AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.4.2.2

Neutralisation of acids and salt production

Past-paper questions

Tier	**Foundation**
Question groups	**14**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

5.4.2.2 Neutralisation of acids and salt production

Question 01

0 3 This question is about acids and bases.

0 3 . 1 Which ion is found in all acids?

[1 mark]

Tick **one** box.

Cl^- ☐ H^+ ☐ Na^+ ☐ OH^- ☐

0 3 . 2 Zinc nitrate can be produced by reacting an acid and a metal oxide.

Name the acid and the metal oxide used to produce zinc nitrate.

[2 marks]

Acid _____

Metal oxide _____

0 3 . 3 In an equation, zinc nitrate is written as $Zn(NO_3)_2(aq)$.

What does (aq) mean?

[1 mark]

Tick **one** box.

Dissolved in water ☐

Insoluble ☐

Not all reacted ☐

Reactant ☐

0 3 . 4 The pH of a solution is 8

Some hydrochloric acid is added to the solution.

Suggest the pH of the solution after mixing.

[1 mark]

pH = _____

0 3 . 5 **Table 2** shows the solubility of three solids in water at room temperature.

Table 2

Solid	The mass of the solid that dissolves in 100 cm^3 of water
Phosphorus oxide	50 g
Silicon dioxide	0 g
Sodium hydroxide	100 g

A teacher labelled these three solids **A**, **B** and **C**.

She gave a student the information shown in **Table 3**

Table 3

Solid	Observation when added to water	pH of the solid in water
A	colourless solution	14
B	colourless solution	2
C	solid does not dissolve	7

Describe a method that could be used to identify each of the three solids **A**, **B** and **C**.

You must use an indicator in the method.

Use information in **Table 2** and **Table 3**

[4 marks]

9

5.4.2.2 Neutralisation of acids and salt production

Question 02

June 2018 | 8464/C/1F | Original Q7

0 7 A student plans a method to prepare pure crystals of copper sulfate.

The student's method is:

1. Add one spatula of calcium carbonate to dilute hydrochloric acid in a beaker.
2. When the fizzing stops, heat the solution with a Bunsen burner until all the liquid is gone.

The method contains several errors and does not produce copper sulfate crystals.

Explain the improvements the student should make to the method so that pure crystals of copper sulfate are produced.

[6 marks]

5.4.2.2 Neutralisation of acids and salt production

Question 03

June 2019 | 8464/C/1F | Original Q2

0 2 This question is about salts and electrolysis.

A student wants to make copper chloride crystals.

The student adds excess copper oxide to some hot acid.

The student stirs the mixture.

0 2 . 1 Which acid should the student use?

[1 mark]

Tick (✓) **one** box.

- Hydrochloric acid ☐
- Nitric acid ☐
- Sulfuric acid ☐

0 2 . 2 Suggest how the student would know that excess copper oxide has been added.

[1 mark]

_____

_____

Question 2 continues on the next page

Question 03 · continued

0 2 . 3 There are four more stages, **A**, **B**, **C** and **D**, to make copper chloride crystals.

The stages **A**, **B**, **C** and **D** are not in the correct order.

Stage **A**	Partially evaporate by heating with a water bath
Stage **B**	Filter the mixture into an evaporating basin
Stage **C**	Leave to crystallise
Stage **D**	Remove and dry the crystals

Put stages **A**, **B**, **C** and **D** in the correct order.

[2 marks]

First stage _____

Second stage _____

Third stage _____

Fourth stage _____

0 2 . 4 Molten copper chloride can be electrolysed.

State the product at each electrode when molten copper chloride is electrolysed.

[2 marks]

Negative electrode _____

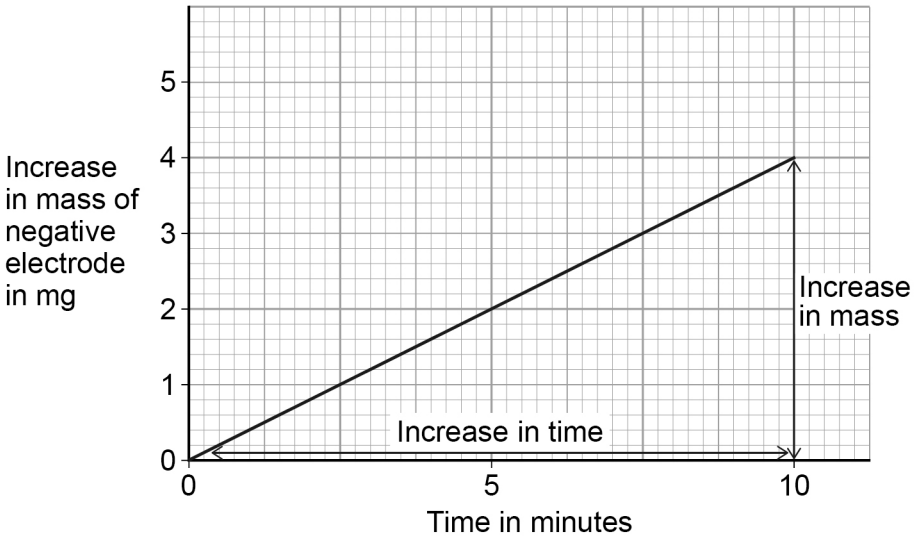
Positive electrode _____

0 2 . 5 A solution of copper chloride is electrolysed.

Figure 3 shows a graph of the increase in mass of the negative electrode.

This increase is shown over a time of 10 minutes.

Figure 3



Calculate the gradient of the line in **Figure 3**.

Use the equation:

$$\text{Gradient} = \frac{\text{increase in mass in mg}}{\text{increase in time in minutes}}$$

[3 marks]

Increase in mass _____

_____

Increase in time _____

_____

Gradient _____

_____

_____

_____

Gradient = _____ mg per minute

5.4.2.2 Neutralisation of acids and salt production

Question 03 · continued

0 2 . 6 Aluminium is produced by electrolysis of a molten mixture.

Complete the sentence.

Choose the answers from the box.

[2 marks]

carbon	**chloride**	**cryolite**	**oxide**	**sulfate**	**water**

The molten mixture contains _____ and

aluminium _____ .

11

5.4.2.2 Neutralisation of acids and salt production

Question 04

June 2019 | 8464/C/1F | Original Q7

0 7 This question is about salts.

Ammonium nitrate solution is produced when ammonia gas reacts with nitric acid.

0 7 . 1 Give the state symbol for ammonium nitrate solution.

[1 mark]

_____

0 7 . 2 What is the formula of nitric acid?

[1 mark]

Tick (✓) **one** box.

HCl ☐

HNO_3 ☐

H_2SO_4 ☐

NH_4OH ☐

0 7 . 3 Ammonia gas dissolves in water to produce ammonia solution.

Ammonia solution contains hydroxide ions, OH^-

A student adds universal indicator to solutions of nitric acid and ammonia.

What colour is observed in each solution?

[2 marks]

Colour in nitric acid _____

Colour in ammonia solution _____

5.4.2.2 Neutralisation of acids and salt production

Question 04 · continued

0 7 . 4 The student gradually added nitric acid to ammonia solution.

Which row, **A**, **B**, **C** or **D**, shows the change in pH as the nitric acid is added until in excess?

[1 mark]

Tick (✓) **one** box.

	pH of ammonia solution at start	pH after addition of excess nitric acid	
A	10	7	☐
B	2	10	☐
C	7	1	☐
D	10	2	☐

0 7 . 5 Calculate the percentage by mass of oxygen in ammonium nitrate (NH_4NO_3).

Relative atomic masses (A_r): H = 1 N = 14 O = 16

Relative formula mass (M_r): NH_4NO_3 = 80

[3 marks]

Percentage by mass of oxygen = _____ %

Question 7 continues on the next page

5.4.2.2 Neutralisation of acids and salt production

Question 04 · continued

0 7 . 6 Describe a method to investigate how the temperature changes when different masses of ammonium nitrate are dissolved in water.

You do **not** need to write about safety precautions.

[6 marks]

14

5.4.2.2 Neutralisation of acids and salt production

Question 05

November 2020 | 8464/C/1F | Original Q1

0 1 This question is about acids and bases.

0 1 . 1 What is the pH of sulfuric acid?

[1 mark]

Tick (✓) **one** box.

1 ☐ 7 ☐ 14 ☐

0 1 . 2 An acid reacts with zinc to produce zinc chloride and hydrogen.

Which acid reacts with zinc to produce zinc chloride?

[1 mark]

Tick (✓) **one** box.

Hydrochloric acid ☐

Nitric acid ☐

Sulfuric acid ☐

0 1 . 3 What type of substance is zinc chloride?

[1 mark]

Tick (✓) **one** box.

Alkali ☐ Base ☐ Salt ☐

5.4.2.2 Neutralisation of acids and salt production

Question 05 · continued

0 1 . 4 An alkali is a base in solution.

Which compound is an alkali?

[1 mark]

Tick (✓) **one** box.

Sodium hydroxide ☐

Sodium nitrate ☐

Sodium sulfate ☐

0 1 . 5 The formula of the copper ion is Cu^{2+}

The formula of the oxide ion is O^{2-}

What is the formula of copper oxide?

[1 mark]

Tick (✓) **one** box.

Cu_2O_2 ☐ CuO_2 ☐ CuO ☐

Question 1 continues on the next page

5.4.2.2 Neutralisation of acids and salt production

Question 05 · continued

A student reacts an acid with copper oxide.

0 1 . 6 The reaction between the acid and copper oxide is very slow at room temperature.

How could the student speed up the reaction?

[1 mark]

0 1 . 7 Complete the sentence to show how the student makes sure that **all** the acid reacts.

Choose the answer from the box.

[1 mark]

in excess	**in solution**	**molten**	**soluble**

The student adds copper oxide to the acid until the

copper oxide is _____.

5.4.2.2 Neutralisation of acids and salt production

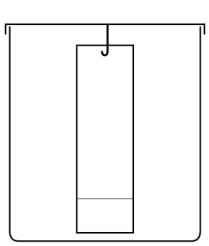
Question 05 · continued

0 1 . 8 The student filters the unreacted copper oxide from the solution.

Which apparatus does the student use?

[1 mark]

Tick (✓) **one** box.



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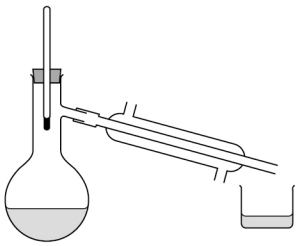

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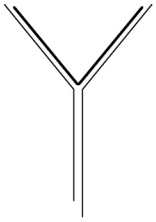

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0 1 . 9 What process is used to produce crystals of a salt from a salt solution?

[1 mark]

_____

_____

9

5.4.2.2 Neutralisation of acids and salt production

Question 06

November 2021 | 8464/C/1F | Original Q7

0 7 Acids react to produce salts.

Universal indicator is added to water and then nitric acid is added to the mixture.

0 7 . 1 Give the colour change when nitric acid is added to the mixture of universal indicator and water.

[1 mark]

Tick (✓) **one** box.

- Blue to red ☐
- Green to purple ☐
- Green to red ☐
- Red to purple ☐

0 7 . 2 What happens to the pH of water when nitric acid is added?

[1 mark]

Tick (✓) **one** box.

- Decreases ☐
- Stays the same ☐
- Increases ☐

0 7 . 3 What is the state symbol for nitric acid?

[1 mark]

_____

5.4.2.2 Neutralisation of acids and salt production

Question 06 · continued

Zinc carbonate reacts with nitric acid.

The word equation for the reaction is:

zinc carbonate (white solid) + nitric acid → zinc nitrate (colourless solution) + water + carbon dioxide

0 7 . 4 Give **two** observations that would be made when zinc carbonate is added to nitric acid until the zinc carbonate is in excess.

[2 marks]

1 _____

_____

2 _____

_____

0 7 . 5 The formula of the zinc ion is Zn^{2+}

The formula of the nitrate ion is NO_3^-

What is the formula for zinc nitrate?

[1 mark]

Tick (✓) **one** box.

- $ZnNO_3$ ☐
- $Zn(NO_3)_2$ ☐
- Zn_2NO_3 ☐
- $Zn_2(NO_3)_2$ ☐

Question 7 continues on the next page

5.4.2.2 Neutralisation of acids and salt production

Question 06 · continued

0 7 . 6 Acids react with insoluble metal oxides to produce salts.

Plan a method to produce a pure, dry sample of the soluble salt copper chloride from an acid and a metal oxide.

[6 marks]

12

5.4.2.2 Neutralisation of acids and salt production

Question 07

June 2022 | 8464/C/1F | Original Q2

0 2 This question is about hydrogen chloride and sodium hydroxide.

0 2 . 1 A chlorine atom has 7 electrons in the outer shell.

A hydrogen atom has 1 electron in the outer shell.

Figure 4 represents part of a dot and cross diagram for a molecule of hydrogen chloride.

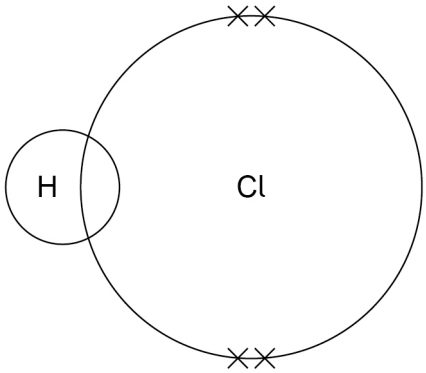
Complete the dot and cross diagram.

Use dots (o) and crosses (x) to represent electrons.

You should show only the electrons in the outer shells.

[2 marks]

Figure 4



0 2 . 2 Hydrogen chloride dissolves in water to produce hydrochloric acid.

Hydrochloric acid reacts with sodium hydroxide solution.

Complete the word equation for the reaction between hydrochloric acid and sodium hydroxide.

[1 mark]

hydrochloric acid + sodium hydroxide → _____ + water

Question 2 continues on the next page

Question 07 · continued

Solutions of hydrochloric acid and sodium hydroxide are reacted and the temperature change is recorded.

0 2 . 3 In the reaction, 3.65 g of hydrogen chloride reacts with 4.00 g of sodium hydroxide.

1.80 g of water is produced.

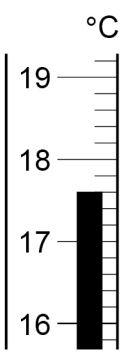
Calculate the mass of the other product.

[1 mark]

Mass = _____ g

0 2 . 4 **Figure 5** shows part of the thermometer used to measure the temperature.

Figure 5



What is the temperature reading on the thermometer?

[1 mark]

Temperature = _____ °C

0 2 . 5 In the reaction, the temperature increases.

What type of reaction is happening when the temperature increases?

[1 mark]

0 2 . 6 Sodium hydroxide is an alkali.

Which **two** ions are in sodium hydroxide solution?

[2 marks]

Tick (✓) **two** boxes.

Cl^- ☐ H^+ ☐ Na^+ ☐ O^{2-} ☐ OH^- ☐

8

5.4.2.2 Neutralisation of acids and salt production

Question 08

June 2022 | 8464/C/1F | Original Q5

0 5 This question is about salts.

Green copper carbonate and sulfuric acid can be used to produce blue copper sulfate crystals.

0 5 . 1 **Excess** copper carbonate is added to sulfuric acid.

Give **three** observations you would make.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

0 5 . 2 How can the excess copper carbonate be removed?

[1 mark]

_____

_____

0 5 . 3 The pH of the solution changes during the reaction.

What is the pH of the solution at the end of the reaction?

[1 mark]

pH = _____

0 5 . 4 Copper carbonate and sulfuric acid react to produce copper sulfate.

What type of reaction is this?

[1 mark]

_____

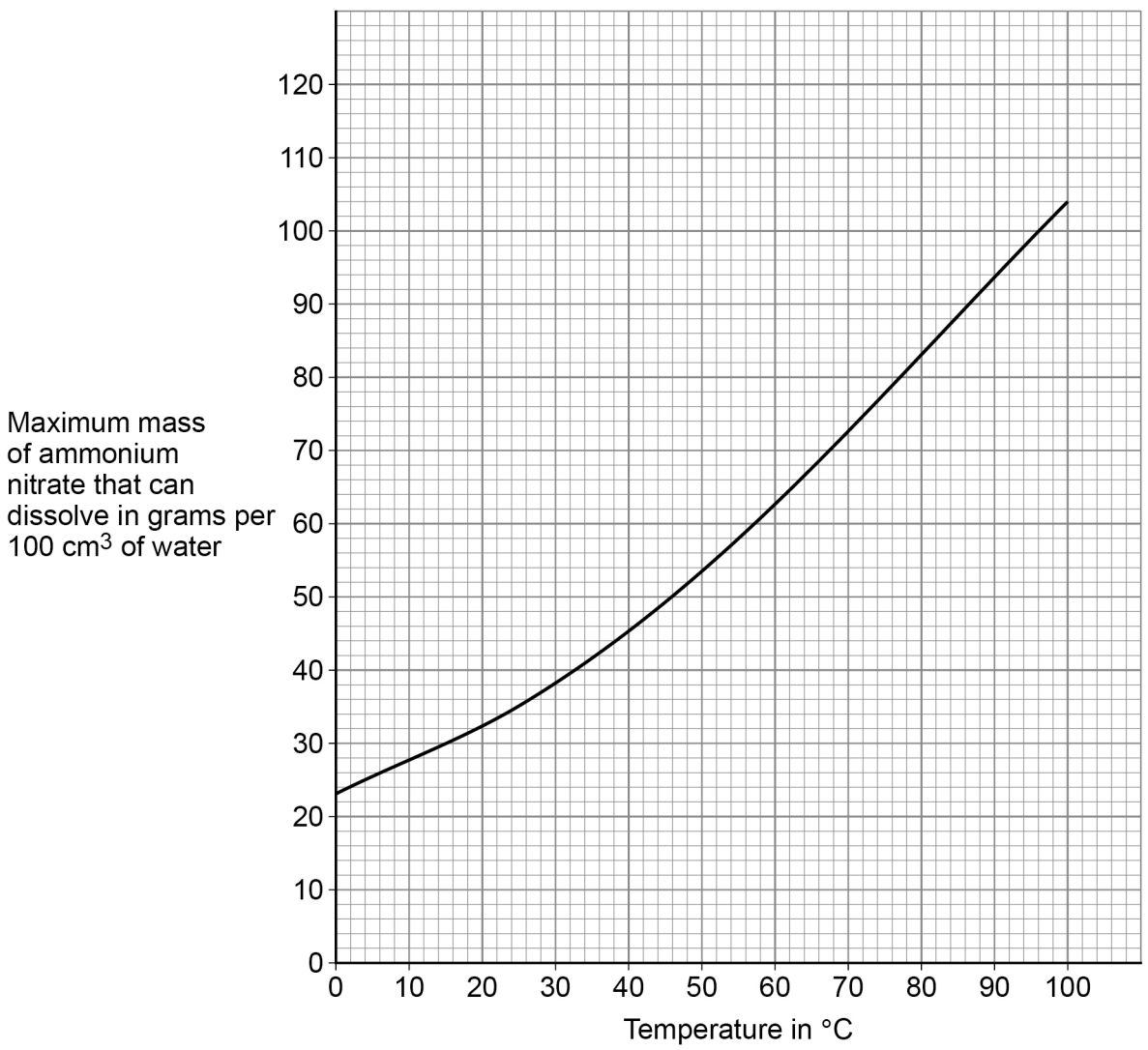
5.4.2.2 Neutralisation of acids and salt production

Question 08 · continued

0 5 . 5 Ammonium nitrate is a salt.

Figure 13 shows the maximum mass of ammonium nitrate that can dissolve in 100 cm^3 of water at different temperatures.

Figure 13



5.4.2.2 Neutralisation of acids and salt production

Question 08 · continued

A student adds ammonium nitrate to water at 80 °C until no more dissolves.

The student cools 100 cm^3 of this solution of ammonium nitrate from 80 °C to 20 °C to produce crystals of ammonium nitrate.

Determine the mass of ammonium nitrate that crystallises on cooling 100 cm^3 of this solution from 80 °C to 20 °C

[3 marks]

Mass = _____ g

9

5.4.2.2 Neutralisation of acids and salt production

Question 09

June 2022 | 8464/C/2F | Original Q7

0 7 . 1 Water that is safe to drink is called potable water.

Compare how easily potable water can be obtained from:

- waste water (sewage)
- ground water (fresh water).

[6 marks]

Question 7 continues on the next page

5.4.2.2 Neutralisation of acids and salt production

Question 09 · continued

A scientist produced potable water from 150 cm^3 of salty water.

0 7 . 2 Which process can be used to produce potable water from salty water?

[1 mark]

Tick (✓) **one** box.

- Distillation ☐
- Electrolysis ☐
- Filtration ☐
- Sterilisation ☐

0 7 . 3 The salty water contains sodium chloride.

The scientist collected 2.40 g of sodium chloride from 150 cm^3 of salty water.

Calculate the concentration of sodium chloride in grams per dm^3

[3 marks]

Concentration of sodium chloride = _____ g/dm^3

10

5.4.2.2 Neutralisation of acids and salt production

Question 10

June 2023 | 8464/C/1F | Original Q6

0 6 This question is about carbon dioxide.

Carbon dioxide is soluble in water and forms an acidic solution.

0 6 . 1 Which ion makes the solution acidic?

[1 mark]

_____

0 6 . 2 Name an indicator that could be used to test if the solution is acidic.

Give the result of the test.

[2 marks]

Indicator _____

Result _____

_____

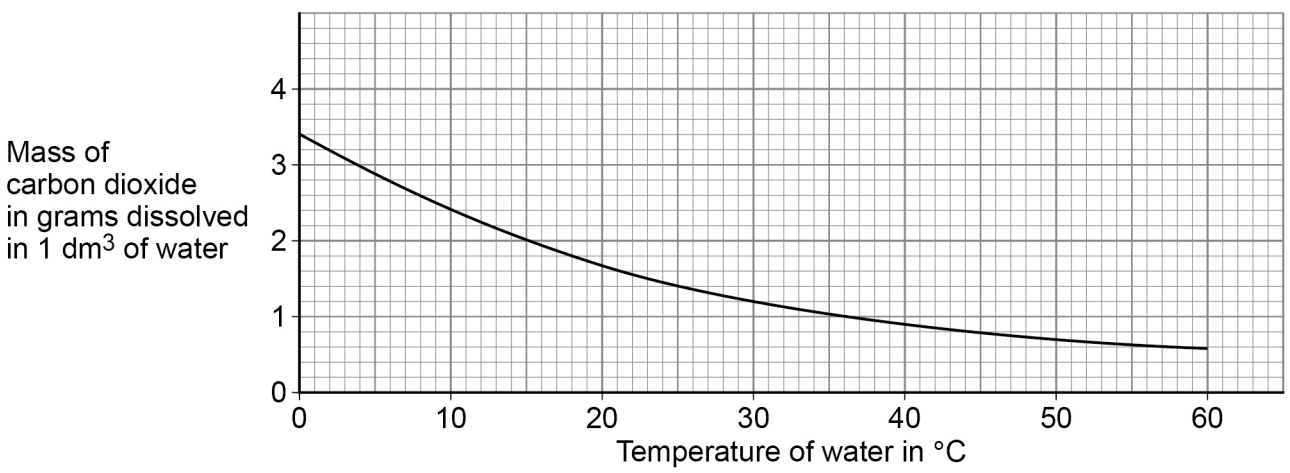
Question 6 continues on the next page

5.4.2.2 Neutralisation of acids and salt production

Question 10 · continued

Figure 14 shows the mass of carbon dioxide that will dissolve in 1 dm^3 of water at different temperatures.

Figure 14



0 6 . 3 How does the solubility of carbon dioxide change as the temperature of the water increases?

[1 mark]

Tick (✓) **one** box.

The solubility decreases ☐

The solubility does not change ☐

The solubility increases ☐

Question 10 · continued

0 6 . 4 Carbon dioxide dissolves in water to form an acidic solution.

How does the pH of the solution change as the temperature of the water increases?

Use **Figure 14**.

[1 mark]

Tick (✓) **one** box.

pH of the solution decreases ☐

pH of the solution does not change ☐

pH of the solution increases ☐

Calcium carbonate reacts with hydrochloric acid to produce carbon dioxide.

The equation for the reaction is:

$$CaCO_3(s) + 2\,HCl(aq) \longrightarrow CaCl_2(aq) + CO_2(g) + H_2O(\mathbf{x})$$

0 6 . 5 What is the state symbol (**x**) in the equation?

[1 mark]

Tick (✓) **one** box.

(aq) ☐ (g) ☐ (l) ☐ (s) ☐

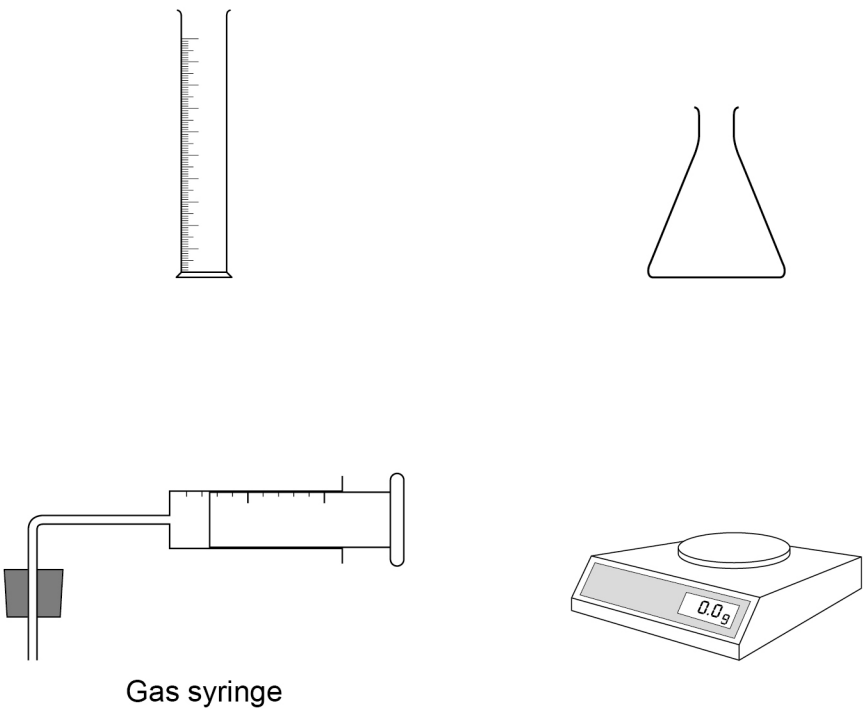
Question 6 continues on the next page

5.4.2.2 Neutralisation of acids and salt production

Question 10 · continued

0 6 . 6 **Figure 15** shows equipment a student used for an investigation.

Figure 15



Gas syringe

5.4.2.2 Neutralisation of acids and salt production

Question 10 · continued

The student investigated the volume of carbon dioxide produced when different masses of calcium carbonate react with hydrochloric acid.

Describe a method the student could use.

[6 marks]

12

5.4.2.2 Neutralisation of acids and salt production

Question 11

June 2024 | 8464/C/1F | Original Q5

0 5 Magnesium chloride is a soluble salt.

0 5 . 1 Magnesium reacts with hydrochloric acid to produce magnesium chloride and a gas.

Which gas is produced?

[1 mark]

Tick (✓) **one** box.

- Hydrogen ☐
- Nitrogen ☐
- Oxygen ☐

Question 5 continues on the next page

5.4.2.2 Neutralisation of acids and salt production

Question 11 · continued

Magnesium chloride ($MgCl_2$) can be electrolysed when molten.

0 5 . 2 Which represents molten magnesium chloride?

[1 mark]

Tick (✓) **one** box.

$MgCl_2(g)$ ☐

$MgCl_2(l)$ ☐

$MgCl_2(s)$ ☐

0 5 . 3 Magnesium chloride contains Mg^{2+} ions and Cl^- ions.

Name the product at each electrode when molten magnesium chloride is electrolysed.

[2 marks]

Negative electrode _____

Positive electrode _____

5.4.2.2 Neutralisation of acids and salt production

Question 11 · continued

A student investigated the reactivity of three metals: copper, magnesium and iron.

The student mixed each metal with each metal chloride solution.

Table 6 shows the results.

Table 6

	Copper chloride solution	**Magnesium chloride solution**	**Iron chloride solution**
Copper	No reaction	No reaction	No reaction
Magnesium	Reaction	No reaction	Reaction
Iron	Reaction	No reaction	No reaction

0 5 . 4 What is the order of reactivity for copper, magnesium and iron?

Give **two** reasons for your answer.

Use **Table 6**.

[3 marks]

Most reactive _____

_____

Least reactive _____

Reason 1 _____

_____

Reason 2 _____

_____

Question 5 continues on the next page

5.4.2.2 Neutralisation of acids and salt production

Question 11 · continued

0 5 . 5 When heated 0.72 g of magnesium reacts with iron oxide to produce 2.32 g of products.

Calculate the mass of iron oxide that reacts with 0.72 g of magnesium.

[1 mark]

Mass of iron oxide = _____ g

0 5 . 6 The student used 30 cm^3 of magnesium chloride solution.

1 dm^3 of magnesium chloride solution contains 180 g of magnesium chloride.

1 dm^3 = 1000 cm^3

Calculate the mass of magnesium chloride in 30 cm^3 of magnesium chloride solution.

[3 marks]

Mass of magnesium chloride = _____ g

11

5.4.2.2 Neutralisation of acids and salt production

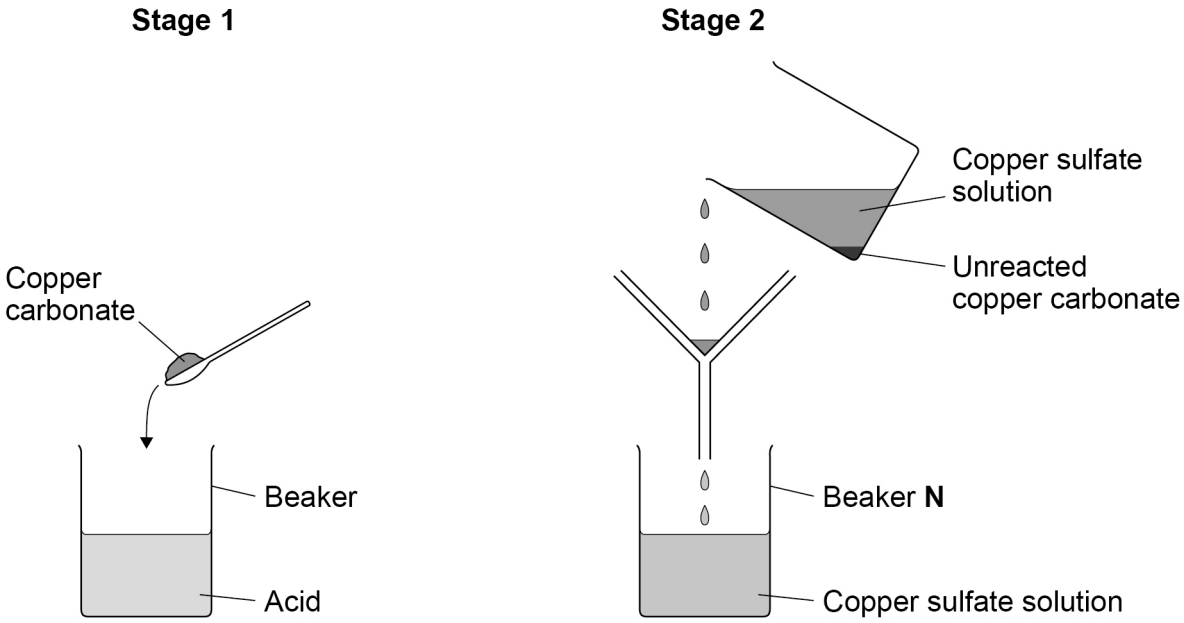
Question 12

June 2024 | 8464/C/1F | Original Q7

0 7 A student prepared copper sulfate by reacting an acid with excess copper carbonate.

Figure 13 shows the first two stages in the preparation of copper sulfate.

Figure 13



0 7 . 1 What is the formula of the acid used to prepare copper sulfate?

[1 mark]

Tick (✓) **one** box.

- HCl ☐
- HNO_3 ☐
- H_2SO_4 ☐

5.4.2.2 Neutralisation of acids and salt production

Question 12 · continued

0 7 . 2 Why is excess copper carbonate used in **stage 1**?

[1 mark]

0 7 . 3 Beaker **N** contained copper sulfate solution.

Describe how the student could produce copper sulfate crystals from the copper sulfate solution in beaker **N**.

[2 marks]

Question 7 continues on the next page

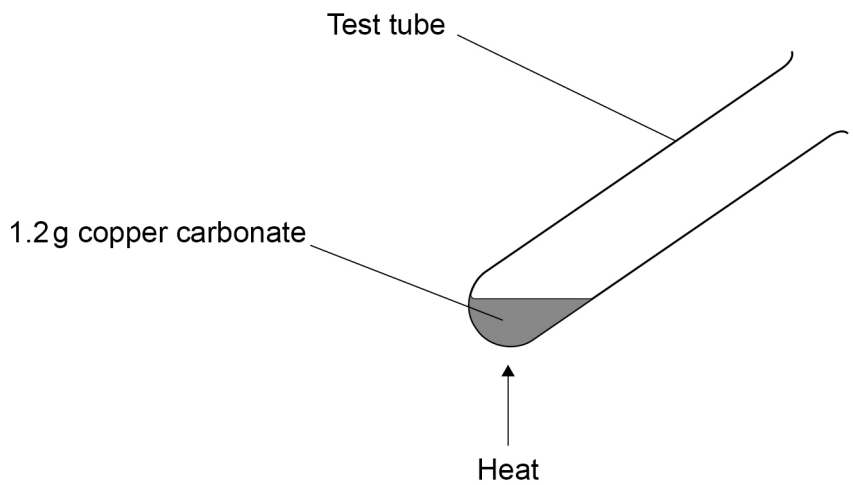
Question 12 · continued

A student investigated the thermal decomposition of copper carbonate.

Copper carbonate decomposes to form two products.

Figure 14 shows the apparatus.

Figure 14



This is the method used.

1. Add 1.2 g of copper carbonate to a test tube.
2. Heat the test tube and contents until the mass does not change.
3. Record the mass of the contents of the test tube after heating.
4. Repeat steps 1 to 3 with different masses of copper carbonate.

Table 7 shows the results.

Table 7

Mass of copper carbonate in test tube before heating in grams	Mass of the contents of test tube after heating in grams
1.2	0.8
2.4	1.7
3.6	2.2
4.8	3.1
6.0	3.9

5.4.2.2 Neutralisation of acids and salt production

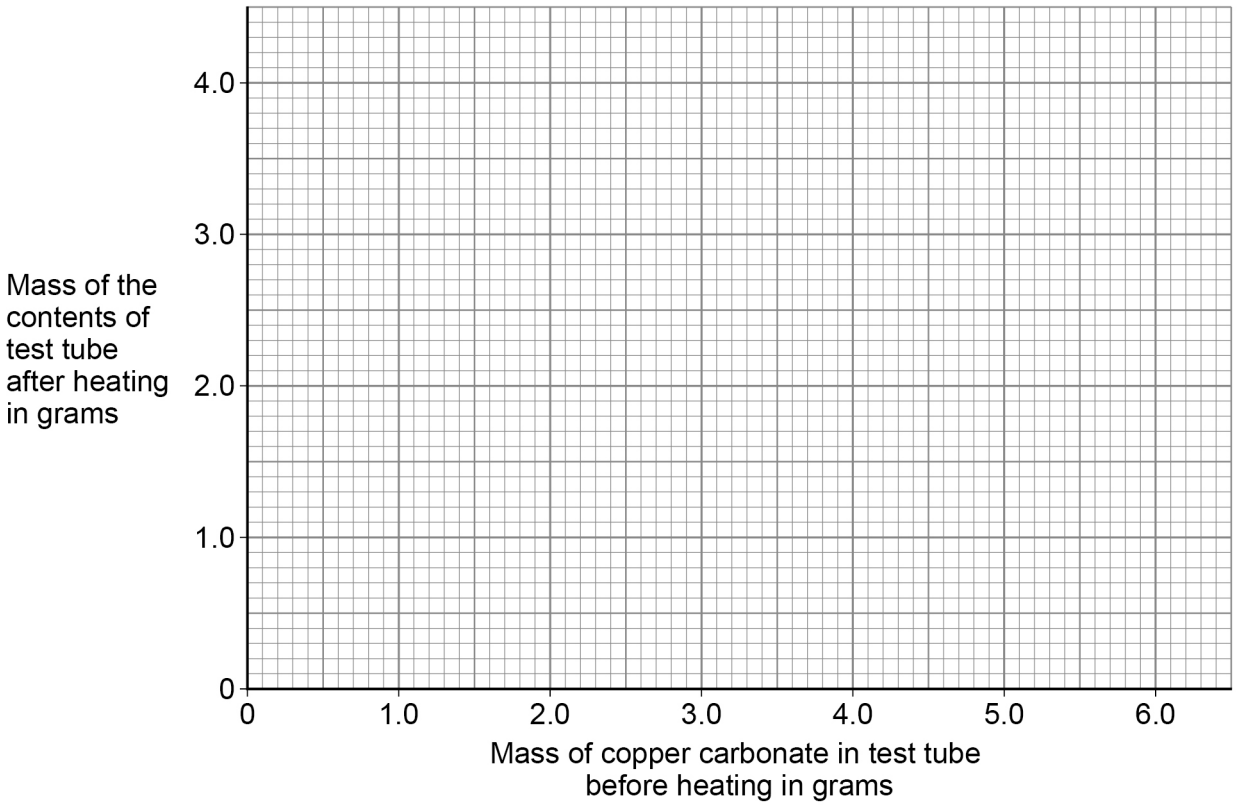
Question 12 · continued

0 7 . 4 Plot the data from **Table 7** on **Figure 15**.

Draw a line of best fit.

[3 marks]

Figure 15



0 7 . 5 Why does the mass of the contents of the test tube decrease in mass when copper carbonate is thermally decomposed?

[1 mark]

8

5.4.2.2 Neutralisation of acids and salt production

Question 13

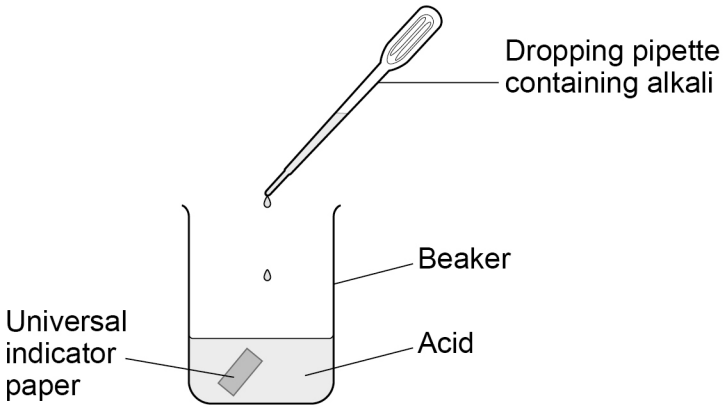
June 2025 | 8464/C/1F | Original Q5

0 5 This question is about acids.

A student investigated the volume of an alkali needed to react completely with 25 cm^3 of an acid.

Figure 10 shows the apparatus.

Figure 10



This is the method used.

1. Add 25 cm^3 of the acid to a beaker.
2. Add a piece of universal indicator paper to the acid.
3. Add the alkali drop by drop to the acid until the universal indicator paper changes colour to green.
4. Record the number of drops of alkali added.

0 5 . 1 The method does **not** give an accurate volume of alkali needed to react completely with the acid.

Suggest **two** improvements to the method.

[2 marks]

1 _____

_____

2 _____

_____

5.4.2.2 Neutralisation of acids and salt production

Question 13 · continued

0 5 . 2 What is the pH of the solution when the universal indicator paper turns green?

[1 mark]

Tick (✓) **one** box.

1 ☐ 5 ☐ 7 ☐ 9 ☐

0 5 . 3 What name is given to the reaction between an acid and an alkali?

[1 mark]

Tick (✓) **one** box.

Combustion ☐

Displacement ☐

Neutralisation ☐

0 5 . 4 Which ion do all acids contain?

[1 mark]

Tick (✓) **one** box.

Cl^- ☐ H^+ ☐ Na^+ ☐

0 5 . 5 Name the acid that reacts with sodium hydroxide to produce sodium nitrate.

[1 mark]

_____

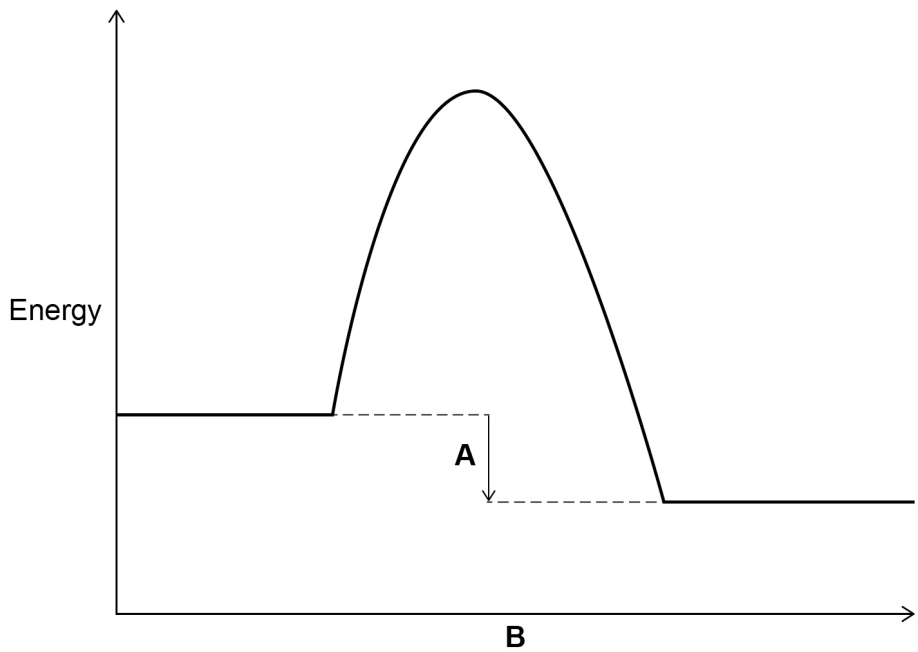
Question 5 continues on the next page

5.4.2.2 Neutralisation of acids and salt production

Question 13 · continued

0 5 . 6 **Figure 11** shows a reaction profile for the reaction between an acid and an alkali.

Figure 11



What do labels **A** and **B** represent on **Figure 11**?

Choose the answers from the box.

[2 marks]

activation energy	**overall energy change**	**products**
progress of reaction	**reactants**	

A _____

B _____

5.4.2.2 Neutralisation of acids and salt production

Question 13 · continued

Acids also react with insoluble solid substances to produce salt solutions.

0 5 . 7 When making a salt solution, excess solid is added to the acid.

Draw the apparatus used to separate the excess solid from the salt solution by filtration.

The apparatus should collect:

- the excess solid
- the salt solution.

[2 marks]

0 5 . 8 Solid **X** reacts with hydrochloric acid to produce zinc chloride and hydrogen gas.

Name solid **X**.

[1 mark]

11

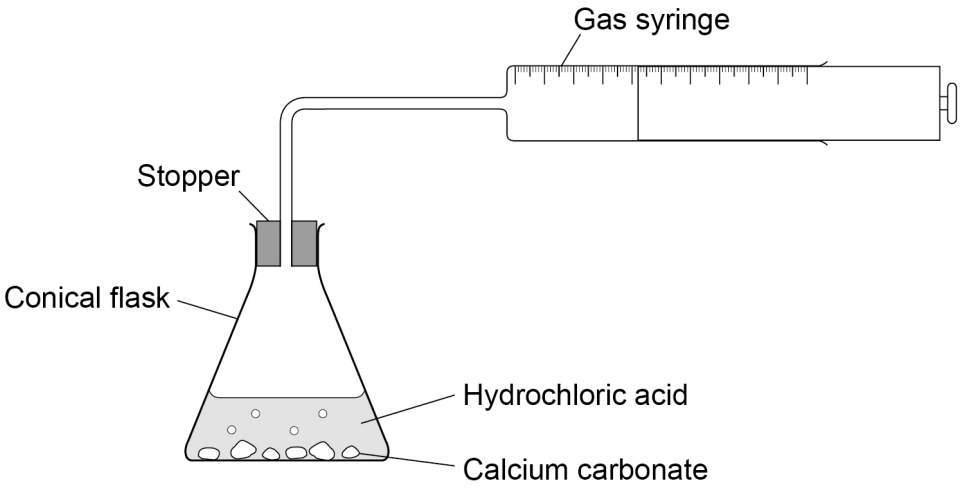
5.4.2.2 Neutralisation of acids and salt production

Question 14

0 2 A student investigated the reaction of calcium carbonate with hydrochloric acid.

Figure 2 shows the apparatus.

Figure 2



This is the method used.

1. Measure 50 cm^3 of hydrochloric acid into a conical flask.
2. Add 4.0 g of calcium carbonate to the conical flask.
3. Insert the stopper into the conical flask as quickly as possible.
4. Start a timer.
5. Measure the volume of gas collected every 30 seconds for 3 minutes.
6. Repeat steps 1 to 5 using different concentrations of hydrochloric acid.

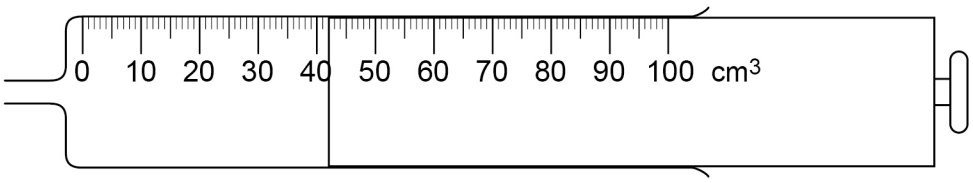
0 2 . 1 Name a suitable piece of equipment to measure 4.0 g of calcium carbonate.

[1 mark]

Question 14 · continued

0 2 . 2 **Figure 3** shows the gas syringe during the investigation.

Figure 3



What is the reading on the gas syringe?

[1 mark]

_____ cm^3

0 2 . 3 What is the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

Concentration of hydrochloric acid ☐

Mass of calcium carbonate ☐

Temperature of the room ☐

0 2 . 4 Why did the student insert the stopper into the conical flask as quickly as possible in step 3?

[1 mark]

_____

_____

Question 2 continues on the next page

5.4.2.2 Neutralisation of acids and salt production

Question 14 · continued

0 2 . 5 The gas produced during the investigation is carbon dioxide.

The test for carbon dioxide uses limewater.

What is the chemical name for limewater?

[1 mark]

Tick (✓) **one** box.

Calcium hydroxide solution ☐

Potassium carbonate solution ☐

Sodium chloride solution ☐

Question 14 · continued

0 2 . 6 The student measured the volume of gas collected every 30 seconds for 3 minutes.

The volume of gas was zero at the start.

For one concentration of hydrochloric acid, the volumes of gas collected were:

43 cm^3 66 cm^3 78 cm^3 83 cm^3 84 cm^3 85 cm^3

Complete **Table 3**.

You should:

- add headings to each column
- add units
- add all of the results to the table.

[4 marks]

Table 3

0	0

Question 14 · continued

0 2 . 7 The student used a different concentration of hydrochloric acid.

18 cm^3 of gas was collected in the first 30 seconds.

Calculate the mean rate of reaction for the first 30 seconds.

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{volume of gas collected in cm}^3}{\text{time taken in seconds}}$$

Choose the unit from the box.

[3 marks]

cm^3	**cm^3/s**	**s**	**s/cm^3**

Mean rate of reaction = _____ Unit _____

0 2 . 8 Increasing the concentration of hydrochloric acid increases the rate of the reaction.

What are **two** reasons why?

[2 marks]

Tick (✓) **two** boxes.

- The particles are closer together. ☐
- The particles collide more frequently. ☐
- The particles have a lower surface area. ☐
- The particles have less energy. ☐
- The particles move faster. ☐

14