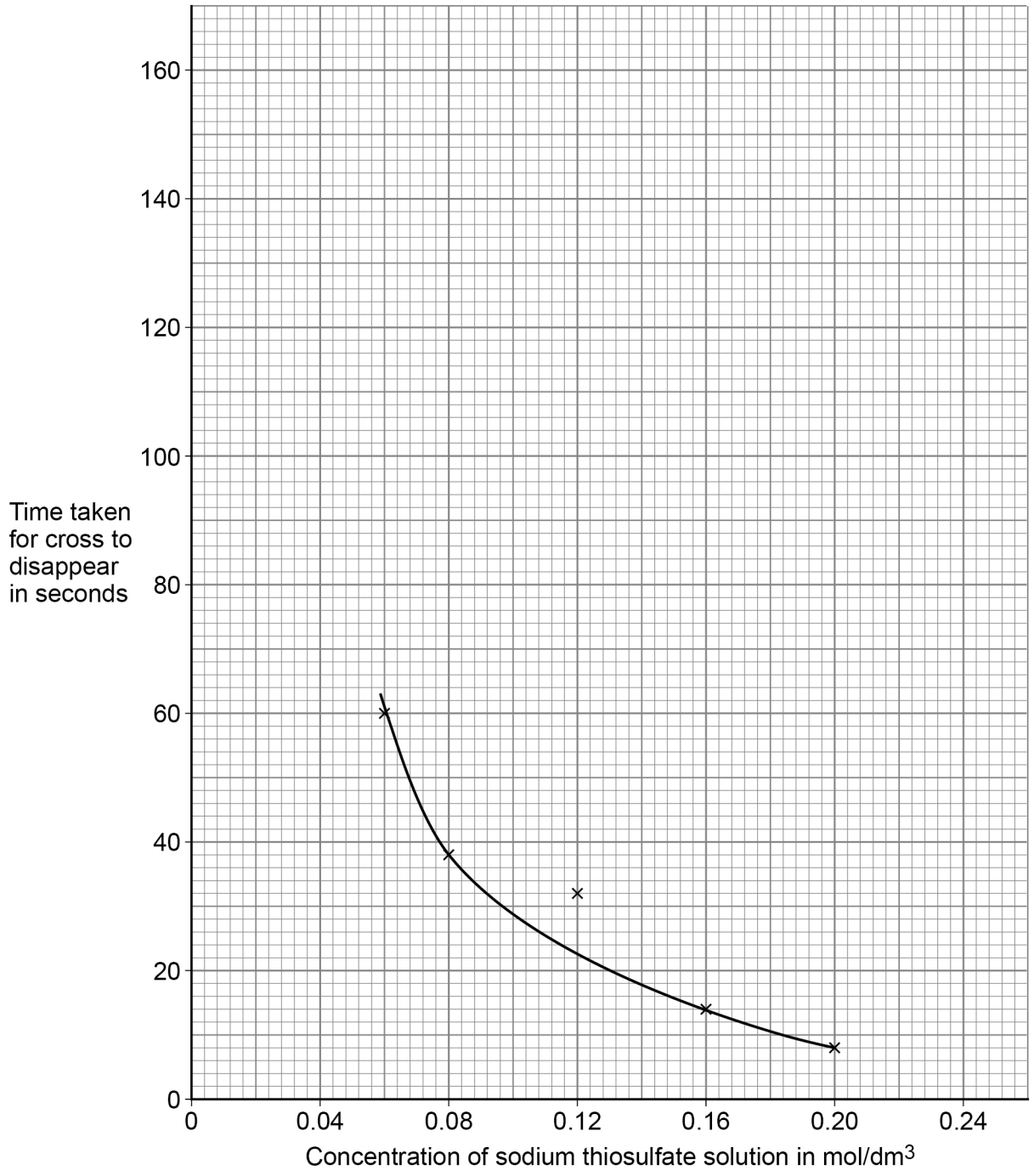
Figure 4 shows the results of the student's investigation.

Figure 4



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0 3 . 4 What is the time taken for the cross to disappear when using 0.04 mol/dm^3 sodium thiosulfate solution?

Show your working by extending the line of best fit on **Figure 4**.

[2 marks]

Time taken = _____ s

0 3 . 5 Which concentration of sodium thiosulfate solution in **Figure 4** produced an anomalous result?

Suggest what may have happened to cause this anomalous result.

[2 marks]

Concentration = _____ mol/dm^3

Reason _____

_____

0 3 . 6 Describe the relationship between the concentration of sodium thiosulfate solution and the time taken for the cross to disappear.

Use **Figure 4**.

[2 marks]

_____

_____

_____

_____

Question 3 continues on the next page

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0 3 . 7 Another student does the same investigation and gets the same results.

Which word describes an investigation that gets the same results but is done by a different person?

Tick (✓) **one** box.

[1 mark]

Accurate ☐

Precise ☐

Reproducible ☐

Valid ☐

0 3 . 8 In one experiment 0.15 g of sulfur was produced in 20 seconds.

Calculate the rate of reaction.

Give the unit.

[3 marks]

Rate of reaction = _____ Unit = _____

16

Do not write outside the box

0 4 **Table 2** gives the relative atomic mass and the density of four metals.

Table 2

Metal	Relative atomic mass	Density in g/cm^3
Chromium	52	7.20
Cobalt	59	8.86
Iron	56	7.86
Zinc	65	7.14

0 4 . 1 A block of chromium has a volume of 1500 cm^3

Calculate the mass of the block in kg.

Use the equation:

mass in g = density in g/cm^3 × volume in cm^3

[2 marks]

Mass = _____ kg

Question 4 continues on the next page

Do not write outside the box

0 4 . 2 A student made a hypothesis:

"The order of the relative atomic masses is related to the order of the densities for these four metals."

Evaluate the student's hypothesis.

Use **Table 2**.

[4 marks]

0 4 . 3 All four metals react with dilute hydrochloric acid to give a salt and a gas.

Write a word equation for the reaction of zinc with dilute hydrochloric acid.

[2 marks]

0 4 . 4 The student wants to do an experiment to find the order of reactivity of the metals with dilute hydrochloric acid.

Describe a method for the experiment.

Your method should give valid results.

[6 marks]

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Extra space

0 4 . 5 Explain why electroplating iron with copper can prevent iron reacting with dilute hydrochloric acid.

[3 marks]

17

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0 5 This question is about carboxylic acids.

0 5 . 1 Ethanoic acid can be produced from ethanol.

What type of reaction produces ethanoic acid from ethanol?

Tick (✓) **one** box.

[1 mark]

Combustion ☐

Neutralisation ☐

Oxidation ☐

Polymerisation ☐

0 5 . 2 Complete **Figure 5** to show the displayed structure of ethanoic acid (CH_3COOH).

[1 mark]

Figure 5

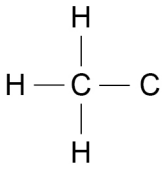

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Table 3 gives some information about five carboxylic acids.

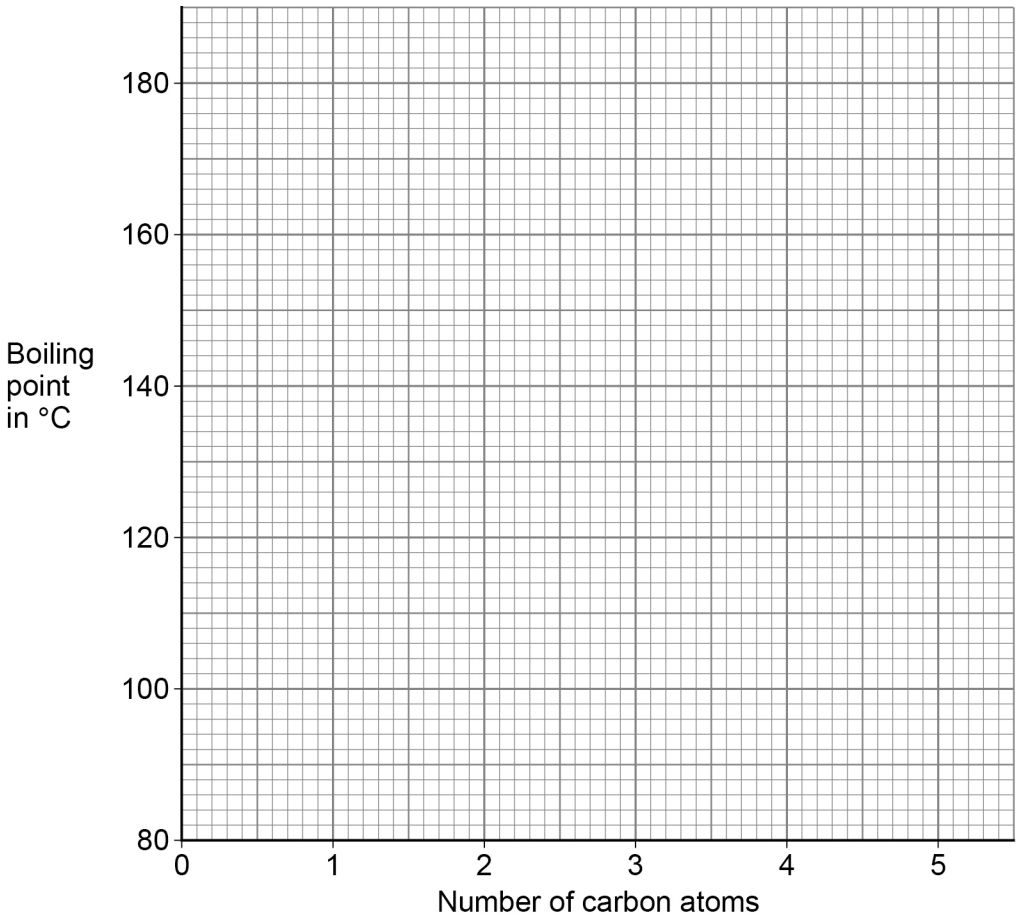
Table 3

Name	Number of carbon atoms	Boiling point in °C
Methanoic acid	1	100
Ethanoic acid	2	118
Propanoic acid	3	141
Butanoic acid	4	166
Pentanoic acid	5	186

0 5 . 3 Plot the data from **Table 3** on **Figure 6**.

[2 marks]

Figure 6



Question 5 continues on the next page

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0 5 . 4 Solutions of ethanoic acid and hydrochloric acid with the same concentration have different pH values.

Explain why the solution of ethanoic acid has a different pH than the solution of hydrochloric acid.

[4 marks]

8

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0 6 **Table 4** gives some properties of four halogen molecules.

Table 4

Halogen molecule	Bond energy in kJ/mol	Number of electrons in the molecule
F – F	157	18
Cl – Cl	243	34
Br – Br	193	70
I – I	152	106

0 6 . 1 Describe the trends in **Table 4** as you read down the table.

[3 marks]

0 6 . 2 Describe the test for chlorine gas.

Give the result of the test.

[3 marks]

Test _____

Result _____

Question 6 continues on the next page

Do not write outside the box

0 6 . 3 Chlorine has two main isotopes.

^{35}Cl ^{37}Cl

Compare the numbers of protons, electrons and neutrons in atoms of ^{35}Cl and ^{37}Cl.

[3 marks]

Protons _____

_____

Electrons _____

_____

Neutrons _____

_____

Do not write outside the box

0 6 . 4 **Figure 7** shows the reaction between ethene and chlorine.

Figure 7

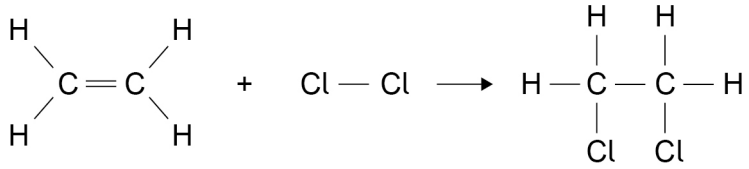


Table 5 gives the bond energy values.

Table 5

Bond	Bond energy in kJ/mol
C = C	612
C – C	347
C – H	413
Cl – Cl	243
C – Cl	346

Calculate the enthalpy change (ΔH) for the reaction in **Figure 7**.

Use **Table 5**.

Give your answer in kJ/mol.

[4 marks]

Enthalpy change (ΔH) = _____ kJ/mol

Turn over ►

Do not write outside the box

0 6 . 5 A sample of compound **X** consists of:

- 2.6 g of chromium
- 5.3 g of chlorine

Calculate the empirical formula of compound **X**.

Relative atomic masses (A_r): Cr = 52 Cl = 35.5

You must show your working.

[4 marks]

Empirical formula = _____

0 6 . 6 Ammonium chloride (NH_4Cl) can be produced in a neutralisation reaction.

Name the **two** reactants used to produce ammonium chloride.

[2 marks]

1 _____

2 _____

Do not write outside the box

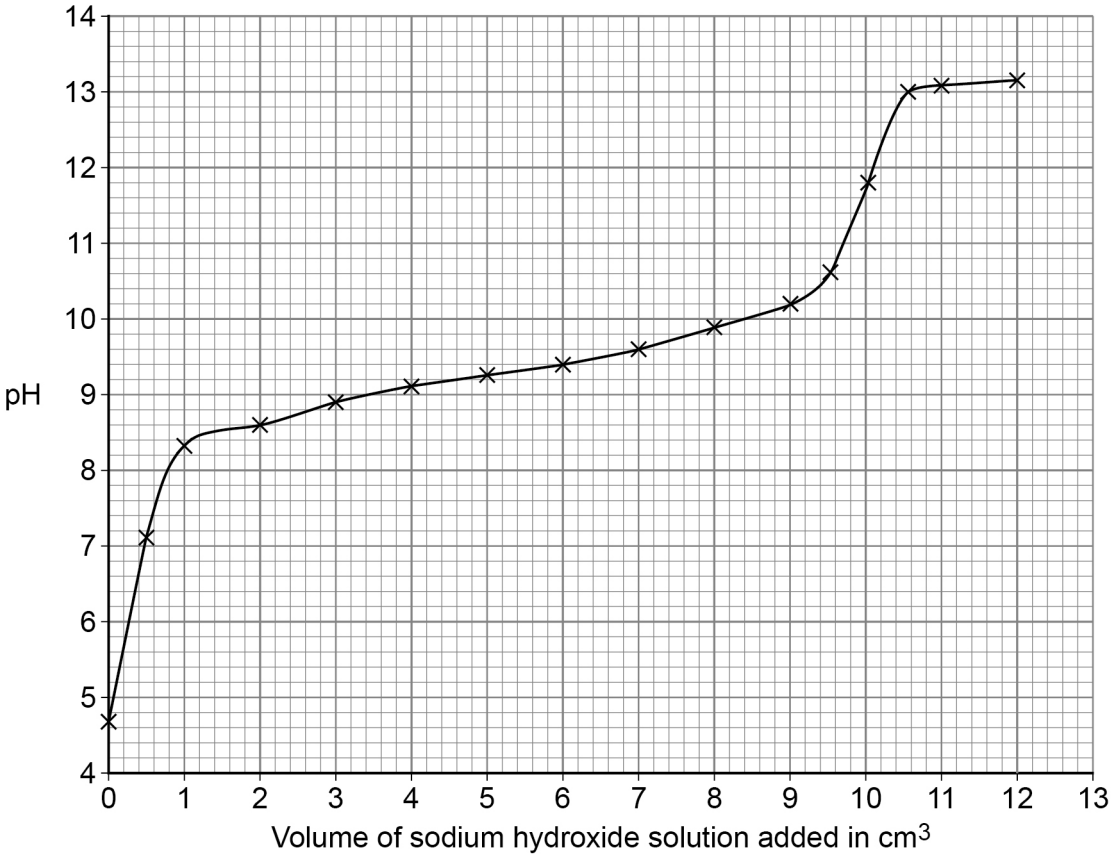
Ammonium chloride can act as a weak acid when dissolved in water.

A student titrated ammonium chloride solution with sodium hydroxide solution.

The student used a pH meter to measure the pH of the mixture after each addition of alkali.

Figure 8 shows the results.

Figure 8



0 6 . 7 What volume of sodium hydroxide solution is needed to produce a neutral solution?

[1 mark]

_____ cm^3

0 6 . 8 The student repeated the experiment using universal indicator instead of the pH meter.

Give the colour of the universal indicator after 10 cm^3 of sodium hydroxide solution has been added.

[1 mark]

_____

Question 6 continues on the next page

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0 6 . 9 The equation for the reaction of ammonium chloride solution and sodium hydroxide solution is:

$$NH_4Cl(aq) + NaOH(aq) \longrightarrow NH_3(g) + NaCl(aq) + H_2O(l)$$

Complete the ionic equation for this reaction.

You do not need to include state symbols.

[2 marks]

$$NH_4^+ + \underline{\qquad\qquad} \longrightarrow NH_3 + \underline{\qquad\qquad}$$

23

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Turn over for the next question

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0 7 Silver chloride and silver carbonate are insoluble in water.

A student had a mixture of silver chloride and silver carbonate.

The student wanted to obtain pure, dry silver chloride from this mixture.

This is the method used.

1 Put the mixture into a beaker.
2 Add dilute nitric acid until in excess.
3 Filter off the remaining solid.
4 Leave the solid to dry.

0 7 . 1 What change does the student observe when the dilute nitric acid is in excess?

[1 mark]

0 7 . 2 Why is it important that the dilute nitric acid is added in excess?

[1 mark]

0 7 . 3 An important instruction is missing between **step 3** and **step 4** in the student's method.

What is the missing instruction?

Give the reason why this instruction is important.

[2 marks]

Missing instruction

Reason

Do not write outside the box

0 7 . 4 Another student tried to identify a pure ionic compound, **Y**.

Table 6 shows the results.

Table 6

Test	Final Result
Add NaOH (aq) in excess	White precipitate
Add HCl (aq) followed by $BaCl_2$ (aq)	White precipitate

What can you conclude about the identity of **Y**?

[2 marks]

Question 7 continues on the next page

Do not write outside the box

0 7 . 5 **Z** is an unknown element.

A compound of **Z** has the formula **Z**$(OH)_2$

The percentage by mass of **Z** in **Z**$(OH)_2$ is 80 %.

Calculate the relative atomic mass (A_r) of **Z**.

Relative atomic masses (A_r): H = 1 O = 16

You do not need to identify element **Z**.

[4 marks]

Relative atomic mass (A_r) of **Z** = _____

10

END OF QUESTIONS

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