AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.4.2.2

Neutralisation of acids and salt production

Past-paper questions

Tier	**Foundation**
Question groups	**41**
Available paper years	**2008–2025**

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.

4.4.2.2 Neutralisation of acids and salt production

Question 01

January 2008 | CHY2F | Original Q3 | Legacy

3 Distress flares are used to attract attention in an emergency.



Flares often contain magnesium. Magnesium burns to form magnesium oxide.

(a) The distress flare burns with a bright flame because the reaction is very *exothermic*.

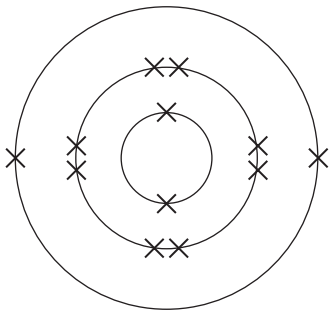
Complete the following sentence using the correct words from the box.

gives out heat	**stores heat**	**takes in heat**

An *exothermic* reaction is one which ..... .

(1 mark)

(b) The diagram shows the electronic structure of a magnesium atom.
The atomic (proton) number of magnesium is 12.



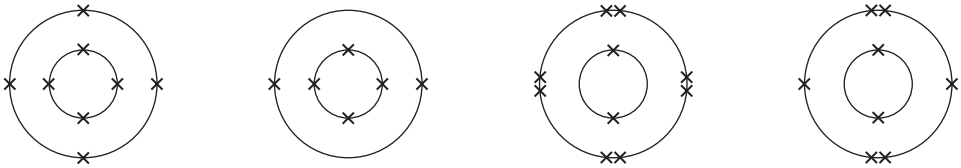
Magnesium atom

Question 01 · continued

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The atomic (proton) number of oxygen is 8.

Which diagram, **A**, **B**, **C** or **D**, shows the electronic structure of an oxygen atom?

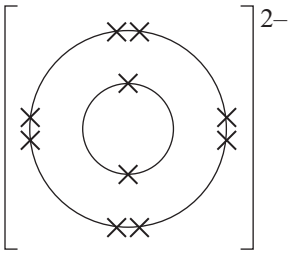


A **B** **C** **D**

Diagram .....

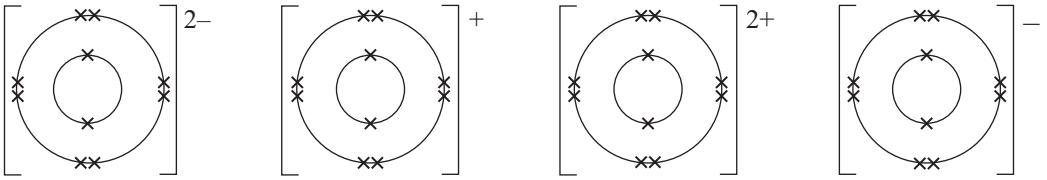
(1 mark)

(c) Magnesium ions and oxide ions are formed when magnesium reacts with oxygen. The diagram shows the electronic structure of an oxide ion.



Oxide ion

Which diagram, **J**, **K**, **L** or **M**, shows the electronic structure of a magnesium ion?



J **K** **L** **M**

Diagram .....

(1 mark)

(d) Indigestion tablets can be made from magnesium oxide. The magnesium oxide neutralises some of the hydrochloric acid in the stomach.

Draw a ring around the name of the salt formed when magnesium oxide reacts with hydrochloric acid.

magnesium chloride **magnesium hydroxide** **magnesium sulfate**

(1 mark)

4

4.4.2.2 Neutralisation of acids and salt production

Question 02

June 2008 | CHY2F | Original Q1 | Legacy

1 This label was taken from a cola drink.



The pH of this drink is 2.5.

1 (a) (i) Which **one** of the ingredients in the cola drink causes the low pH?

.....

(1 mark)

1 (a) (ii) Draw a ring around the name of the ion that gives the cola drink its low pH.

chloride **hydrogen** **hydroxide** **sodium**

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 02 · continued

for mark

1 (b) The preservative used in the cola drink is sodium benzoate.
Sodium benzoate is made using two chemical reactions.

Reaction 1
Methylbenzene is reacted with oxygen, with the help of a catalyst, to form benzoic acid.

Reaction 2
Benzoic acid is neutralised by sodium hydroxide solution to form sodium benzoate and water.

1 (b) (i) How does the catalyst help **reaction 1**?

.....

.....

(1 mark)

1 (b) (ii) **Reaction 1** has a high atom economy.

The table lists several statements. Put a tick (✓) next to the **one** statement which best describes a high atom economy.

Statement	(✓)
All the atoms used are cheap.	
Most of the starting materials end up as useful products.	
Only a small number of atoms are used in the reaction.	

(1 mark)

1 (b) (iii) **Reaction 2** is a neutralisation reaction.

Complete the equation by writing the formula of the product.

$H^+ + OH^- \rightarrow$ .....

(1 mark)

5

4.4.2.2 Neutralisation of acids and salt production

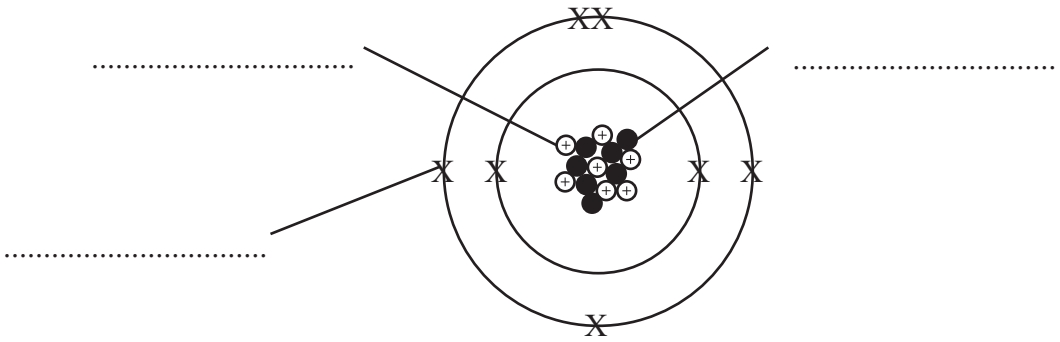
Question 03

June 2008 | CHY2F | Original Q5 | Legacy

5 (a) The diagram represents an atom of nitrogen.

5 (a) (i) Use words from the box to label the diagram.

electron	**neutron**	**nucleus**	**proton**



(2 marks)

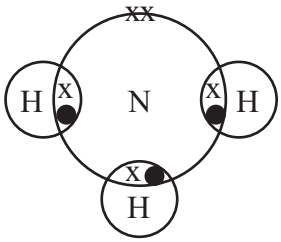
5 (a) (ii) Draw a ring around the mass number of this atom.

5 **7** **14** **21**

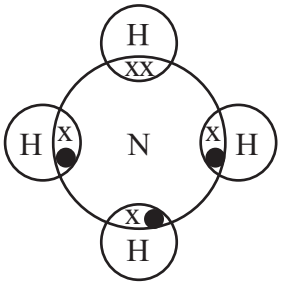
(1 mark)

5 (b) Nitrogen can react with hydrogen to make ammonia, NH_3.

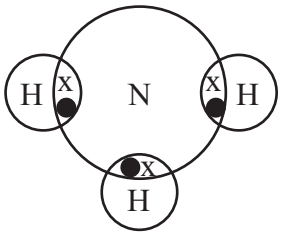
A



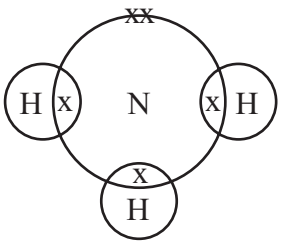
B



C



D



Which diagram, **A**, **B**, **C** or **D**, best represents an ammonia molecule?

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 03 · continued

for mark

5 (c) Ammonia is made using the Haber process. The word equation for this reaction is shown below.

nitrogen + hydrogen $\rightleftharpoons$ ammonia

5 (c) (i) Which **two** of the statements in the table do you know are true **only** by looking at the word equation?

Put a tick (✓) next to these **two** true statements.

Statement	(✓)
The reaction is very fast.	
Ammonia can break up to form nitrogen and hydrogen.	
Ammonia is made from nitrogen and hydrogen.	
The reaction that makes ammonia is endothermic.	

(2 marks)

5 (c) (ii) Draw a ring around the name of the raw material from which nitrogen is obtained.

air **methane** **oil** **water**

(1 mark)

5 (d) Some of the ammonia produced is neutralised by nitric acid to make a salt. This salt is used as a fertiliser.

Put a tick (✓) next to the name of the salt produced when ammonia is neutralised with nitric acid.

Name of salt	(✓)
ammonia nitrate	
ammonia nitride	
ammonium nitrate	
ammonium nitride	

(1 mark)

8

4.4.2.2 Neutralisation of acids and salt production

Question 04

January 2010 | CHY2F | Original Q2 | Legacy

2 Ammonium salts are used to help farmers grow crops.



2 (a) Use the correct word from the box to complete the sentence.

fertilisers	**insecticides**	**pesticides**

Ammonium salts contain nitrogen and are used by farmers as ..... to replace the nitrogen lost from the soil.

(1 mark)

2 (b) Ammonia is made by reacting nitrogen with hydrogen.

Draw a ring around the name of the raw material that provides the nitrogen.

air **crude oil** **water**

(1 mark)

2 (c) Methane and water react together to form the hydrogen.

methane and water → reactor containing a catalyst → hydrogen and carbon monoxide

2 (c) (i) Complete the word equation for this reaction.

methane + ... → hydrogen + ...

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 04 · continued

for mark

2 (c) (ii) How does the catalyst help this reaction?

.....

.....

(1 mark)

2 (d) The reaction between nitrogen and hydrogen to make ammonia can be represented by this equation.

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

Draw a ring around the meaning of the symbol, $\rightleftharpoons$

endothermic reaction **precipitation reaction** **reversible reaction**

(1 mark)

2 (e) A solution of ammonia in water is alkaline.

2 (e) (i) Which **one** of these values could be the pH of this ammonia solution?

Draw a ring around your answer.

4 **7** **10**

(1 mark)

2 (e) (ii) The ammonium salt called ammonium sulfate can be made by reacting ammonia solution with an acid.

Use the correct words from the box to complete the sentences.

hydrochloric	**hydrogen**	**sulfuric**	**water**

Ammonia solution is reacted with ..... acid to make ammonium sulfate.

During the reaction the hydrogen ions from the acid react with hydroxide ions from the alkali to make..... .

(2 marks)

8

4.4.2.2 Neutralisation of acids and salt production

Question 05

8 Read the article.

In the late eighteenth century the French scientist Nicolas Leblanc invented a process to change sodium chloride into sodium carbonate.

The main steps in the original process were:

Step 1. Sodium chloride was reacted with sulfuric acid to make sodium sulfate. Hydrogen chloride was formed and escaped into the atmosphere.
The hydrogen chloride damaged plants over a wide area around the factory.

Step 2. The sodium sulfate was heated with limestone and coal. A solid mixture was formed which contained sodium carbonate, calcium sulfide and unreacted coal.
The calcium sulfide gave off a very unpleasant smell.

Step 3. The sodium carbonate was dissolved in water and separated from the insoluble calcium sulfide and unreacted coal.

Step 4. Crystals of sodium carbonate were obtained from the solution of sodium carbonate.

The process was later improved.

- The hydrogen chloride produced in **Step 1** was changed into chlorine which was used to make bleach.
- The calcium sulfide produced in **Step 2** was converted into sulfur. This sulfur was used to make sulfuric acid.

8 (a) The symbol equation for the reaction in **Step 1** is shown below.

$$2NaCl(s) + H_2SO_4(l) \rightarrow Na_2SO_4(s) + 2HCl(g)$$

What property of hydrogen chloride allowed it to escape into the atmosphere?

.....

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 05 · continued

for mark

8 (b) The insoluble solids, calcium sulfide and unreacted coal were separated from the sodium carbonate solution in **Step 3**.

Suggest how this was done.

.....

.....

(1 mark)

8 (c) Sodium carbonate crystals were obtained from sodium carbonate solution in **Step 4**.

Suggest how this was done.

.....

.....

(1 mark)

8 (d) It has been stated that: 'the Chemical Industry can turn problems into profit'.

State **two** problems with the original process and explain how they were turned into profit.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

(4 marks)

7

4.4.2.2 Neutralisation of acids and salt production

Question 06

4 Alums are salts. They have been used since ancient times in dyeing and medicine and still have many uses today.

Three alums are shown in the table:

Name	Ions present		
Ammonium alum	NH_4^+	Al^{3+}	SO_4^{2-}
Potassium alum	K^+	Al^{3+}	SO_4^{2-}
Sodium alum	Na^+	Al^{3+}	SO_4^{2-}

A student tested these alums to show which ions were present.

4 (a) The student did a flame test on these alums. A sample of each alum was held on a wire in a colourless flame.

In (a)(i) and (a)(ii) use the correct word from the box to complete each sentence.

blue	**lilac**	**yellow**	**green**

4 (a) (i) Sodium ions give a ..... flame.

(1 mark)

4 (a) (ii) Potassium ions give a ..... flame.

(1 mark)

4 (a) (iii) Draw a ring around the correct answer to complete the sentence.

The wire used in a flame test should have a high

density.
electrical conductivity.
melting point.

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 06 · continued

for mark

4 (b) Draw a ring around the correct word to complete the sentences.

4 (b) (i) The student tested a solution of each salt for sulfate ions (SO_4^{2-}).

The student added dilute hydrochloric acid and [barium chloride / nitric acid / silver nitrate] solution and a white [gas / liquid / solid] was formed.

(2 marks)

4 (b) (ii) The student tested a solution of each salt for aluminium ions (Al^{3+}).

The student added sodium hydroxide solution and a [green / red / white] precipitate was formed. When excess sodium hydroxide solution was added, the precipitate [boiled. / condensed. / dissolved.]

(2 marks)

7

4.4.2.2 Neutralisation of acids and salt production

Question 07

1 The table shows some information about acids and alkalis.

Name of acid or alkali	Type	Ions produced in solution		pH	Effect on Universal Indicator
Hydrochloric acid	Strong acid	H^+	Cl^-	1	Goes red
Sodium hydroxide	Strong alkali	Na^+	OH^-	13	Goes purple

Use the information in the table to help you answer parts **(a)** and **(b)**.

1 (a) Draw a ring around the correct answer to complete each sentence.

1 (a) (i) Hydrochloric acid is acidic.

This is because it contains [Cl^- / H^+ / OH^-] ions.

(1 mark)

1 (a) (ii) Sodium hydroxide solution is alkaline.

This is because it contains [H^+ / Na^+ / OH^-] ions.

(1 mark)

1 (a) (iii) The pH of acids is [higher than / lower than / the same as] the pH of alkalis.

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 07 · continued

1 (b) Ethanoic acid is a weak acid.

Universal Indicator can be used to show that hydrochloric acid is a stronger acid than ethanoic acid of the same concentration.

Explain how.

.....

.....

.....

.....

(2 marks)

1 (c) Draw a ring around the correct answer to complete this sentence.

Strong acids and strong alkalis are [completely / not / partially] ionised in water.

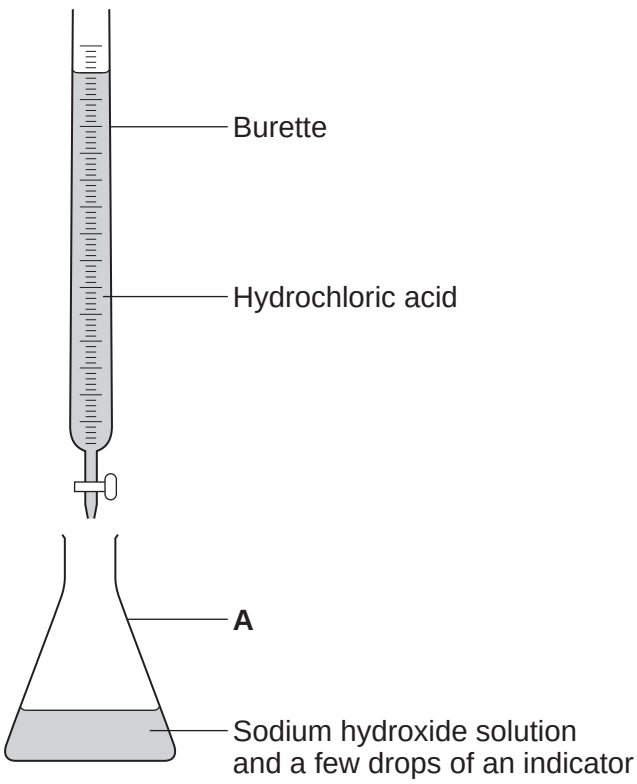
(1 mark)

Question 1 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 07 · continued

1 (d) The diagram shows the apparatus used to find the volume of hydrochloric acid that reacts with 25.0 cm^3 of sodium hydroxide solution.



1 (d) (i) Which **one** of the following is the correct name for **A**?

Draw a ring around your answer.

beaker **conical flask** **pipette**

(1 mark)

1 (d) (ii) Use the correct word from the box to complete the sentence.

distillation	**filtration**	**titration**

The method used to find the volume of acid that reacts with a known volume of alkali is ..... .

(1 mark)

1 (d) (iii) Suggest **one** way to make the results more reliable.

.....

(1 mark)

9

4.4.2.2 Neutralisation of acids and salt production

Question 08

January 2011 | CHY2F | Original Q3 | Legacy

3 (a) A magnesium atom contains 12 protons (●),12 neutrons (o) and 12 electrons (×).

Which diagram, **A**, **B** or **C**, represents this magnesium atom?

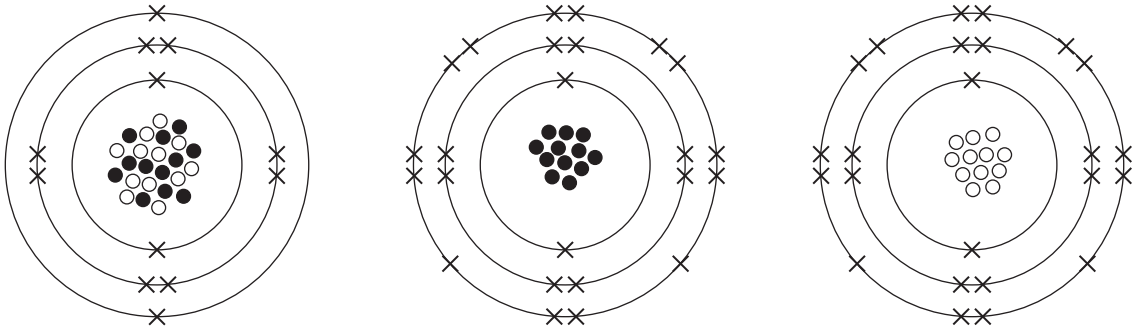
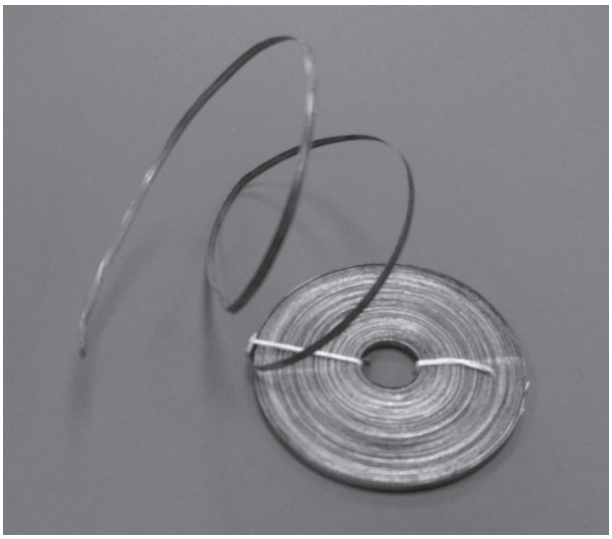


Diagram A **Diagram B** **Diagram C**

This magnesium atom is **Diagram** ☐ .

(1 mark)

3 (b) Magnesium metal is shaped to make magnesium ribbon.



Tick (✓) **two** reasons which explain why metals can be shaped.

Reason why	Tick (✓)
The atoms are all joined by covalent bonds.	
The atoms can slide over each other.	
The atoms are large.	
The atoms are in layers.	

(2 marks)

4.4.2.2 Neutralisation of acids and salt production

Question 08 · continued January 2011 | CHY2F | Original Q3 | Legacy

3 (c) Magnesium sulfate is a salt of magnesium.

It can be prepared by the reaction of magnesium metal with an acid. The equation for the reaction of magnesium with this acid is:

Mg(s)	+	H_2SO_4(aq)	→	$MgSO_4$(aq)	+	H_2(g)
magnesium		acid		magnesium sulfate solution		hydrogen

3 (c) (i) Draw a ring around the name of the acid used in this reaction.

hydrochloric **nitric** **sulfuric**

(1 mark)

3 (c) (ii) Use the equation to help you to answer this question.

Tick (✓) **two** things that happen when this reaction takes place.

	Tick (✓)
Bubbles are produced.	
The magnesium disappears.	
A solid is formed.	
Water is formed.	

(2 marks)

3 (c) (iii) Draw a ring around a method to get solid magnesium sulfate from magnesium sulfate solution.

crystallisation **electrolysis** **oxidation**

(1 mark)

7

4.4.2.2 Neutralisation of acids and salt production

Question 09

June 2011 | CHY1F | Original Q7 | Legacy

7 The raw materials used to make the polymer polyvinyl chloride (PVC) are crude oil and sea salt (sodium chloride).

7 (a) There are three main stages in the production of PVC.

7 (a) (i) **Stage 1** Cracking of hydrocarbons from crude oil produces ethene, C_2H_4

$$C_{10}H_{22} \longrightarrow C_8H_{18} + C_2H_4$$

How are hydrocarbons cracked?

.....

.....

.....

.....

(2 marks)

7 (a) (ii) **Stage 2** Electrolysis of sodium chloride solution produces chlorine.
Ethene from **Stage 1** is then reacted with this chlorine.
One of the hydrogen atoms in each ethene molecule is replaced by a chlorine atom to produce vinyl chloride.

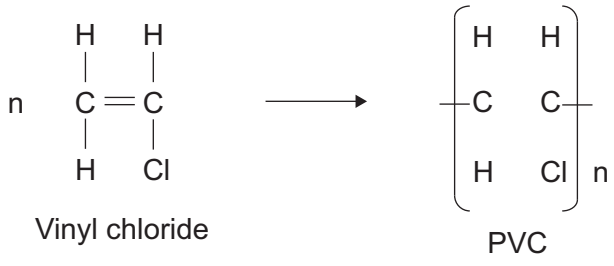
Complete the chemical equation by writing in the formula of the product vinyl chloride.

$$C_2H_4 + Cl_2 \longrightarrow \text{.....} + HCl$$

(1 mark)

7 (a) (iii) **Stage 3** Polymerisation of vinyl chloride produces polyvinyl chloride (PVC).

Complete the chemical equation by drawing in the missing bonds of the product, PVC.



(1 mark)

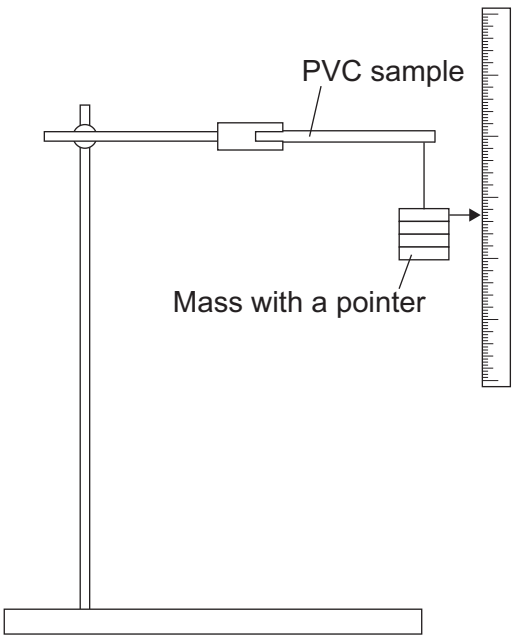
Question 7 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 09 · continued

7 (b) Unplasticised polyvinyl chloride (uPVC) is used to make door and window frames.
PVC with a plasticiser added is used to make cling film for wrapping food.
A plasticiser is a chemical compound.

A student investigated how the percentage of plasticiser added to PVC affected its flexibility.
The student measured the bending of PVC samples when a mass was added.



The student's results are shown in the table.

Sample of PVC	Percentage (%) of plasticiser added	Bending of PVC sample in mm				
		Test 1	Test 2	Test 3	Test 4	Mean
A	**0**	2	3	3	4	3
B	**5**	22	15	23	24	
C	**10**	27	27	29	29	28
D	**15**	34	35	35	36	35

7 (b) (i) Each PVC sample should be the same size to make it a fair test.
Explain why.

.....

.....

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 09 · continued June 2011 | CHY1F | Original Q7 | Legacy

7 (b) (ii) The student repeated the test four times for each sample.
Explain why.

.....

.....

(1 mark)

7 (b) (iii) Calculate the mean value for sample **B**.

.....

.....

.....

.....

(2 marks)

7 (b) (iv) Each of the samples bent the most in test **4**.
Suggest a possible reason for this.

.....

.....

(1 mark)

7 (c) Suggest why unplasticised polyvinyl chloride (uPVC) is used to make door and window frames.

.....

.....

(1 mark)

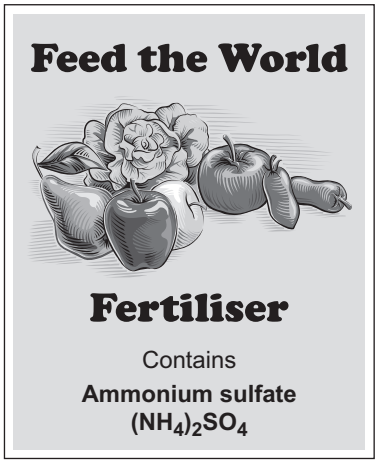
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4.4.2.2 Neutralisation of acids and salt production

Question 10

June 2011 | CHY3F | Original Q3 | Legacy

3 Ammonium sulfate is an artificial fertiliser.



3 (a) A student tested this fertiliser to prove that it contained ammonium ions and sulfate ions.

Draw a ring around the correct answer to complete each sentence.

3 (a) (i) Test for ammonium ions (NH_4^+).

The student added [sodium chloride solution / sodium hydroxide solution / dilute sulfuric acid] to the fertiliser.

A gas called ammonia was produced.

Ammonia turns damp litmus paper [blue. / green. / red.]

(2 marks)

3 (a) (ii) Test for sulfate ions (SO_4^{2-}).

The student added [barium chloride / silver nitrate / sodium chloride] solution to a solution of the fertiliser.

A [blue / red / white] precipitate was formed.

(2 marks)

4.4.2.2 Neutralisation of acids and salt production

Question 10 · continued

3 (b) Ammonium sulfate is made by reacting sulfuric acid with ammonia solution.

Sulfuric acid is a *strong* acid.

Draw a ring around the correct answer to complete the sentence.

The word *strong* means that the acid is

- difficult to break.
- very concentrated.
- fully ionised in water.

(1 mark)

3 (c) Use the information about acids in the table to help you answer these questions.

Name of chemical	Ions produced in aqueous solution		pH	Universal Indicator added
Ethanoic acid	H^+	CH_3COO^-	5	Goes orange
Sulfuric acid	H^+	SO_4^{2-}	1	Goes red

Draw a ring around the correct answer to complete each sentence.

3 (c) (i) Sulfuric acid and ethanoic acid are both acids because they contain

- CH_3COO^- ions.
- H^+ ions.
- SO_4^{2-} ions.

(1 mark)

3 (c) (ii) Sulfuric acid is a stronger acid than ethanoic acid.

The pH of stronger acids is

- higher than
- lower than
- the same as

the pH of weaker acids.

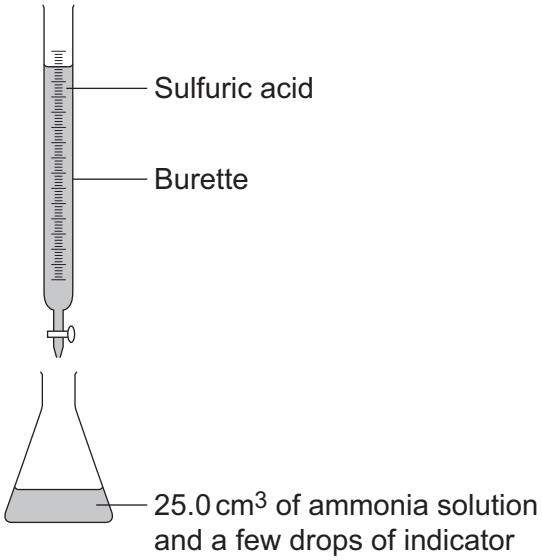
(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 10 · continued

3 (d) The volume of sulfuric acid that reacts with 25.0 cm^3 of ammonia solution can be found by titration.

The diagram shows the apparatus used for the titration.



A student did the titration five times and recorded the following results.

Titration	1	2	3	4	5
Volume of acid added in cm^3	13.3	13.9	13.2	13.1	13.2

3 (d) (i) How did the student know when enough sulfuric acid had been added to neutralise the ammonia solution?

.....

.....

(1 mark)

3 (d) (ii) The student did **not** use one of the results because it was anomalous.

Which result was anomalous? .....

(1 mark)

3 (d) (iii) Use the **other** four results to calculate the mean volume of sulfuric acid that reacted with the ammonia.

.....

.....

Mean volume = ... cm^3

(1 mark)

10

4.4.2.2 Neutralisation of acids and salt production

Question 11

June 2012 | CH2FP | Original Q7 | Legacy

7 (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The salt called potassium chloride is made when potassium hydroxide solution reacts with hydrochloric acid.

potassium hydroxide solution + hydrochloric acid → potassium chloride solution + water

Describe a method for making **crystals** of potassium chloride from potassium hydroxide solution and hydrochloric acid.

In this method you should:

- describe how you will add the correct amount of the hydrochloric acid to neutralise the potassium hydroxide solution
- describe how you will get crystals of potassium chloride.

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(6 marks)

Question 7 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 11 · continued

7 (b) Ammonium nitrate is another salt.
Ammonium nitrate is made when ammonia solution is neutralised with an acid.

Name the acid to complete the word equation.

ammonia + ... acid → ammonium nitrate

(1 mark)

7 (c) Read the information.

Ammonium nitrate – good or bad?

Some farmers put a lot of ammonium nitrate on their farmland.

Many people are worried about this use of ammonium nitrate.

Rain water can wash the ammonium nitrate off the farmland and into rivers and lakes. The ammonium nitrate may get into drinking water supplies and could be harmful to health.

7 (c) (i) Why do some farmers put ammonium nitrate on their farmland?

.....

.....

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 11 · continued

7 (c) (ii) Which **one** of the questions in the table cannot be answered by science alone?

Tick (✓) **one** question.

Question	Tick (✓)
How much ammonium nitrate is in drinking water?	
Should farmers stop using ammonium nitrate on their farmland?	
Is ammonium nitrate soluble in rain water?	

Give **two** reasons why this question **cannot** be answered by science alone.

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(3 marks)

11

4.4.2.2 Neutralisation of acids and salt production

Question 12

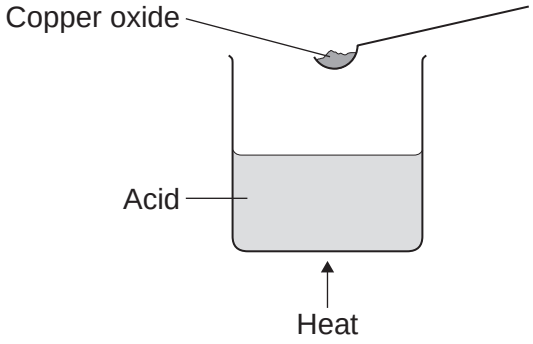
January 2013 | CH2FP | Original Q5 | Legacy

5 A student added copper oxide to an acid to make copper sulfate.

The student heated the acid.

The student added copper oxide until no more reacted.

5 (a) The diagram shows the first stage in the experiment.



5 (a) (i) Complete the word equation.

Copper oxide + ... acid → copper sulfate + water

(1 mark)

5 (a) (ii) Which **one** of these values could be the pH of the acid?

Draw a ring around the correct answer.

1 **7** **11**

(1 mark)

5 (a) (iii) Why is the acid heated?

.....

.....

(1 mark)

5 (b) After the reaction is complete, some solid copper oxide remains.
Why?

.....

.....

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 12 · continued

5 (c) The student removed the solid copper oxide from the solution.

Suggest what the student should do to the solution to form copper sulfate crystals.

.....

.....

(1 mark)

5 (d) The mass of copper sulfate crystals was less than the student expected.

Tick (✓) the **one** statement that explains why the mass of copper sulfate crystals was less than expected.

Statement	Tick (✓)
Some copper sulfate may have been lost during the experiment.	
The student added too much copper oxide.	
The copper sulfate crystals were wet when they were weighed.	

(1 mark)

6

4.4.2.2 Neutralisation of acids and salt production

Question 13

7 A student investigated the rate of reaction between sodium thiosulfate and dilute hydrochloric acid.

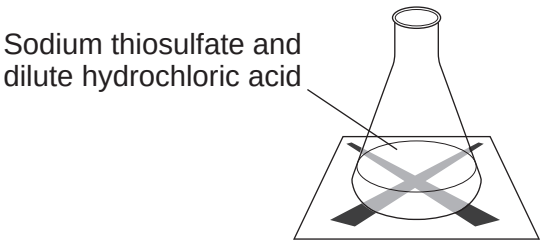
The student placed a conical flask over a cross on a piece of paper.

The student mixed the solutions in the flask.

The solution slowly went cloudy.

The student timed how long it took until the cross could not be seen.





The equation for the reaction is:

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

sodium thiosulfate + hydrochloric acid → sodium chloride + water + sulfur dioxide + sulfur

7 (a) Explain why the solution goes cloudy.

.....

.....

.....

.....

(2 marks)

4.4.2.2 Neutralisation of acids and salt production

Question 13 · continued

7 (b) The student repeated the experiment with different concentrations of sodium thiosulfate.

Concentration of sodium thiosulfate in moles per dm^3	Time taken until the cross could not be seen in seconds			
	Trial 1	Trial 2	Trial 3	Mean
0.040	71	67	69	69
0.060	42	45	45	44
0.080	31	41	33	

7 (b) (i) Calculate the mean time for 0.080 moles per dm^3 of sodium thiosulfate.

.....

.....

.....

Mean = ... seconds
(2 marks)

7 (b) (ii) Describe and explain, in terms of particles and collisions, the effect that increasing the concentration of sodium thiosulfate has on the rate of the reaction.

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.....
(3 marks)

7

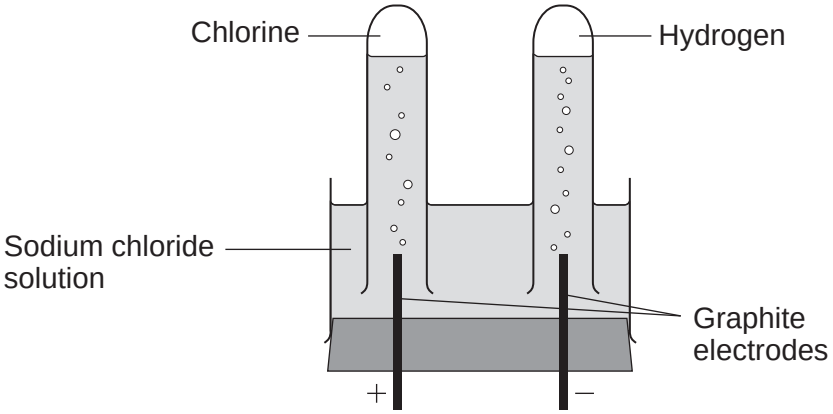
4.4.2.2 Neutralisation of acids and salt production

Question 14

January 2013 | CH2FP | Original Q8 | Legacy

8 The electrolysis of sodium chloride solution is an industrial process.

The diagram shows the apparatus used in a school experiment.



8 (a) One of the products of the electrolysis of sodium chloride solution is hydrogen.

8 (a) (i) Why do hydrogen ions move to the negative electrode?

.....

.....

(1 mark)

8 (a) (ii) How does a hydrogen ion change into a hydrogen atom?

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(1 mark)

4.4.2.2 Neutralisation of acids and salt production

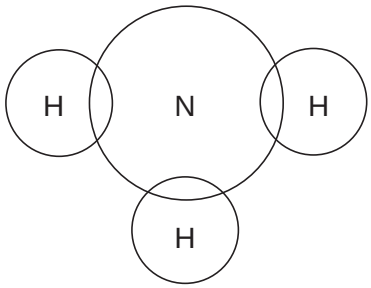
Question 14 · continued

8 (b) Hydrogen is used to make ammonia (NH_3).

Complete the diagram to show the bonding in ammonia.

Use dots (●) and crosses (x) to show electrons.

Show only outer shell electrons.



(2 marks)

8 (c) The table shows the ions in sodium chloride solution.

Positive ions	Negative ions
hydrogen	chloride
sodium	hydroxide

In industry, some of the waste from the electrolysis of sodium chloride solution is alkaline and has to be neutralised.

8 (c) (i) Which ion makes the waste alkaline?

.....

(1 mark)

8 (c) (ii) This waste must be neutralised.

Write the ionic equation for the neutralisation reaction.

.....

(1 mark)

Question 8 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 14 · continued

8 (d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The electrolysis of sodium chloride solution also produces chlorine and sodium hydroxide.

In industry, the electrolysis of sodium chloride solution can be done in several types of electrolysis cell.

Some information about two different types of electrolysis cell is given below.

	Mercury cell	**Membrane cell**
Cost of construction	Expensive	Relatively cheap
Additional substances used	Mercury, which is recycled. Mercury is toxic so any traces of mercury must be removed from the waste.	Membrane, which is made of a polymer. The membrane must be replaced every 3 years.
Amount of electricity used for each tonne of chlorine produced in kWh	3400	2950
Quality of chlorine produced	Pure	Needs to be liquefied and distilled to make it pure.
Quality of sodium hydroxide solution produced	50% concentration. Steam is used to concentrate the sodium hydroxide solution produced.	30% concentration. Steam is used to concentrate the sodium hydroxide solution produced.

Use the information and your knowledge and understanding to compare the environmental and economic advantages and disadvantages of these **two** types of electrolysis cell.

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4.4.2.2 Neutralisation of acids and salt production

Question 15

June 2013 | CH1FP | Original Q3 | Legacy

3 Carbon dioxide is produced when metal carbonates are heated.

3 (a) (i) Draw a ring around the correct answer to complete the word equation.

magnesium carbonate ⟶ [magnesium / magnesium hydroxide / magnesium oxide] + carbon dioxide

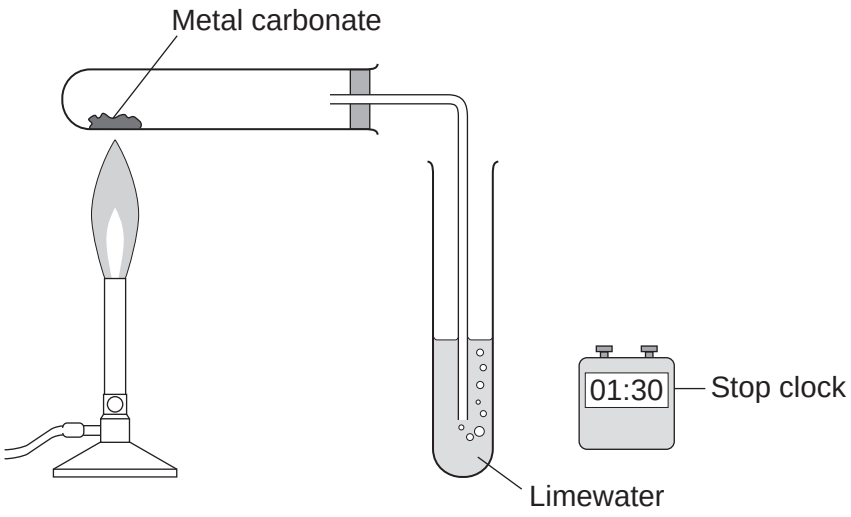
(1 mark)

3 (a) (ii) Draw a ring around the correct answer to complete the sentence.

The reaction to produce carbon dioxide from magnesium carbonate is [combustion. / decomposition. / fermentation.]

(1 mark)

3 (b) A student investigated what happens when metal carbonates are heated.



The student:

- used the apparatus to investigate heating four metal carbonates
- started the stop clock at the same time as he began to heat the metal carbonate
- stopped the stop clock when carbon dioxide was produced.

4.4.2.2 Neutralisation of acids and salt production

Question 15 · continued

The student's results are shown in the table.

Metal carbonate	Time taken for the production of carbon dioxide to start in seconds
Calcium carbonate	163
Copper carbonate	24
Magnesium carbonate	92
Zinc carbonate	67

3 (b) (i) Tick (✓) the type of graph the student should draw from these results.

Type of graph	Tick (✓)
Bar chart	
Line graph	
Scatter graph	

(1 mark)

3 (b) (ii) Use the Chemistry Data Sheet to help you to answer this question.

Draw a ring around the correct answer to complete the sentence.

The more reactive the metal in the carbonate the [less / more / same] time is taken for the production of carbon dioxide to start.

(1 mark)

3 (b) (iii) How did the student know that carbon dioxide was produced?

Use the diagram of the apparatus to help you to answer this question.

.....

.....

.....

.....

(2 marks)

6

4.4.2.2 Neutralisation of acids and salt production

Question 16

June 2013 | CH2FP | Original Q2 | Legacy

2 This question is about salts of ammonia and salts of lead.

2 (a) Ammonia dissolves in water to make an alkaline solution.

Draw a ring around the correct answer to complete the sentence.

The pH of a solution of ammonia is

2.
7.
11.

(1 mark)

2 (b) Ammonia can be reacted with an acid to produce the salt ammonium nitrate.

2 (b) (i) Name the acid used to produce ammonium nitrate.

.....

(1 mark)

2 (b) (ii) Draw a ring around the correct answer to complete the sentence.

The reaction of ammonia with an acid is a

neutralisation
polymerisation
reduction

reaction.

(1 mark)

2 (c) Why do farmers use ammonium nitrate on their fields?

.....

.....

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 16 · continued

2 (d) Lead iodide is a salt that can be produced without using an acid.

2 (d) (i) Lead iodide is produced by mixing two solutions.

Complete the word equation.

lead ..... + potassium ..... ⟶ lead iodide + potassium nitrate

(2 marks)

2 (d) (ii) The lead iodide is produced as a solid.

Complete the sentence.

A solid that is produced when two solutions are mixed is called a ..... .

(1 mark)

2 (d) (iii) How could the solid lead iodide be separated from the solution?

.....

(1 mark)

2 (d) (iv) A student mixed two solutions to make sodium chloride.

The equation for the reaction the student used is:

$$HCl(aq) + NaOH(aq) \longrightarrow NaCl(aq) + H_2O(l)$$

How could the student obtain solid sodium chloride from the solution?

.....

(1 mark)

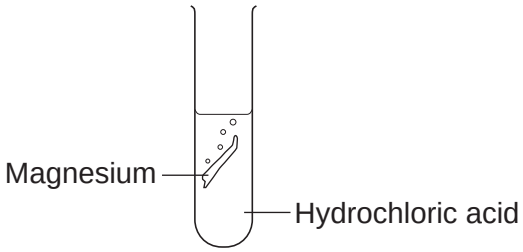
9

4.4.2.2 Neutralisation of acids and salt production

Question 17

June 2013 | CH2FP | Original Q6 | Legacy

6 A student investigated the reaction between magnesium and hydrochloric acid.



The equation for the reaction is:

Mg(s)	+	2 HCl(aq)	⟶	$MgCl_2$(aq)	+	H_2(g)
magnesium		hydrochloric acid		magnesium chloride		hydrogen

6 (a) Give **two** observations the student could make during the reaction.

1 .....

.....

2 .....

.....

(2 marks)

6 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The student investigated how the rate of this reaction changed when the concentration of hydrochloric acid was changed.

Write a plan the student could use.

In your plan you should:

- describe how you would carry out the investigation and make it a fair test
- describe the measurements you would make.

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4.4.2.2 Neutralisation of acids and salt production

Question 18

June 2013 | CH3FP | Original Q2 | Legacy

2 Low sodium salt is used on food. This label is from a packet of low sodium salt.

Low Sodium Salt

Ingredients:

Sodium chloride
Potassium chloride
Drying agent: magnesium carbonate

A chemist tests the low sodium salt for the substances on the label.

2 (a) The chemist tests for sodium ions and potassium ions using a flame test.

Draw a ring around the correct answer to complete each sentence.

2 (a) (i) In a flame test, sodium ions produce a lilac / red / yellow colour.

(1 mark)

2 (a) (ii) In a flame test, potassium ions produce a lilac / red / yellow colour.

(1 mark)

4.4.2.2 Neutralisation of acids and salt production

Question 18 · continued

2 (b) The chemist added hydrochloric acid to low sodium salt. Carbon dioxide gas was produced.

Describe the test for carbon dioxide and give the result of the test.

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.....

(2 marks)

2 (c) The chemist made a solution of low sodium salt.

2 (c) (i) Tick (✓) **one** box to show the chemical used to test for chloride ions.

	Tick (✓)
Barium chloride solution	
Silver nitrate solution	
Sodium sulfate solution	

(1 mark)

2 (c) (ii) Sodium hydroxide solution is used to test for magnesium ions.

Draw a ring around the colour of precipitate produced by this test.

brown **green** **white**

(1 mark)

6

Turn to page 7 for the next question

4.4.2.2 Neutralisation of acids and salt production

Question 19

June 2014 | CH2FP | Original Q4 | Legacy

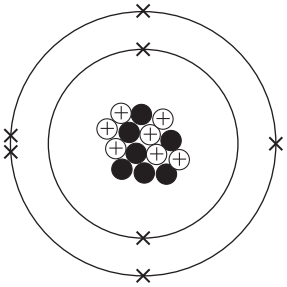
4 Fertilisers contain elements that plants need.

AQAGROW
Plant Fertiliser

Contains:
- Nitrogen
- Phosphorus
- Potassium

4 (a) **Figure 5** represents a nitrogen atom.

Figure 5



Complete each sentence.

4 (a) (i) The mass number of this nitrogen atom is ..... .

[1 mark]

4 (a) (ii) Atoms of nitrogen with different numbers of neutrons are called ..... .

[1 mark]

4 (a) (iii) Compared with a proton, the mass of an electron is ..... .

[1 mark]

4.4.2.2 Neutralisation of acids and salt production

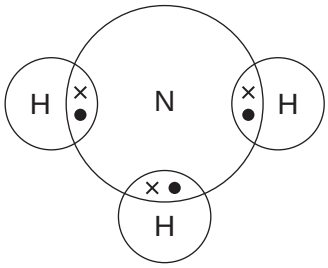
Question 19 · continued

4 (b) Fertilisers can be made from ammonia.

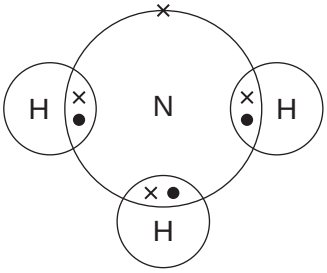
4 (b) (i) Which diagram, **A**, **B**, or **C**, represents the electronic structure of an ammonia molecule?

[1 mark]

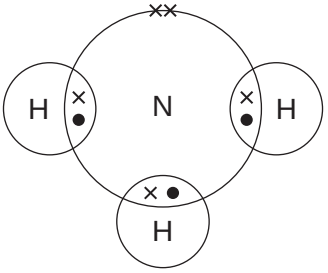
A



B



C



The electronic structure of an ammonia molecule is shown in diagram ☐

4 (b) (ii) What is the correct formula of ammonia?

Draw a ring around the correct answer.

[1 mark]

N_3H **NH_3** **NH^3**

Question 4 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 19 · continued

4 (c) A student made ammonium nitrate by reacting ammonia solution with an acid.

4 (c) (i) Name the acid used to make ammonium nitrate.

[1 mark]

.....

4 (c) (ii) Complete the sentence.

[1 mark]

The student added a few drops of ....., which changed colour when the ammonia solution had neutralised the acid.

4 (c) (iii) The student added charcoal and filtered the mixture.

This produced a colourless solution of ammonium nitrate.

How is solid ammonium nitrate obtained from the solution?

[1 mark]

.....

4 (c) (iv) A farmer put ammonium nitrate fertiliser onto a field of grass.

Suggest what would happen to the grass.

[1 mark]

.....

.....

4.4.2.2 Neutralisation of acids and salt production

Question 19 · continued

4 (d) Some fertilisers contain potassium chloride.

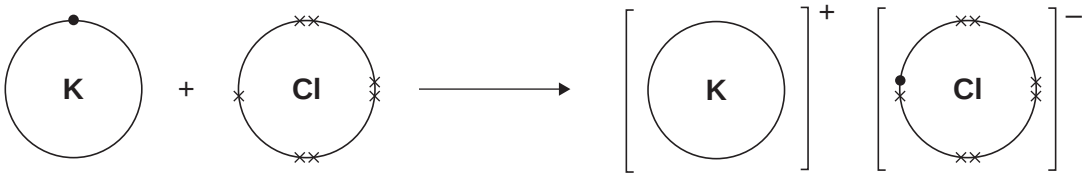
Potassium reacts with chlorine to produce potassium chloride.

Figure 6 shows how this happens.

The dots (•) and crosses (x) represent electrons.

Only the outer shell is shown.

Figure 6



Use **Figure 6** to help you answer this question.

Describe, as fully as you can, what happens when potassium reacts with chlorine to produce potassium chloride.

[4 marks]

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13

4.4.2.2 Neutralisation of acids and salt production

Question 20

June 2015 | CH1FP | Original Q5 | Legacy

5 Limestone is used to make many different materials.

5 (a) Heating limestone produces calcium oxide and carbon dioxide.

Complete the sentences.

5 (a) (i) The main compound in limestone is calcium ..... .
[1 mark]

5 (a) (ii) The reaction to produce calcium oxide from limestone is thermal ..... .
[1 mark]

5 (a) (iii) Calcium hydroxide is produced when calcium oxide reacts with ..... .
[1 mark]

5 (a) (iv) Calcium hydroxide is used to neutralise acids because it is an ..... .
[1 mark]

Question 5 continues on the next page

Question 20 · continued

5 (b) Cement is made from limestone and clay.

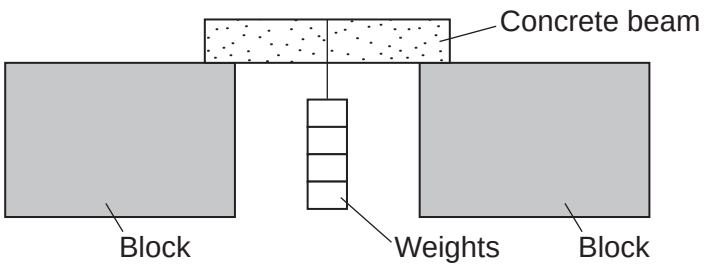
Concrete is made by mixing cement with water, sand and aggregate (small pieces of rock).

A group of students did an investigation on the amount of aggregate needed to make the strongest concrete beam.

The students used this method:

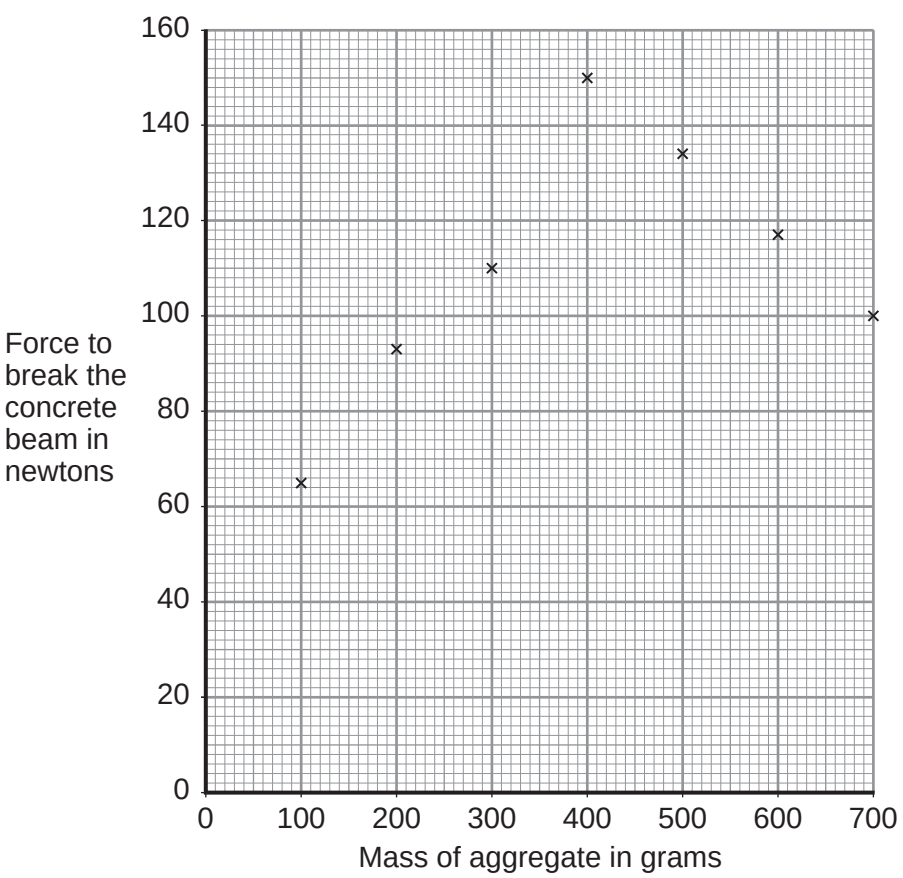
- use the same mass of cement and the same mass of sand but change the mass of aggregate to make seven different concrete mixtures
- use the different concrete mixtures to make beams of the same size
- add weights, as shown in **Figure 7**, until the concrete beam breaks.

Figure 7



The students' results are plotted on the graph in **Figure 8**.

Figure 8



4.4.2.2 Neutralisation of acids and salt production

Question 20 · continued

5 (b) (i) One of the points is anomalous.

Complete the graph in **Figure 8** by drawing **two** straight lines of best fit.

[2 marks]

5 (b) (ii) Describe **one** way the students could improve the method so that their results are more accurate for each graph point.

[2 marks]

.....

.....

.....

.....

5 (b) (iii) What force is needed to break a concrete beam containing no aggregate?

Show your working on the graph.

[2 marks]

Force = ... newtons

5 (b) (iv) One of the students concluded that:

'The force needed to break a concrete beam increases as the mass of aggregate increases.'

The student's conclusion is **not completely** correct. Use values from the graph to explain why.

[3 marks]

.....

.....

.....

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.....

13

4.4.2.2 Neutralisation of acids and salt production

Question 21

June 2015 | CH2FP | Original Q2 | Legacy

2 This question is about salts.

2 (a) Salt (sodium chloride) is added to many types of food.

Sodium chloride is produced by reacting sodium with chlorine.

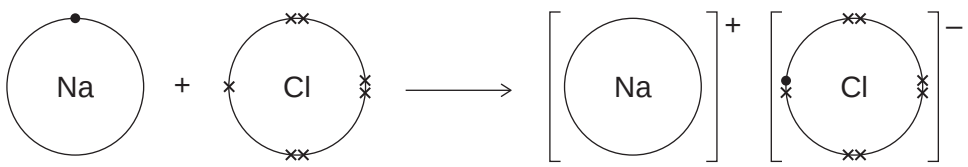
sodium + chlorine ⟶ sodium chloride

Figure 2 shows what happens to atoms of sodium and chlorine in this reaction.

The dots (•) and crosses (×) represent electrons.

Only the outer electrons are shown.

Figure 2



Describe, in terms of electrons, what happens when a sodium atom reacts with a chlorine atom to produce sodium chloride.

[3 marks]

.....

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.....

Question 2 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 21 · continued

2 (b) Lack of iodine can affect the learning ability of children.

One idea is that salt (sodium chloride) should have iodine added.

2 (b) (i) Iodine consists of simple molecules.

What is a property of substances that have simple molecules?

[1 mark]

Tick (✓) **one** box.

Have no overall electric charge ☐

Have high boiling points ☐

Have giant covalent structures ☐

2 (b) (ii) Which one of the following questions cannot be answered by science alone?

[2 marks]

Tick (✓) **one** box.

How much sodium chloride is in food? ☐

What harm does a lack of iodine do? ☐

Should iodine be added to salt in food? ☐

Give **one** reason why this question cannot be answered by science alone.

.....

.....

2 (c) A student produced the salt ammonium nitrate by adding an acid to ammonia solution.

2 (c) (i) Name the acid used.

[1 mark]

.....

4.4.2.2 Neutralisation of acids and salt production

Question 21 · continued

2 (c) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

an acid	an alkali	a salt

Ammonia solution (ammonium hydroxide) is ..... .

2 (c) (iii) The student added a few drops of a solution which changed colour when the reaction was complete.

Complete the sentence.

[1 mark]

The solution added is an ..... .

2 (d) Farmers buy solid ammonium nitrate in poly(ethene) sacks.

2 (d) (i) How is solid ammonium nitrate made from a solution of ammonium nitrate?

[1 mark]

Tick (✓) **one** box.

Crystallisation ☐

Decomposition ☐

Electrolysis ☐

2 (d) (ii) Why do farmers use ammonium nitrate on their fields?

[1 mark]

.....

.....

2 (d) (iii) The properties of poly(ethene) depend on the reaction conditions when it is made.

State **one** reaction condition that can be changed when making poly(ethene).

[1 mark]

.....

.....

12

4.4.2.2 Neutralisation of acids and salt production

Question 22

June 2015 | CH3FP | Original Q6 | Legacy

6 This question is about chemical tests.

6 (a) Solutions of copper(II) ions and iron(III) ions produce coloured precipitates with sodium hydroxide solution.

Draw **one** line from each metal ion to the colour of the precipitate it produces.

[2 marks]

Metal ion	Colour of precipitate
Copper(II) (Cu^{2+})	Blue
	Brown
	Green
Iron(III) (Fe^{3+})	White

6 (b) Sodium hydroxide solution was added to a solution containing ions of a metal.

A white precipitate was produced. The white precipitate dissolved in excess sodium hydroxide solution.

Use the correct answer from the box to complete the sentence.

[1 mark]

aluminium	**magnesium**	**potassium**

The ions in the solution were ions of ..... .

4.4.2.2 Neutralisation of acids and salt production

Question 22 · continued

6 (c) Low sodium salt contains sodium chloride and potassium chloride.

A student used a flame test on low sodium salt.

6 (c) (i) What is the colour produced by sodium ions in a flame test?

[1 mark]

.....

6 (c) (ii) What is the colour produced by potassium ions in a flame test?

[1 mark]

.....

6 (c) (iii) Why is it **not** possible to tell from the flame test that both ions are present in low sodium salt?

[1 mark]

.....

.....

6

4.4.2.2 Neutralisation of acids and salt production

Question 23

June 2015 | CH3FP | Original Q7 | Legacy

7 Some pollutants cause acid rain.

A student tested 25.0 cm^3 samples of three types of rainwater, **P**, **Q** and **R**.
The student titrated the samples with sodium hydroxide solution (an alkali).

The student recorded the volume of sodium hydroxide solution needed to neutralise the rainwater. The student's results are shown in **Table 1**.

Table 1

	Volume of sodium hydroxide needed to neutralise the rainwater in cm^3				
Type of rainwater	**Titration 1**	**Titration 2**	**Titration 3**	**Titration 4**	**Mean value**
P	18.0	15.5	14.5	15.0	15.0
Q	13.0	10.0	11.0	10.5	10.5
R	23.0	19.5	18.5	19.0	19.0

7 (a) (i) The student calculated the mean value for rainwater **R** as 19.0 cm^3.

Show how the student calculated the mean value for rainwater **R**.

[2 marks]

.....

.....

.....

.....

7 (a) (ii) Write down **P**, **Q** and **R** in order of their acidity.

[2 marks]

Most acidic .....

.....

Least acidic .....

4.4.2.2 Neutralisation of acids and salt production

Question 23 · continued

7 (b) A second student repeated the experiment and recorded the results in **Table 2**.

Table 2

	Volume of sodium hydroxide needed to neutralise the rainwater in cm^3	
Type of rainwater	**Titration 1**	**Titration 2**
P	17	15
Q	11	9
R	20	18

Use **Table 1** and **Table 2** to suggest **two** improvements the second student could make to obtain more accurate results.

[2 marks]

.....

.....

.....

.....

7 (c) The results of the two students show that the experiment is reproducible.

Give the reason why.

[1 mark]

.....

.....

7

4.4.2.2 Neutralisation of acids and salt production

Question 24

June 2016 | CH2FP | Original Q6 | Legacy

6 This question is about ammonia and fertilisers.

6 (a) Ammonia is produced by a reversible reaction.

The equation for the reaction is:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

Complete the sentence.

[1 mark]

The forward reaction is exothermic, so the reverse reaction is _____ .

6 (b) Calculate the percentage by mass of nitrogen in ammonia (NH_3).
Relative atomic masses (A_r): H = 1; N = 14
You **must** show how you work out your answer.

[3 marks]

_____

_____

_____

_____

_____

_____

Percentage by mass of nitrogen = _____%

4.4.2.2 Neutralisation of acids and salt production

Question 24 · continued

6 (c) A neutral solution can be produced when ammonia reacts with an acid.

6 (c) (i) Give the pH of a neutral solution.

[1 mark]

pH _____

6 (c) (ii) Which of these ionic equations shows a neutralisation reaction?

[1 mark]

Tick (✓) **one** box.

$H^+ + OH^- \longrightarrow H_2O$ ☐

$NH_4^+ + OH^- \longrightarrow NH_4OH$ ☐

$H^+ + Cl^- \longrightarrow HCl$ ☐

$H^+ + H_2O \longrightarrow H_3O^+$ ☐

6 (c) (iii) Name the salt produced when ammonia reacts with hydrochloric acid.

[1 mark]

_____

Question 6 continues on the next page

Question 24 · continued

6 (d) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Farmers use ammonium nitrate as a fertiliser for crops.

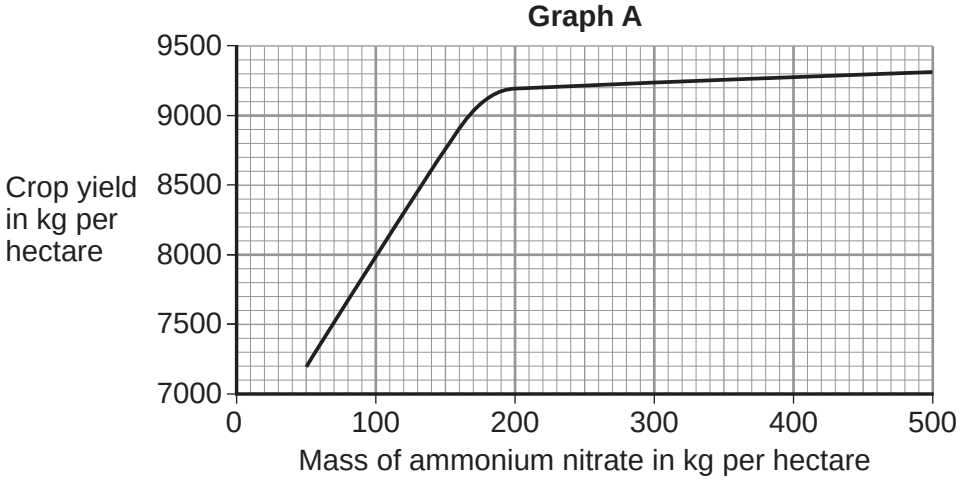
Rainwater dissolves ammonium nitrate in the soil.

Some of the dissolved ammonium nitrate runs off into rivers and lakes.

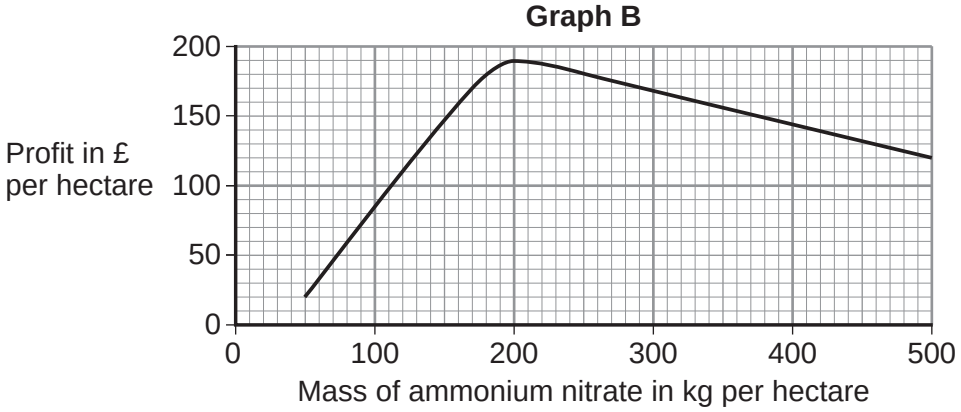
Figure 12 shows three graphs **A**, **B** and **C**. The graphs show information about the use of ammonium nitrate as a fertiliser. A hectare is a measurement of an area of land.

Figure 12

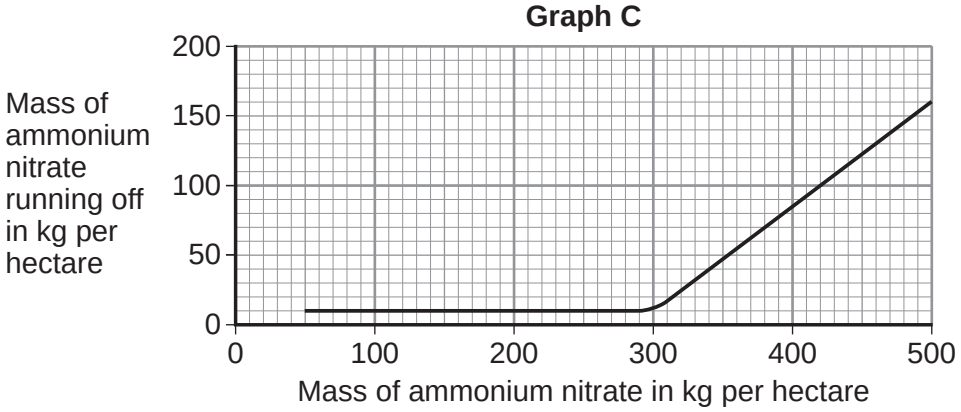
Graph A



Graph B



Graph C



4.4.2.2 Neutralisation of acids and salt production

Question 24 · continued

Suggest how much ammonium nitrate farmers should use per hectare.
Give reasons for your answer.
Use information from graphs **A**, **B** and **C**.

[6 marks]

Extra space

13

4.4.2.2 Neutralisation of acids and salt production

Question 25

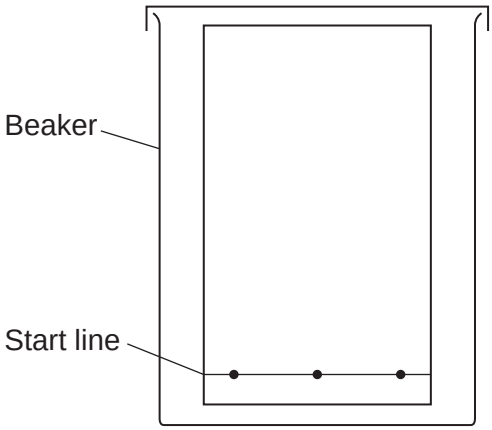
June 2017 | CH2FP | Original Q1 | Legacy

1 This question is about methods of analysis.

1 (a) A student used paper chromatography to identify colours in an ink.

Figure 1 shows the apparatus the student used.

Figure 1



1 (a) (i) Why should the student use a pencil and not a pen to draw the start line?

[1 mark]

_____

1 (a) (ii) The student put water in the beaker.

Use the correct answer from the box to complete the sentence.

[1 mark]

above	**below**	**on**

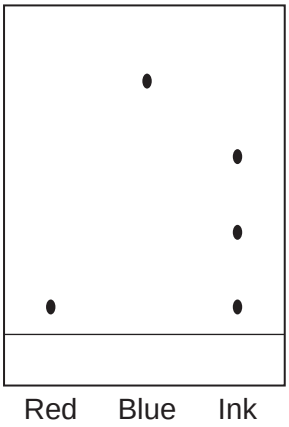
The water level should be _____ the start line drawn by the student.

4.4.2.2 Neutralisation of acids and salt production

Question 25 · continued

1 (a) (iii) **Figure 2** shows the student's results.

Figure 2



Give **two** conclusions about the colours in the ink.

[2 marks]

Question 1 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 25 · continued

1 (b) Gas chromatography is an instrumental method of analysis.

1 (b) (i) Use the correct answer from the box to complete the sentence.

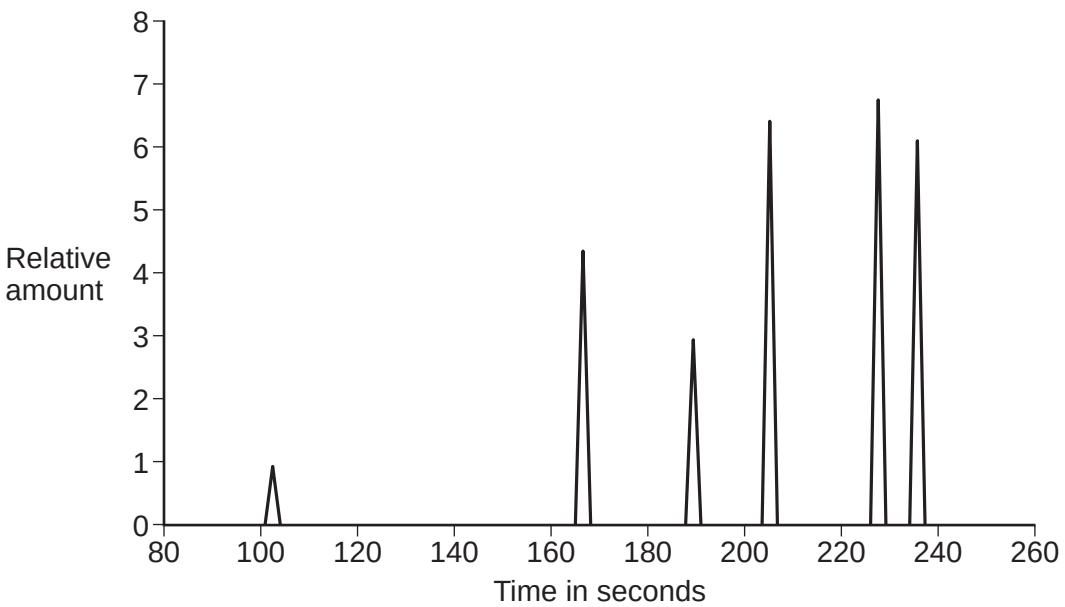
[1 mark]

neutralised	reduced	separated

The mixture of compounds in gas chromatography is _____ .

1 (b) (ii) **Figure 3** shows the results from a gas chromatograph.

Figure 3



How many compounds were in the sample?

[1 mark]

_____

1 (b) (iii) Give **one** advantage of using instrumental methods of analysis.

[1 mark]

_____

7

4.4.2.2 Neutralisation of acids and salt production

Question 26

June 2017 | CH2FP | Original Q2 | Legacy

2 This question is about sulfuric acid, copper sulfate and ethene.

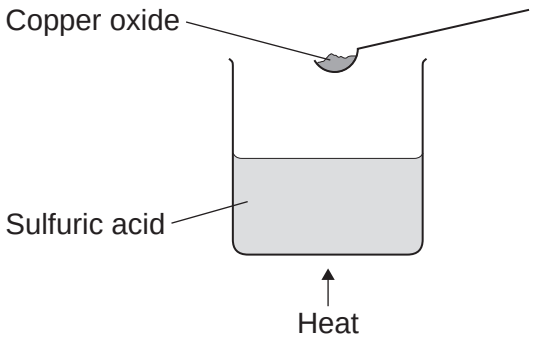
2 (a) A student added copper oxide to sulfuric acid to make copper sulfate.

The word equation for the reaction is:

sulfuric acid + copper oxide ⟶ copper sulfate + water

Figure 4 shows the first stage of the student's method.

Figure 4



2 (a) (i) The state symbol for CuO is missing from the equation below.

Use the correct answer from the box to complete the equation.

[1 mark]

aq	g	l	s

H_2SO_4 (aq) + CuO (___) ⟶ $CuSO_4$ (aq) + H_2O (l)

2 (a) (ii) Why is the sulfuric acid heated?

[1 mark]

_____

_____

Question 2 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 26 · continued

2 (a) (iii) Which of these values could be the pH of sulfuric acid?

[1 mark]

Tick (✓) **one** box.

1 ☐

7 ☐

11 ☐

14 ☐

2 (a) (iv) Why does the student continue to add copper oxide until some is left at the end of the reaction?

[1 mark]

Tick (✓) **one** box.

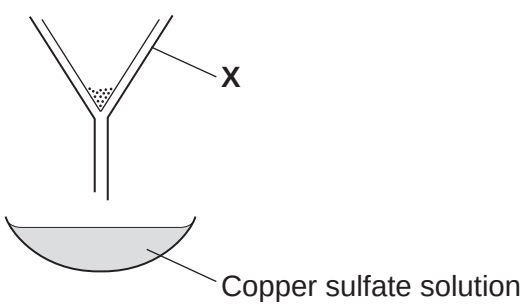
To make bigger copper sulfate crystals. ☐

To make sure all the copper oxide has reacted. ☐

To make sure all the sulfuric acid has reacted. ☐

2 (b) **Figure 5** shows the second stage of the student's method.

Figure 5



4.4.2.2 Neutralisation of acids and salt production

Question 26 · continued

2 (b) (i) Name the apparatus labelled **X** on **Figure 5**.

[1 mark]

_____

2 (b) (ii) What could the student do to the copper sulfate solution to get copper sulfate crystals?

[1 mark]

_____

_____

2 (c) The student weighed the copper sulfate crystals.

Why was the mass of the copper sulfate crystals less than the student expected?

[1 mark]

Tick (✓) **one** box.

The student added too much copper oxide. ☐

The student left some copper sulfate crystals in the apparatus. ☐

The student weighed the copper sulfate crystals when they were wet. ☐

2 (d) The equation shows the reaction when blue hydrated copper sulfate crystals are heated.

hydrated copper sulfate $\rightleftharpoons$ anhydrous copper sulfate + water

2 (d) (i) What colour is anhydrous copper sulfate?

[1 mark]

_____

2 (d) (ii) What would you see if water is added to anhydrous copper sulfate?

[1 mark]

_____

4.4.2.2 Neutralisation of acids and salt production

Question 26 · continued

2 (e) Ethene and sulfuric acid are used to make many substances.

Table 1 shows data about wealth of countries, ethene production and sulfuric acid production.

Table 1

Country	Wealth of country in billions of dollars	Ethene production in kilotonnes	Sulfuric acid production in kilotonnes
A	4000	13 900	36 000
B	1300	4 400	6 600
C	1290	2 700	26 000
D	460	1 500	2 500

2 (e) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

alloys	chlorine	graphite	polymers

Ethene is used to make _____ .

2 (e) (ii) Describe the relationship, if any, between the wealth of a country and the production of ethene.

[1 mark]

_____

_____

2 (e) (iii) Describe the relationship, if any, between the wealth of a country and the production of sulfuric acid.

[1 mark]

_____

_____

12

4.4.2.2 Neutralisation of acids and salt production

Question 27

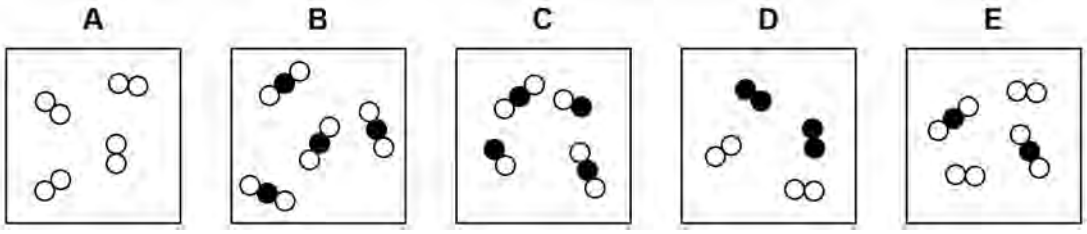
June 2019 | 8462/1F | Original Q3

0 3 This question is about elements, compounds and mixtures.

Figure 5 shows five different substances, **A**, **B**, **C**, **D** and **E**.

○ and ● represent atoms of different elements.

Figure 5



Use **Figure 5** to answer Questions **03.1** to **03.3**

0 3 . 1 Which substance is only one compound?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 3 . 2 Which substance is a mixture of elements?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 3 . 3 Which substance is a mixture of an element and a compound?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

4.4.2.2 Neutralisation of acids and salt production

Question 27 · continued

Substances are separated from a mixture using different methods.

0 3 . 4 Draw **one** line from each method of separation to the substance and mixture it would separate.

[2 marks]

Method of separation	Substance and mixture
chromatography	blue food colour from a mixture of food colours
	copper from an alloy of copper and zinc
crystallisation	copper sulfate from copper sulfate solution
	ethanol from a mixture of ethanol and water

4.4.2.2 Neutralisation of acids and salt production

Question 27 · continued

0 3 . 5 Sand does not dissolve in water. A student separates a mixture of sand and water by filtration.

Draw a diagram of the apparatus the student could use.

You should label:

- where the sand is collected
- where the water is collected.

[3 marks]

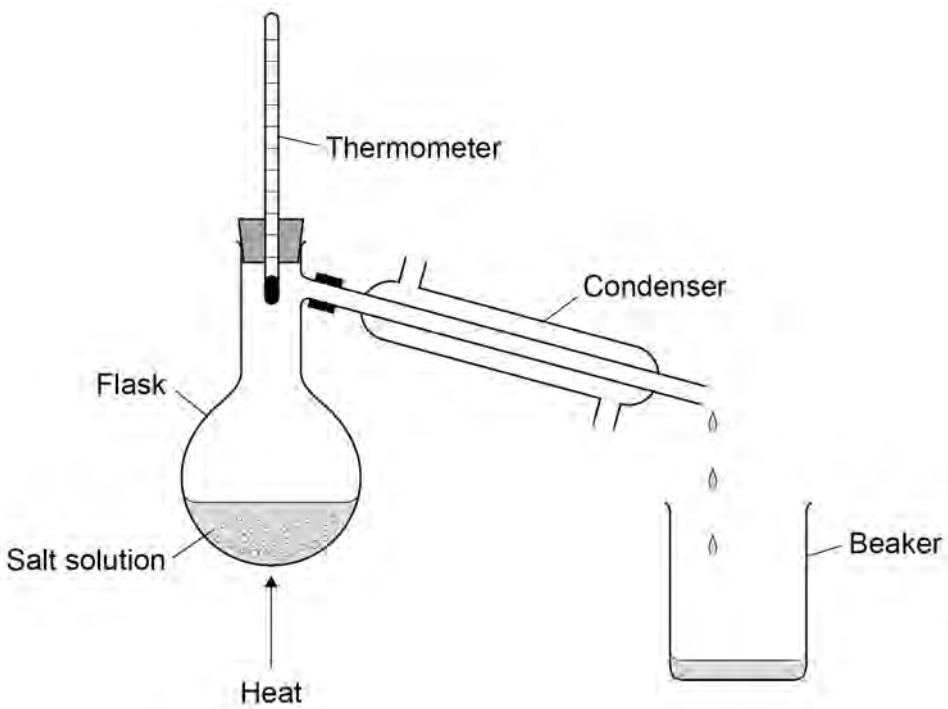
Diagram

Question 3 continues on the next page

0 3 . 6 A student distils a sample of salt solution to produce pure water.

Figure 6 shows the apparatus.

Figure 6



What temperature would you expect the thermometer to show?

[1 mark]

Tick (✓) **one** box.

0 °C ☐

10 °C ☐

50 °C ☐

100 °C ☐

4.4.2.2 Neutralisation of acids and salt production

Question 27 · continued

0 3 . 7 Describe how the process of distillation shown in **Figure 6** produces pure water from salt solution.

[4 marks]

13

Turn over for the next question

4.4.2.2 Neutralisation of acids and salt production

Question 28

0 9 This question is about acids and alkalis.

0 9 . 1 Which ion do all acids produce in aqueous solution?

[1 mark]

Tick (✓) **one** box.

- H^+ ☐
- H^- ☐
- O^{2-} ☐
- OH^- ☐

0 9 . 2 Calcium hydroxide solution reacts with an acid to form calcium chloride.

Complete the word equation for the reaction.

[2 marks]

calcium hydroxide + _____ acid → calcium chloride + _____

Question 9 continues on the next page

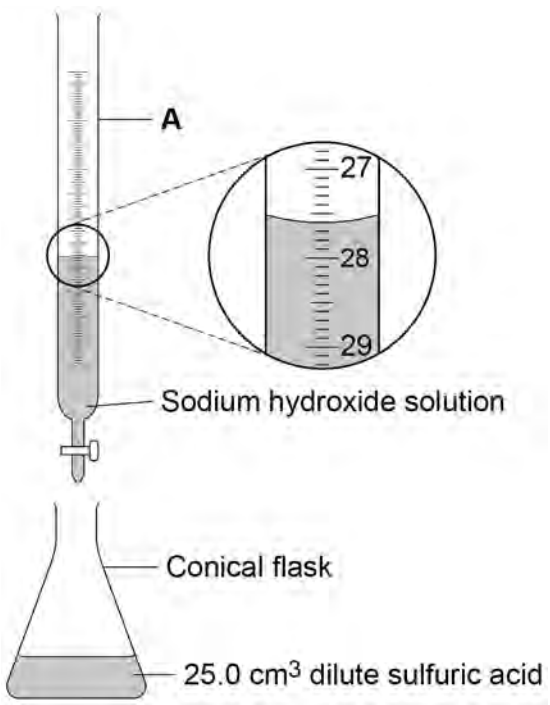
4.4.2.2 Neutralisation of acids and salt production

Question 28 · continued

A student investigates the volume of sodium hydroxide solution that reacts with 25.0 cm^3 of dilute sulfuric acid.

Figure 12 shows the apparatus the student uses.

Figure 12



Use **Figure 12** to answer Questions **09.3** and **09.4**

0 9 . 3 Name apparatus **A**.

[1 mark]

0 9 . 4 What is the reading on apparatus **A**?

[1 mark]

_____ cm^3

4.4.2.2 Neutralisation of acids and salt production

Question 28 · continued

0 9 . 5 The higher the concentration of a sample of dilute sulfuric acid, the greater the volume of sodium hydroxide needed to neutralise the acid.

The student tested two samples of dilute sulfuric acid, **P** and **Q**.

Describe how the student could use titrations to find which sample, **P** or **Q**, is more concentrated.

[6 marks]

11

4.4.2.2 Neutralisation of acids and salt production

Question 29

November 2020 | 8462/1F | Original Q4

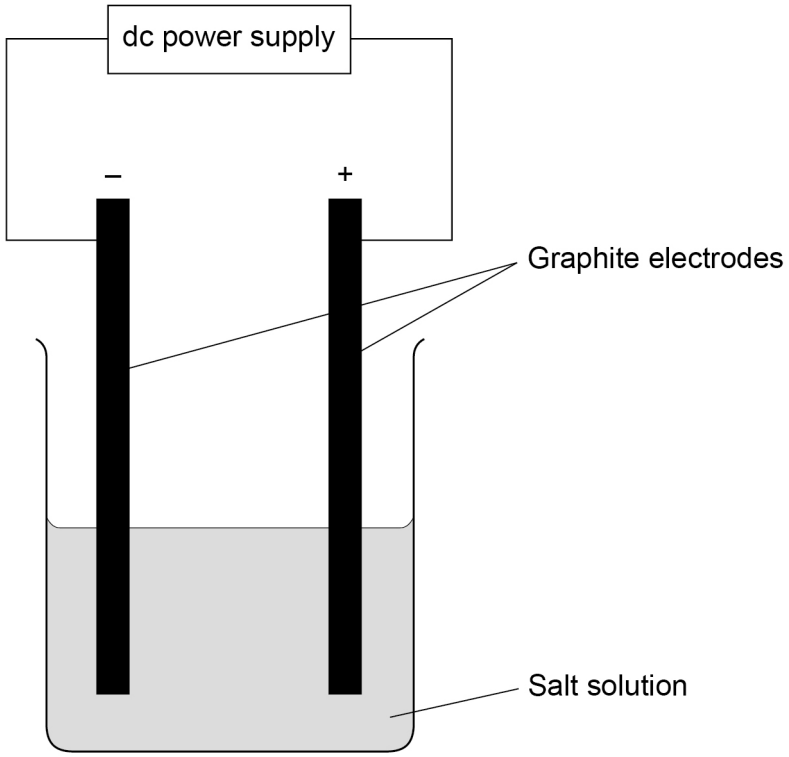
0 4 This question is about electrolysis.

A student investigated the hypothesis:

'The electrolysis of a salt solution produces a metal at the negative electrode and a gas at the positive electrode.'

Figure 4 shows the apparatus used.

Figure 4



0 4 . 1 What observation would be made at each electrode if the hypothesis is correct?

[2 marks]

Observation if metal produced at the negative electrode _____

_____

Observation if gas produced at the positive electrode _____

_____

4.4.2.2 Neutralisation of acids and salt production

Question 29 · continued

Table 3 shows the student's results.

Table 3

Salt solution	Product at the negative electrode	Product at the positive electrode
Copper chloride	Copper	Chlorine
Potassium nitrate	Hydrogen	Oxygen
Silver nitrate	Silver	Oxygen

0 4 . 2 Which salt solution in **Table 3** does **not** match the student's hypothesis?

Give **one** reason why.

[2 marks]

Salt solution _____

Reason _____

_____

0 4 . 3 Give **two** reasons why graphite is used for the electrodes.

[2 marks]

1 _____

_____

2 _____

_____

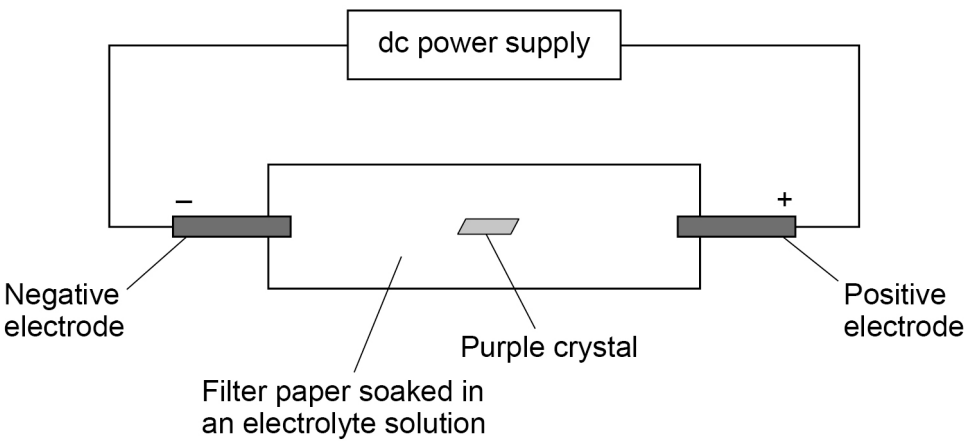
4.4.2.2 Neutralisation of acids and salt production

Question 29 · continued

A different student investigated what happens during electrolysis.

Figure 5 shows the apparatus.

Figure 5



The purple crystal contained:

- colourless positive ions
- purple coloured negative ions.

The purple crystal dissolved in the electrolyte solution.

0 4 . 4 What happens to the purple coloured ions?

Give **one** reason for your answer.

[2 marks]

Tick (✓) **one** box.

The ions do not move. ☐

The ions move towards the negative electrode. ☐

The ions move towards the positive electrode. ☐

Reason _____

_____

8

4.4.2.2 Neutralisation of acids and salt production

Question 30

November 2020 | 8462/1F | Original Q7

0 7 This question is about acids, bases and salts.

Zinc nitrate is a salt.

A student produces zinc nitrate using an acid and a base.

0 7 . 1 Which acid should the student use to produce zinc nitrate?

[1 mark]

Tick (✓) **one** box.

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

0 7 . 2 Which is a base the student could use to produce zinc nitrate?

[1 mark]

Tick (✓) **one** box.

- Zinc chloride ☐
- Zinc oxide ☐
- Zinc sulfate ☐

0 7 . 3 Name the salt with the formula $MgBr_2$

[1 mark]

_____

4.4.2.2 Neutralisation of acids and salt production

Question 30 · continued

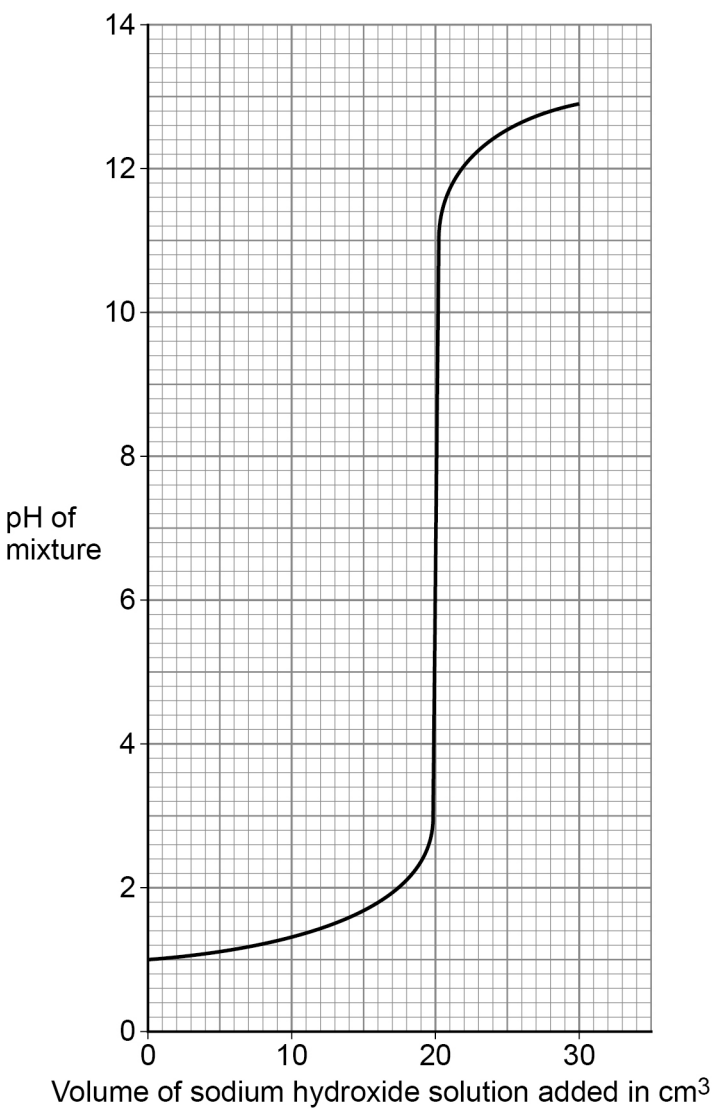
A student investigated how pH changes during a titration.

This is the method used.

1. Pour 25.0 cm^3 of hydrochloric acid into a beaker.
2. Measure the pH of the hydrochloric acid with a pH probe.
3. Add 1.0 cm^3 of sodium hydroxide solution from a burette.
4. Swirl the mixture.
5. Measure the pH of the mixture.
6. Repeat steps 3 to 5 until a total of 30.0 cm^3 of sodium hydroxide solution has been added.

Figure 10 shows the student's results.

Figure 10



4.4.2.2 Neutralisation of acids and salt production

Question 30 · continued

0 7 . 4 Describe how the pH of the mixture changes as sodium hydroxide solution is added to hydrochloric acid.

Use data from **Figure 10** in your answer.

[3 marks]

0 7 . 5 What volume of sodium hydroxide solution is needed to neutralise 25.0 cm^3 of hydrochloric acid?

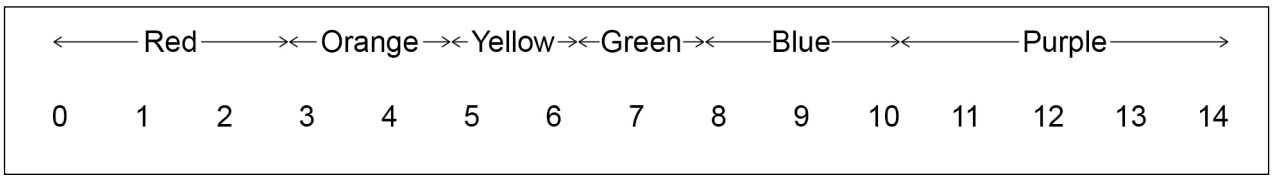
Use **Figure 10**.

[1 mark]

Volume = _____ cm^3

0 7 . 6 **Figure 11** shows the colour of universal indicator at different pH values.

Figure 11



The student could have used universal indicator instead of a pH probe.

Determine the colour of universal indicator when 10.0 cm^3 of sodium hydroxide solution has been added to 25.0 cm^3 of hydrochloric acid.

Use **Figure 10** and **Figure 11**.

[1 mark]

Colour = _____

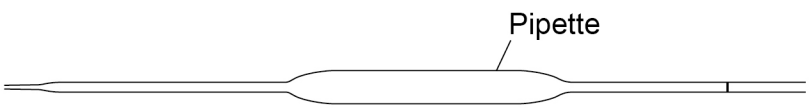
4.4.2.2 Neutralisation of acids and salt production

Question 30 · continued

0 7 . 7 The student used a pipette to measure 25.0 cm^3 of hydrochloric acid.

Figure 12 shows a pipette.

Figure 12



The pipette is labelled 25.0 ± 0.06 cm^3

Calculate the percentage uncertainty in the volume measured using this pipette.

Use the equation:

$$\text{percentage uncertainty} = \frac{\text{uncertainty}}{\text{volume measured}} \times 100$$

[2 marks]

Percentage uncertainty = _____ %

0 7 . 8 Give **one** advantage of using a pipette rather than using a measuring cylinder to measure the volume of hydrochloric acid.

[1 mark]

11

4.4.2.2 Neutralisation of acids and salt production

Question 31

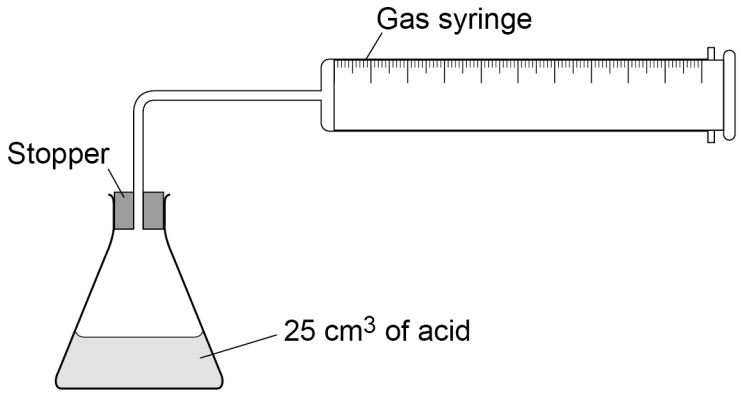
November 2021 | 8462/1F | Original Q6

0 6 This question is about metal carbonates.

A student investigated the reaction of copper carbonate with an acid.

Figure 8 shows the apparatus.

Figure 8

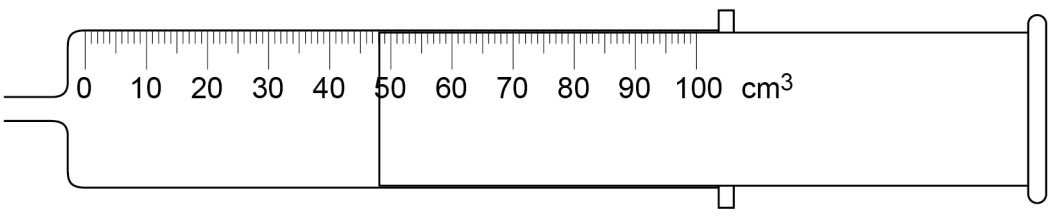


This is the method used.

1. Pour 25 cm^3 of the acid into a conical flask.
2. Weigh 0.10 g of copper carbonate.
3. Remove the stopper and add the copper carbonate to the flask.
4. Quickly replace the stopper.
5. Record the maximum volume of gas collected in the gas syringe.
6. Repeat steps 1 to 5 with different masses of copper carbonate.

0 6 . 1 **Figure 9** shows the gas syringe during the experiment.

Figure 9



What is the reading on the gas syringe?

[1 mark]

_____ cm^3

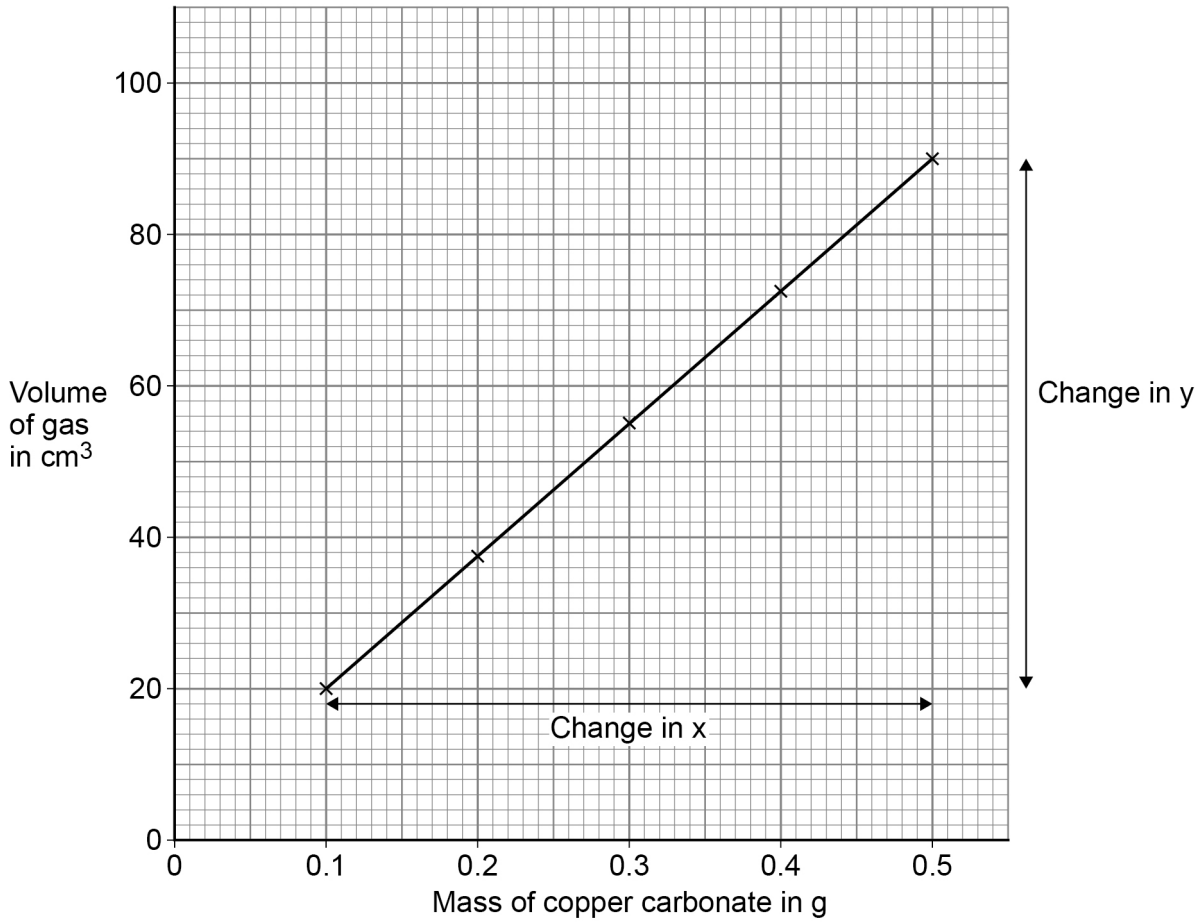
4.4.2.2 Neutralisation of acids and salt production

Question 31 · continued

0 6 . 2 The student plotted the results on a graph.

Figure 10 shows the student's graph.

Figure 10



Determine the gradient of the line of best fit.

You should:

- calculate the values of the change in y and the change in x
- calculate the gradient of the line of best fit.

[4 marks]

Change in y = _____ cm^3

Change in x = _____ g

Gradient _____

_____

Gradient = _____ cm^3/g

4.4.2.2 Neutralisation of acids and salt production

Question 31 · continued

0 6 . 3 Copper chloride was produced in the reaction.

Which acid reacts with copper carbonate to produce copper chloride?

[1 mark]

Tick (✓) **one** box.

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

0 6 . 4 The reaction between copper carbonate and the acid produced a gas.

What was the gas?

[1 mark]

Tick (✓) **one** box.

- Carbon dioxide ☐
- Chlorine ☐
- Hydrogen ☐
- Oxygen ☐

4.4.2.2 Neutralisation of acids and salt production

Question 31 · continued

A different student produced a pure, dry sample of copper chloride using the same reaction.

This is the method used.

1. Add excess copper carbonate to the acid.
2. Filter the mixture.
3. Heat the solution gently until crystals start to form.
4. Leave for 24 hours.
5. Remove the crystals.
6. Rinse with water and dry the crystals.

0 6 . 5 Why was the solution heated gently in **step 3**?

[1 mark]

Tick (✓) **one** box.

- To evaporate acid ☐
- To evaporate copper carbonate ☐
- To evaporate water ☐

0 6 . 6 How should the solution be heated gently in **step 3**?

[1 mark]

_____

_____

9

4.4.2.2 Neutralisation of acids and salt production

Question 32

November 2021 | 8462/1F | Original Q7

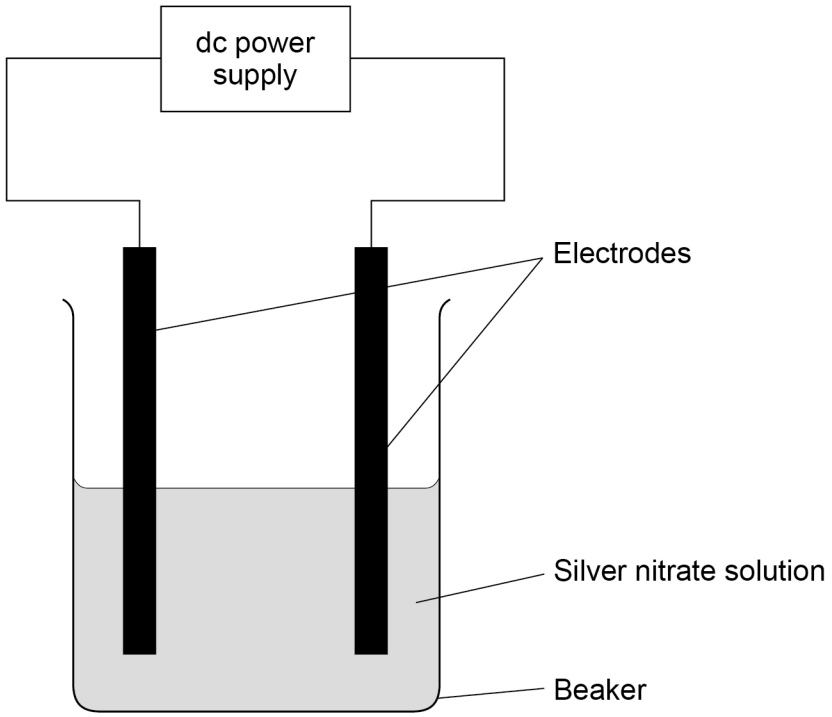
0 7 This question is about electrolysis.

Some students investigated the electrolysis of silver nitrate solution.

This electrolysis produces silver at the negative electrode.

Figure 11 shows the apparatus.

Figure 11



This is the method used.

1. Weigh the negative electrode.
2. Set up the apparatus shown in **Figure 11**.
3. Switch on the power supply.
4. Switch off the power supply after five minutes.
5. Rinse the negative electrode with water and allow to dry.
6. Reweigh the negative electrode.
7. Repeat steps 1 to 6 for different times.

Question 32 · continued

0 7 . 1 Some silver did not stick to the negative electrode but fell to the bottom of the beaker.

The students needed to weigh this silver.

How could the students separate the silver from the silver nitrate solution?

[1 mark]

Tick (✓) **one** box.

By chromatography ☐

By crystallisation ☐

By distillation ☐

By filtration ☐

Table 5 shows the students' results.

Table 5

Time in minutes	Mass of silver in g
0	0.00
5	0.06
10	0.12
15	0.18
20	0.24
25	0.30

4.4.2.2 Neutralisation of acids and salt production

Question 32 · continued

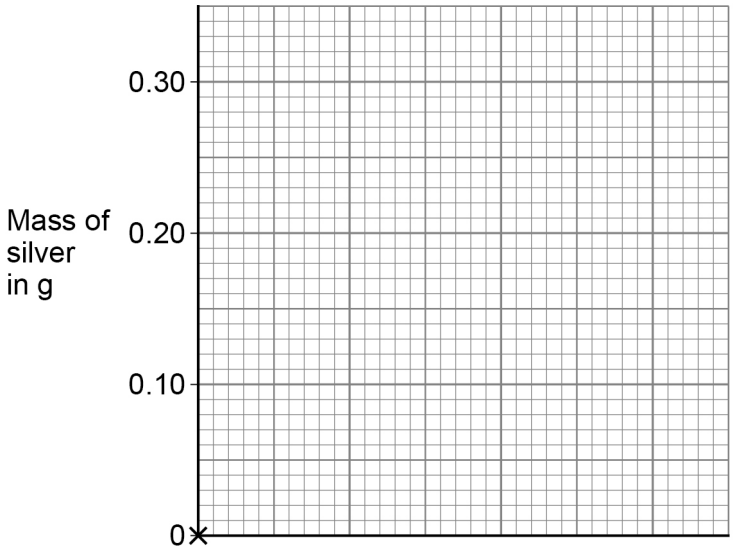
0 7 . 2 Draw a graph on **Figure 12**.

You should:

- use a suitable scale for the x-axis
- plot the data from **Table 5**
- draw a line of best fit.

[4 marks]

Figure 12



0 7 . 3 Determine the mass of silver that would be produced after 12 minutes.

Use **Figure 12**.

[1 mark]

Mass of silver = _____ g

Question 7 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 32 · continued

0 7 . 4 A student investigated the electrolysis of two aqueous salt solutions.

Hydrogen is produced at the negative electrode when the metal in the salt solution is more reactive than hydrogen.

Complete **Table 6** to show what the student would **observe** at the negative electrode for each salt solution.

[2 marks]

Table 6

Salt solution	Observation at negative electrode
Copper sulfate	
Sodium chloride	

0 7 . 5 A teacher demonstrates the electrolysis of molten lead bromide.

The products at the electrodes are lead and bromine.

Why should the teacher do the demonstration in a fume cupboard?

[1 mark]

0 7 . 6 Two other molten compounds are electrolysed.

Complete **Table 7** to show the molten compounds and the products.

[3 marks]

Table 7

Molten compound electrolysed	Product at the negative electrode	Product at the positive electrode
Zinc chloride		
	Potassium	Iodine

12

4.4.2.2 Neutralisation of acids and salt production

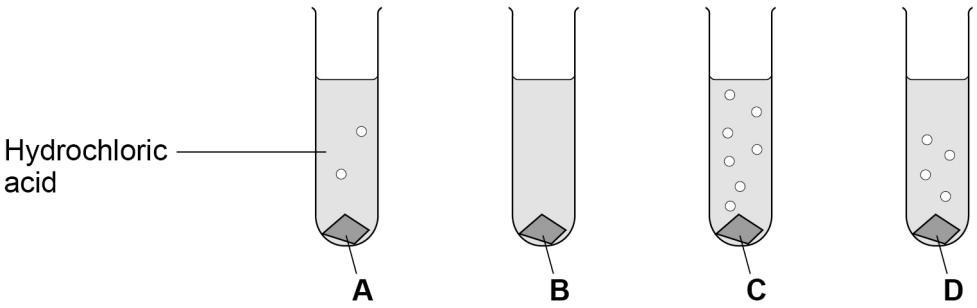
Question 33

0 3 This question is about acids.

A student added four metals, **A**, **B**, **C** and **D** to hydrochloric acid.

Figure 4 shows the rate of bubbling in each tube.

Figure 4



Use **Figure 4** to answer questions **03.1** and **03.2**.

0 3 . 1 Which metal is copper?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 3 . 2 Which metal is the most reactive?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 3 . 3 A metal oxide reacts with an acid to produce zinc sulfate and water.

Name the metal oxide and the acid used in this reaction.

[2 marks]

Name of metal oxide _____

Name of acid _____

4.4.2.2 Neutralisation of acids and salt production

Question 33 · continued

0 3 . 4 Universal indicator is used to measure the pH of a solution.

Draw **one** line from each pH to the colour of universal indicator in a solution with that pH.

[2 marks]

pH	Colour of universal indicator
	Blue
1	Green
	Purple
7	Red
	Yellow

Question 3 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 33 · continued

A student reacts an acid with an alkali in a titration.

0 3 . 5 What is the type of reaction when an acid reacts with an alkali?

[1 mark]

Tick (✓) **one** box.

- Combustion ☐
- Decomposition ☐
- Neutralisation ☐

0 3 . 6 **Figure 5** shows a piece of equipment used to measure the volume of the acid in the titration.

Figure 5



What is the name of this piece of equipment?

[1 mark]

Tick (✓) **one** box.

- Burette ☐
- Pipette ☐
- Syringe ☐
- Tube ☐

8

4.4.2.2 Neutralisation of acids and salt production

Question 34

June 2023 | 8462/1F | Original Q11

1 1 This question is about making a soluble salt.

1 1 . 1 Plan a method to make pure, dry crystals of zinc chloride from zinc carbonate and a dilute acid.

[6 marks]

1 1 . 2 Name **two** other substances that can each be reacted with a dilute acid to make zinc chloride.

Do **not** refer to zinc carbonate in your answer.

[2 marks]

1 _____

2 _____

8

4.4.2.2 Neutralisation of acids and salt production

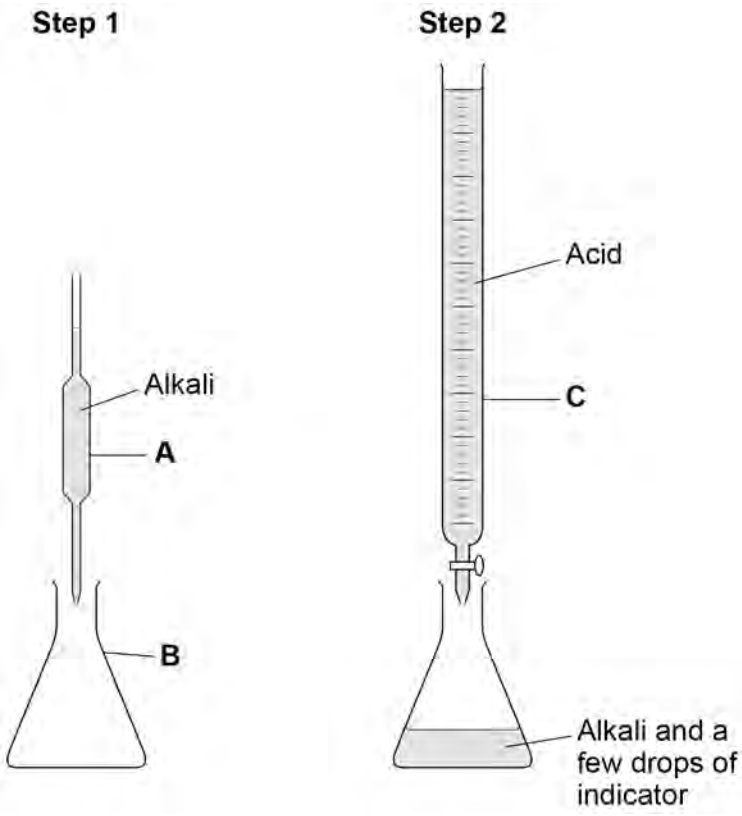
Question 35

June 2024 | 8462/1F | Original Q2

0 2 A titration measures the volumes of an acid and an alkali that neutralise each other.

Figure 4 shows the apparatus used.

Figure 4



0 2 . 1 Name the pieces of equipment labelled **A**, **B** and **C** in **Figure 4**.

Choose answers from the box.

[3 marks]

beaker	**burette**	**conical flask**
measuring cylinder	**pipette**	**test tube**

A _____

B _____

C _____

4.4.2.2 Neutralisation of acids and salt production

Question 35 · continued

In **Step 2** in **Figure 4** the acid is added to the alkali until the solution is neutralised.

The volume of acid added is then read from equipment **C**.

0 2 . 2 Name a suitable indicator for use in **Step 2** of the titration.

[1 mark]

0 2 . 3 Give **one** observation that shows the alkali is neutralised.

[1 mark]

0 2 . 4 Give **two** ways to make sure that the volume of acid added is accurate.

[2 marks]

1

2

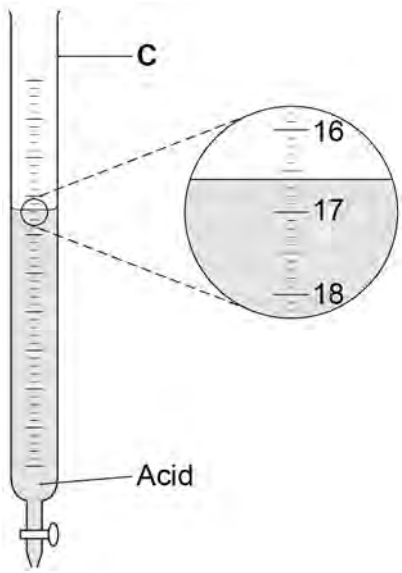
Question 2 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 35 · continued

0 2 . 5 **Figure 5** shows the reading on equipment **C** at the end of **Step 2**.

Figure 5



What is the reading on equipment **C** in **Figure 5**?

[1 mark]

Tick (✓) **one** box.

- 16.4 cm^3 ☐
- 16.6 cm^3 ☐
- 17.4 cm^3 ☐
- 17.6 cm^3 ☐

4.4.2.2 Neutralisation of acids and salt production

Question 35 · continued

0 2 . 6 A student did a different titration.

Table 1 shows the results.

Table 1

	Trial 1	Trial 2	Trial 3
Volume of acid added in cm^3	25.3	23.7	23.6

Which **two** results should be used to calculate the mean volume of acid added?

[1 mark]

Tick (✓) **one** box.

Trial 1 and Trial 2 ☐

Trial 1 and Trial 3 ☐

Trial 2 and Trial 3 ☐

0 2 . 7 A salt is produced when an acid neutralises an alkali.

Barium chloride is a salt containing the ions Ba^{2+} and Cl^-

What is the formula of barium chloride?

[1 mark]

Tick (✓) **one** box.

BaCl ☐ $BaCl_2$ ☐ Ba_2Cl ☐ Ba_2Cl_2 ☐

10

4.4.2.2 Neutralisation of acids and salt production

Question 36

June 2024 | 8462/1F | Original Q8

0 8 A student produced a salt by reacting copper carbonate with sulfuric acid.

This is the method used.

1. Measure 50 cm^3 of sulfuric acid into a beaker.
2. Add copper carbonate powder.
3. Stir the mixture.
4. Repeat steps 2 and 3 until copper carbonate is in excess.
5. Filter the mixture.
6. Warm the filtrate gently until crystals start to appear.
7. Leave the solution to cool and crystallise.

0 8 . 1 Complete the word equation for the reaction.

[2 marks]

copper carbonate + sulfuric acid → _____ + _____ + carbon dioxide

0 8 . 2 Give **one** observation the student could make during **Step 4** which shows that the copper carbonate is in excess.

[1 mark]

_____

_____

0 8 . 3 Give **one** reason for filtering the mixture in **Step 5**.

[1 mark]

_____

_____

4.4.2.2 Neutralisation of acids and salt production

Question 36 · continued

0 8 . 4 Name the equipment that can be used to warm the filtrate **gently** in **Step 6**.

[1 mark]

0 8 . 5 The maximum theoretical mass of the salt that could be produced using 50 cm^3 of the sulfuric acid is 12.5 g.

The percentage yield of the salt is 92.8%.

Calculate the mass of salt actually produced.

Use the equation:

$$\% \text{ yield} = \frac{\text{mass of salt actually produced}}{\text{maximum theoretical mass of salt that could be produced}} \times 100$$

[3 marks]

Mass of salt actually produced = _____ g

Question 8 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 36 · continued

0 8 . 6 Some salts can be produced by reacting sulfuric acid with a metal.

Neither copper nor sodium is used to produce a salt with sulfuric acid.

Give **one** reason why each metal is **not** used.

[2 marks]

Copper _____

_____

Sodium _____

_____

10

4.4.2.2 Neutralisation of acids and salt production

Question 37

June 2024 | 8462/1F | Original Q9

0 9 This question is about the periodic table.

Sodium and potassium are in Group 1 of the periodic table.

0 9 . 1 Give **one** similarity and **one** difference between the electronic structures of sodium and potassium.

[2 marks]

Similarity _____

_____

Difference _____

_____

Group 1 elements react with water.

0 9 . 2 Give **two** observations made when potassium reacts with water.

[2 marks]

1 _____

_____

2 _____

_____

0 9 . 3 Potassium hydroxide solution is produced when potassium reacts with water.

What is the colour of universal indicator when added to potassium hydroxide solution?

Give **one** reason for your answer.

[2 marks]

Colour of universal indicator _____

Reason _____

_____

4.4.2.2 Neutralisation of acids and salt production

Question 37 · continued

Table 4 shows the densities of some of the elements in Group 0 of the periodic table.

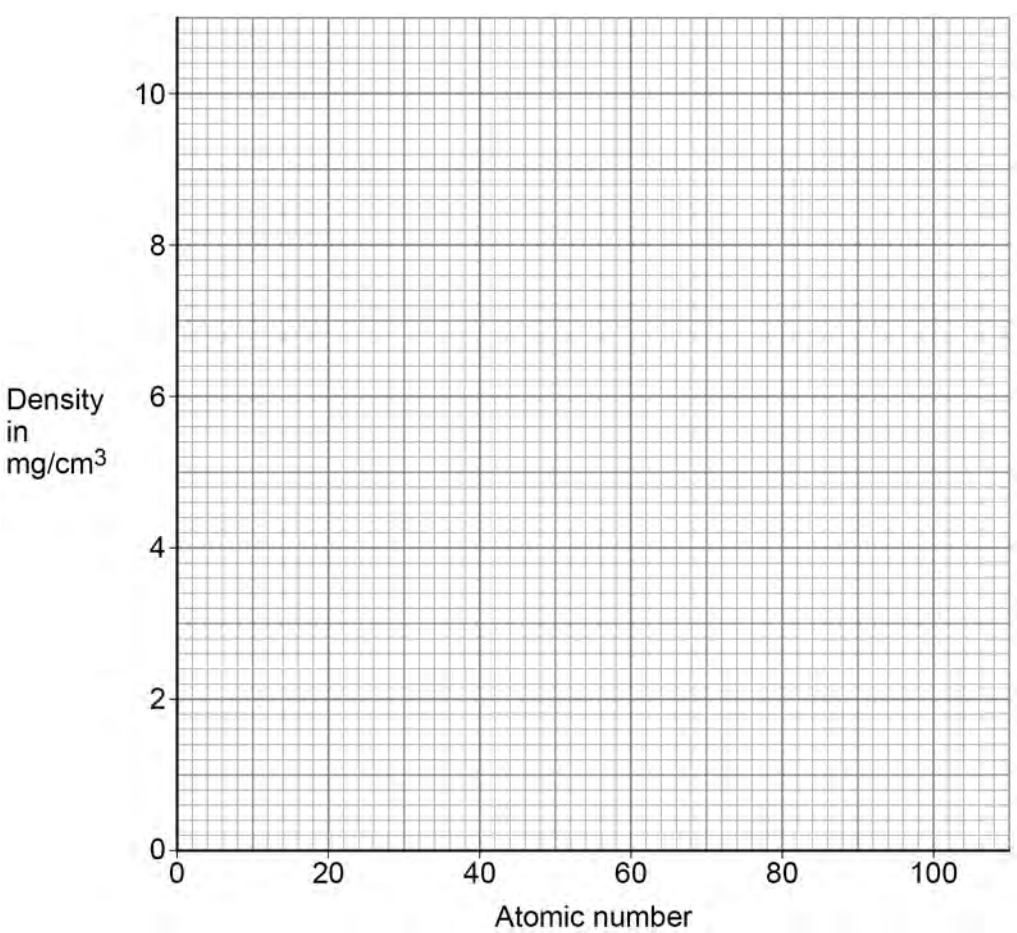
Table 4

Element	Atomic number	Density in mg/cm^3
Helium	2	0.2
Neon	10	0.8
Argon	18	1.6
Krypton	36	**X**
Xenon	54	5.4
Radon	86	9.1

0 9 . 4 Plot the data from **Table 4** on **Figure 15**.

[2 marks]

Figure 15



4.4.2.2 Neutralisation of acids and salt production

Question 37 · continued

0 9 . 5 Estimate the density (**X**) of krypton.

Use **Figure 15** and **Table 4**.

[1 mark]

Density = _____ mg/cm^3

0 9 . 6 The elements in Group 7 are called the halogens.

A more reactive halogen can displace a less reactive halogen from a solution of its salt.

Which combination of solutions will produce a reaction when mixed?

[1 mark]

Tick (✓) **one** box.

- Chlorine and potassium fluoride ☐
- Chlorine and potassium bromide ☐
- Bromine and potassium fluoride ☐
- Bromine and potassium chloride ☐

0 9 . 7 Which of the following describes the trends going down Group 7?

[1 mark]

Tick (✓) **one** box.

- Relative molecular mass decreases and boiling point decreases. ☐
- Relative molecular mass decreases and boiling point increases. ☐
- Relative molecular mass increases and boiling point decreases. ☐
- Relative molecular mass increases and boiling point increases. ☐

11

4.4.2.2 Neutralisation of acids and salt production

Question 38

June 2024 | 8462/2F | Original Q8

0 8 A student investigated an aqueous solution of a salt.

The student identified that the salt solution contained only sodium ions and chloride ions.

0 8 . 1 Describe a test to identify sodium ions.

Give the result of the test.

[2 marks]

Test for sodium ions _____

_____

Result _____

_____

0 8 . 2 Describe a test to identify chloride ions.

Give the result of the test.

[2 marks]

Test for chloride ions _____

_____

Result _____

_____

4.4.2.2 Neutralisation of acids and salt production

Question 38 · continued

The student determined the concentration of sodium chloride in the salt solution.

This is the method used.

1. Weigh an empty evaporating dish.
2. Add 25.0 cm^3 of the salt solution into the evaporating dish.
3. Heat the evaporating dish and contents.
4. Weigh the evaporating dish and contents.
5. Repeat steps 3 to 4 until there is no further change in mass.
6. Repeat steps 1 to 5 three more times.

0 8 . 3 Why did the student heat the evaporating dish and contents until the mass did not change?

[1 mark]

0 8 . 4 How did the student calculate the mass of solid sodium chloride remaining after steps 1 to 5?

[1 mark]

Tick (✓) **one** box.

- Mass of 25 cm^3 of salt solution + mass of empty evaporating dish ☐
- Mass of 25 cm^3 of salt solution – mass of empty evaporating dish ☐
- Mass of evaporating dish and dry contents + mass of empty evaporating dish ☐
- Mass of evaporating dish and dry contents – mass of empty evaporating dish ☐

Question 8 continues on the next page

0 8 . 5 The student calculated the concentration of sodium chloride in the salt solution.

Table 5 shows the results.

Table 5

Concentration of sodium chloride in g/dm^3			
Trial 1	**Trial 2**	**Trial 3**	**Trial 4**
35.2	34.6	36.4	33.8

The percentage by mass of sodium ions in sodium chloride is 39.3%.

Calculate the mean concentration of sodium ions in the salt solution.

[4 marks]

Mean concentration = _____ g/dm^3

10

4.4.2.2 Neutralisation of acids and salt production

Question 39

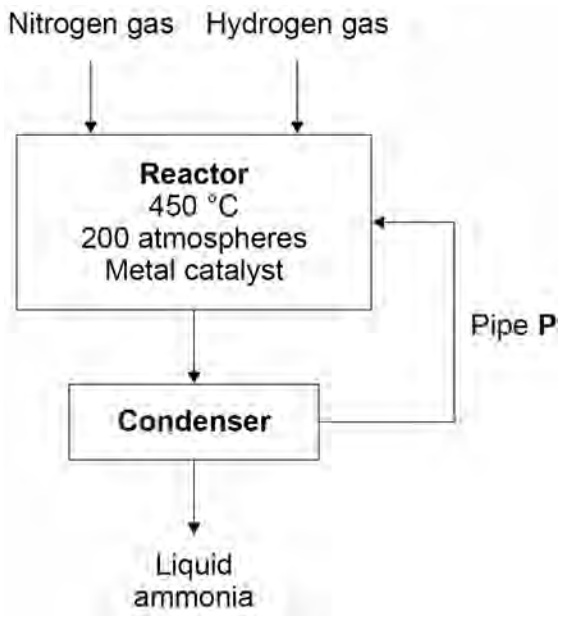
June 2024 | 8462/2F | Original Q9

0 9 This question is about ammonia and nitric acid.

In the Haber process ammonia is produced from nitrogen and hydrogen.

Figure 10 represents the Haber process.

Figure 10



0 9 . 1 Pipe **P** links the condenser to the reactor.

Why is the condenser linked to the reactor?

Use **Figure 10**.

[1 mark]

0 9 . 2 Which metal is used as a catalyst in this reaction?

[1 mark]

4.4.2.2 Neutralisation of acids and salt production

Question 39 · continued

Nitric acid is produced by reacting ammonia with oxygen.

The word equation for the production of nitric acid is:

ammonia + oxygen → water + nitric acid

Platinum is a catalyst in this reaction.

0 9 . 3 Describe the test for oxygen gas.

Give the result if oxygen gas is present.

[2 marks]

Test _____

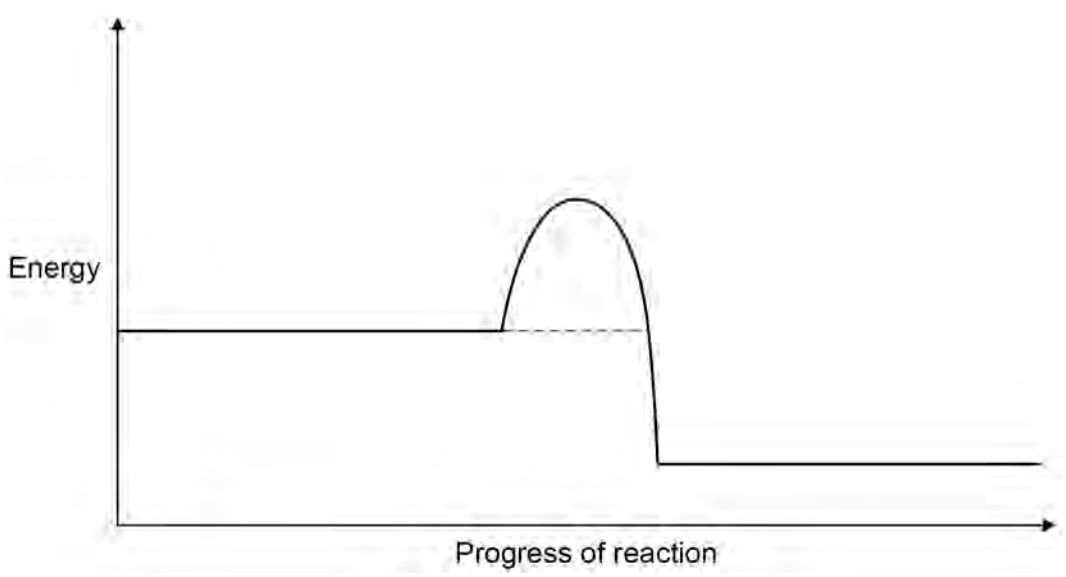
_____

Result _____

_____

Figure 11 represents the reaction profile of the catalysed reaction between ammonia and oxygen.

Figure 11



4.4.2.2 Neutralisation of acids and salt production

Question 39 · continued

0 9 . 4 Complete the reaction profile for the catalysed reaction in **Figure 11**.

You should:

- label the activation energy
- label the reactants and products, using the names of the reactants and products.

[2 marks]

0 9 . 5 How would **Figure 11** be different if **no** catalyst was used?

[1 mark]

Tick (✓) **one** box.

The final energy level would be higher. ☐

The final energy level would be lower. ☐

The line would reach a higher peak. ☐

The line would reach a lower peak. ☐

0 9 . 6 Ammonia and nitric acid react to produce the salt, ammonium nitrate.

Ammonium ions and nitrate ions both contain nitrogen.

Suggest **one** use of ammonium nitrate.

[1 mark]

_____

_____

8

4.4.2.2 Neutralisation of acids and salt production

Question 40

June 2025 | 8462/1F | Original Q2

0 2 Metals react with acids to produce a salt and a gas.

0 2 . 1 Which salt is produced when magnesium reacts with hydrochloric acid?

[1 mark]

Tick (✓) **one** box.

- Magnesium chloride ☐
- Magnesium nitrate ☐
- Magnesium sulfate ☐

0 2 . 2 Which gas is produced when magnesium reacts with hydrochloric acid?

[1 mark]

Tick (✓) **one** box.

- Carbon dioxide ☐
- Chlorine ☐
- Hydrogen ☐
- Oxygen ☐

Question 2 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 40 · continued June 2025 | 8462/1F | Original Q2

A student investigated the temperature change in the reaction between metals and hydrochloric acid.

This is the method used.

1. Measure 25 cm^3 of hydrochloric acid at 20 °C into a container.

2. Add 1 g of a metal.

3. Record the temperature change.

4. Repeat steps 1 to 3 using a different metal.

0 2 . 3 Draw **one** line from the type of variable to the name of the variable in the investigation.

[2 marks]

Type of variable	Name of variable
	Mass of metal
Dependent variable	Temperature change
Independent variable	Type of metal
	Volume of hydrochloric acid

4.4.2.2 Neutralisation of acids and salt production

Question 40 · continued

0 2 . 4 Which container would be the most suitable to reduce energy transfer with the surroundings?

[1 mark]

Tick (✓) **one** box.

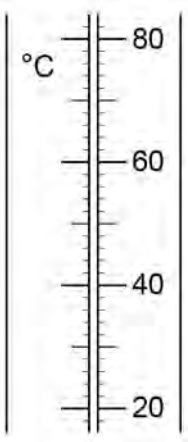
A copper can ☐

A glass beaker ☐

A polystyrene cup ☐

0 2 . 5 **Figure 1** shows part of the scale of the thermometer used in the investigation.

Figure 1



What is the resolution of the thermometer?

[1 mark]

Tick (✓) **one** box.

1 °C ☐ 2 °C ☐ 10 °C ☐ 20 °C ☐

4.4.2.2 Neutralisation of acids and salt production

Question 40 · continued

0 2 . 6 The reaction between a metal and an acid is exothermic.

What happens to the temperature of the mixture during the reaction?

[1 mark]

Tick (✓) **one** box.

Decreases ☐

Stays the same ☐

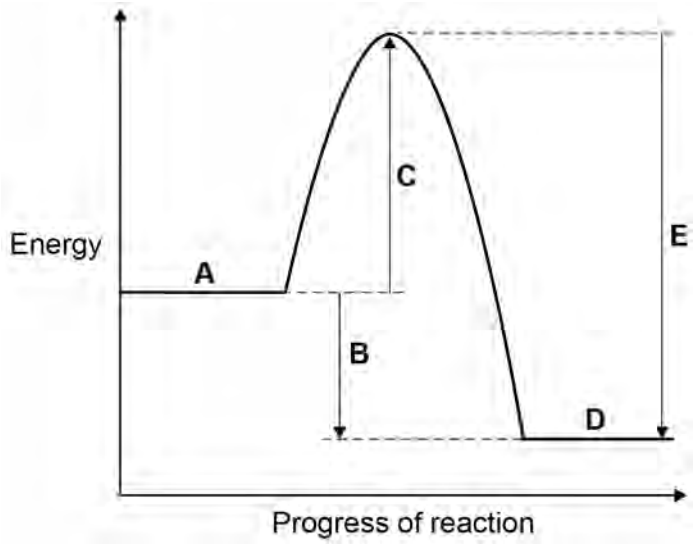
Increases ☐

4.4.2.2 Neutralisation of acids and salt production

Question 40 · continued

Figure 2 shows the reaction profile for the reaction between a metal and an acid.

Figure 2



0 2 . 7 Which letter in **Figure 2** represents the reactants?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 2 . 8 Which letter in **Figure 2** represents the activation energy?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 2 . 9 Which letter in **Figure 2** represents the overall energy change?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

10

4.4.2.2 Neutralisation of acids and salt production

Question 41

June 2025 | 8462/1F | Original Q4

0 4 A student did an experiment to find the volume of an acid that neutralised 25.0 cm^3 of an alkali.

This is the method used.

1. Measure 25.0 cm^3 of the alkali into a conical flask.
2. Add a few drops of substance **X** to the alkali.
3. Place the conical flask on a white tile.
4. Add the acid to the alkali until a colour change is seen.
5. Measure the volume of acid added.
6. Repeat steps 1 to 5 three more times.

0 4 . 1 What is the name of this experiment?

[1 mark]

Tick (✓) **one** box.

- Crystallisation ☐
- Distillation ☐
- Electrolysis ☐
- Titration ☐

0 4 . 2 Substance **X** is used in step 2 of the method.

What type of substance is **X**?

[1 mark]

_____

4.4.2.2 Neutralisation of acids and salt production

Question 41 · continued

0 4 . 3 Which piece of equipment is used to add the acid to the alkali in step 4?

[1 mark]

Tick (✓) **one** box.

Beaker ☐

Burette ☐

Test tube ☐

0 4 . 4 Suggest **one** improvement to step 4 of the method.

[1 mark]

_____

_____

Question 4 continues on the next page

Question 41 · continued

0 4 . 5 **Table 3** shows the results.

Table 3

	Trial 1	Trial 2	Trial 3	Trial 4
Volume of acid in cm^3	8.95	9.00	8.85	8.45

Calculate the mean volume of the acid needed to neutralise 25.0 cm^3 of the alkali.

Give your answer to 3 significant figures.

Do **not** include the anomalous result.

[4 marks]

Mean volume (3 significant figures) = _____ cm^3

4.4.2.2 Neutralisation of acids and salt production

Question 41 · continued

0 4 . 6 Aqueous solutions of acids and alkalis contain ions.

Draw **one** line from each type of aqueous solution to the ion that is **always** in the aqueous solution.

[2 marks]

Type of aqueous solution	Ion
	Cl^-
Acid	H^+
Alkali	Na^+
	OH^-

10