AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.4.2.3

Soluble salts

Past-paper questions

Tier	**Foundation**
Question groups	**34**
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.

4.4.2.3 Soluble salts

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*.

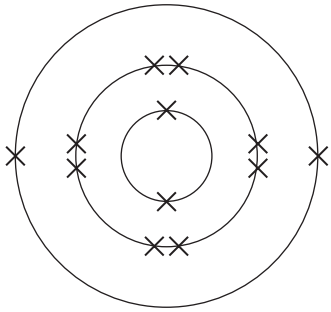
Complete the following sentence using the correct words from the box.

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.



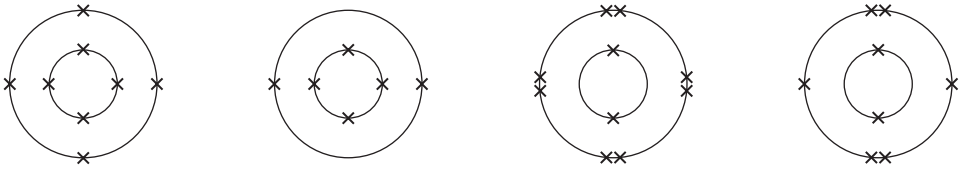
Magnesium atom

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?

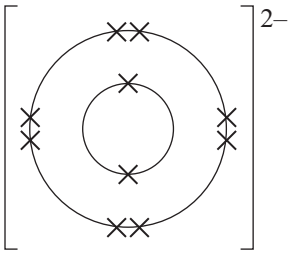


A **B** **C** **D**

Diagram .....

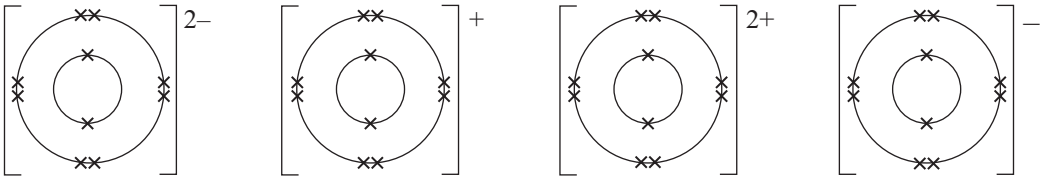
(1 mark)

(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

4.4.2.3 Soluble salts

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)

4.4.2.3 Soluble salts

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

4.4.2.3 Soluble salts

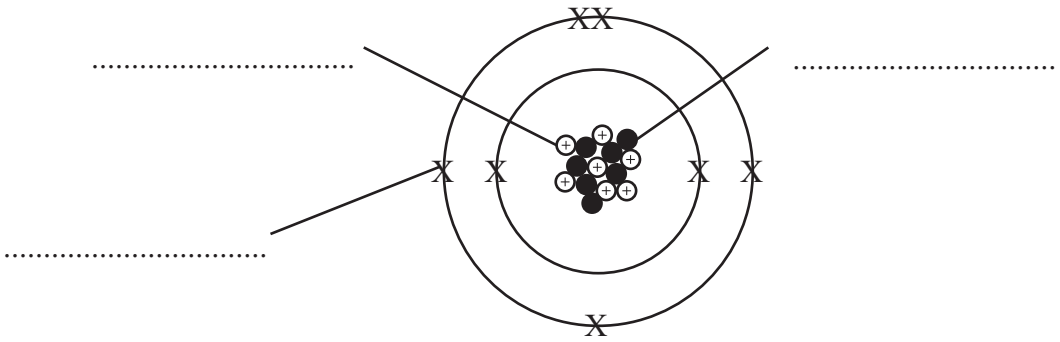
Question 03

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)

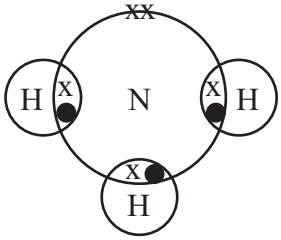
5 (a) (ii) Draw a ring around the mass number of this atom.

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

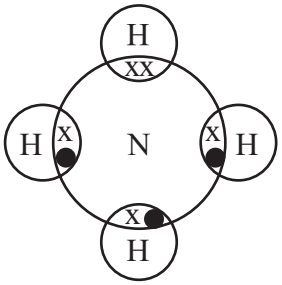
(1 mark)

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

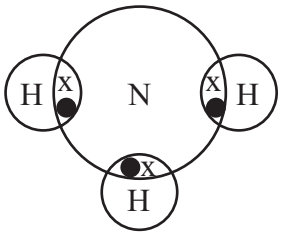
A



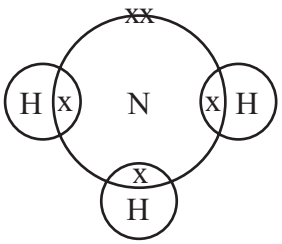
B



C



D



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

(1 mark)

4.4.2.3 Soluble salts

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

4.4.2.3 Soluble salts

Question 04

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?

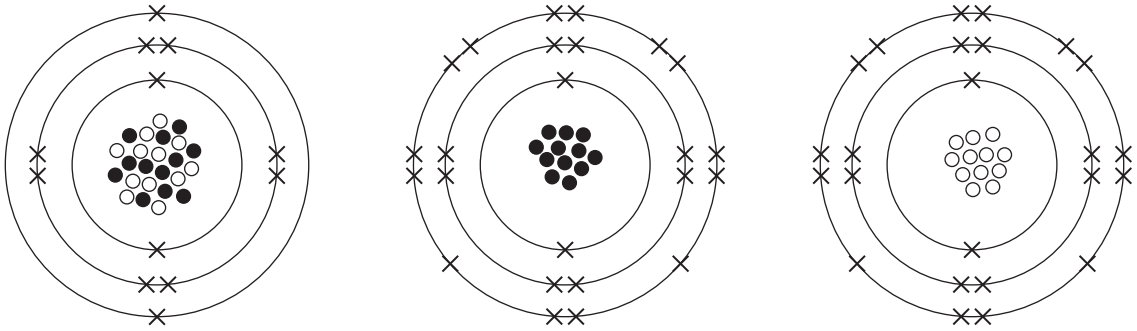
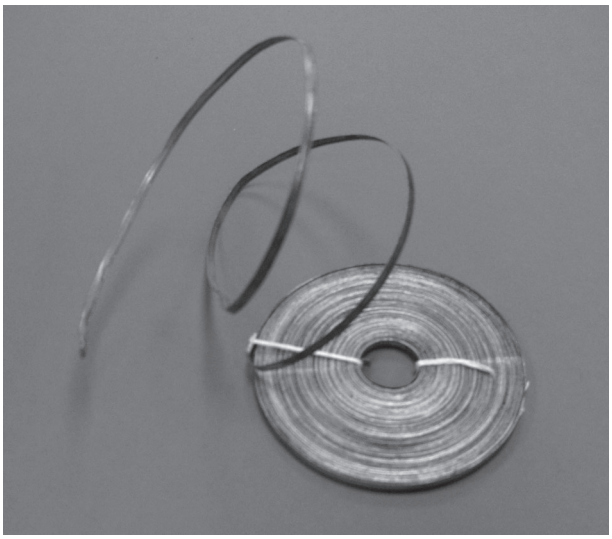


Diagram A **Diagram B** **Diagram C**

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)

4.4.2.3 Soluble salts

Question 04 · continued

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:

$$\underset{\text{magnesium}}{Mg(s)} + \underset{\text{acid}}{H_2SO_4(aq)} \rightarrow \underset{\text{magnesium sulfate solution}}{MgSO_4(aq)} + \underset{\text{hydrogen}}{H_2(g)}$$

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

4.4.2.3 Soluble salts

Question 05

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.

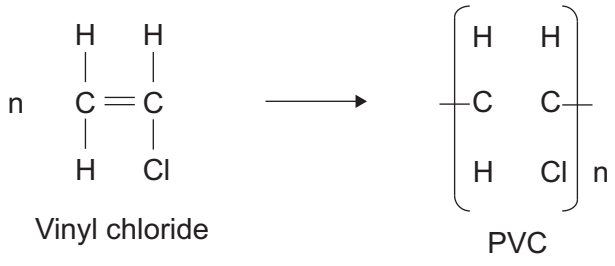
Complete the chemical equation by writing in the formula of the product vinyl chloride.

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

(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)

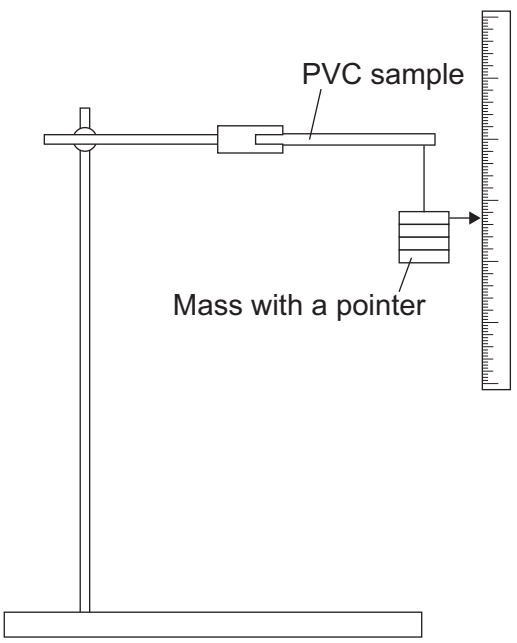
Question 7 continues on the next page

4.4.2.3 Soluble salts

Question 05 · 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)

4.4.2.3 Soluble salts

Question 05 · continued

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**.

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(2 marks)

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

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.....

(1 mark)

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

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.....

(1 mark)

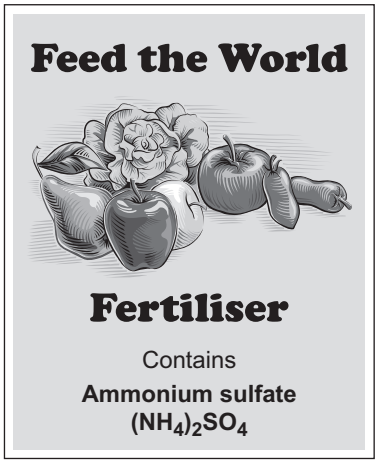
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4.4.2.3 Soluble salts

Question 06

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)

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.

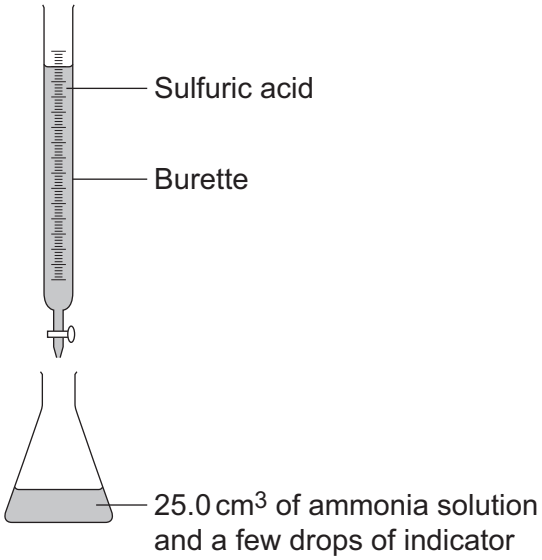
(1 mark)

4.4.2.3 Soluble salts

Question 06 · 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

4.4.2.3 Soluble salts

Question 07

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

4.4.2.3 Soluble salts

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)

4.4.2.3 Soluble salts

Question 07 · 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.

.....

.....

.....

.....

(3 marks)

11

4.4.2.3 Soluble salts

Question 08

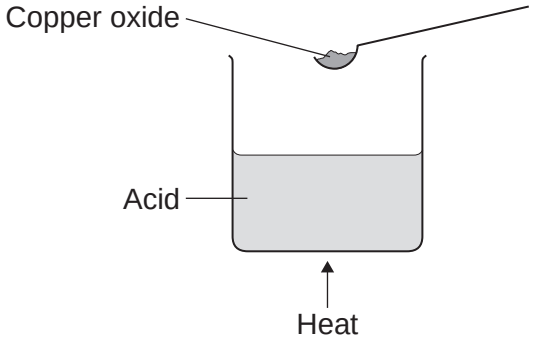
January 2013 | CH2FP | Original Q5 | Legacy

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)

4.4.2.3 Soluble salts

Question 08 · 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

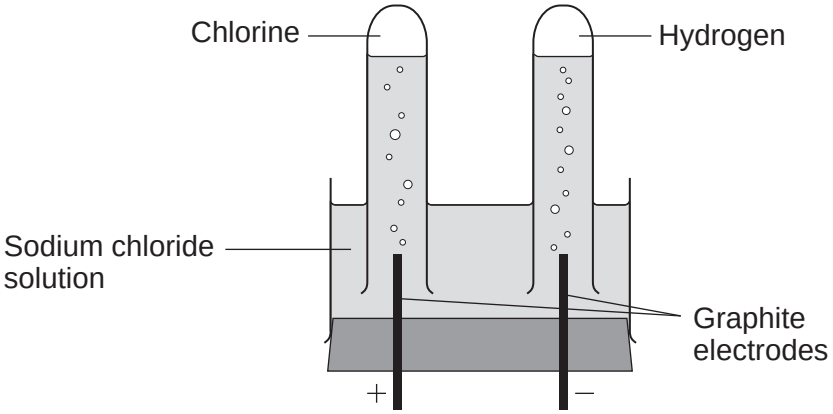
4.4.2.3 Soluble salts

Question 09

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?

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.....

(1 mark)

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

.....

.....

(1 mark)

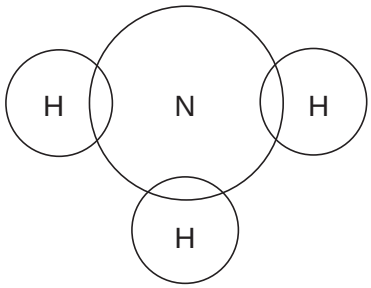
Question 09 · continued

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

4.4.2.3 Soluble salts

Question 09 · 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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4.4.2.3 Soluble salts

Question 10

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)

4.4.2.3 Soluble salts

Question 10 · continued June 2013 | CH2FP | Original Q2 | Legacy

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)

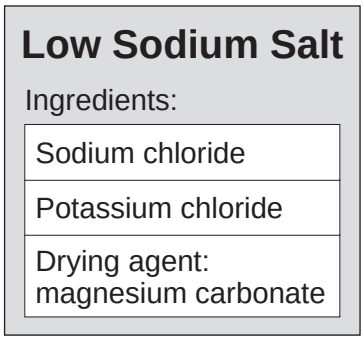
9

4.4.2.3 Soluble salts

Question 11

June 2013 | CH3FP | Original Q2 | Legacy

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



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)

4.4.2.3 Soluble salts

Question 11 · 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.

.....

.....

.....

.....

(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

4.4.2.3 Soluble salts

Question 12

June 2014 | CH2FP | Original Q4 | Legacy

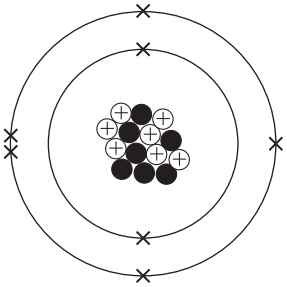
4 Fertilisers contain elements that plants need.

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]

4.4.2.3 Soluble salts

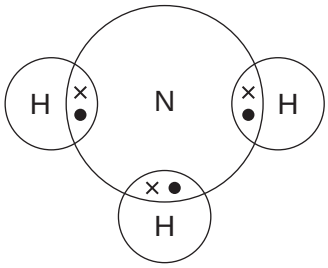
Question 12 · continued

4 (b) Fertilisers can be made from ammonia.

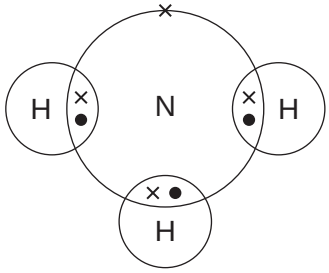
4 (b) (i) Which diagram, **A**, **B**, or **C**, represents the electronic structure of an ammonia molecule?

[1 mark]

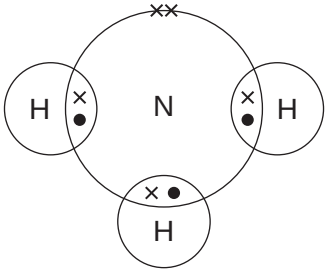
A



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

4.4.2.3 Soluble salts

Question 12 · 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]

.....

.....

Question 12 · continued

4 (d) Some fertilisers contain potassium chloride.

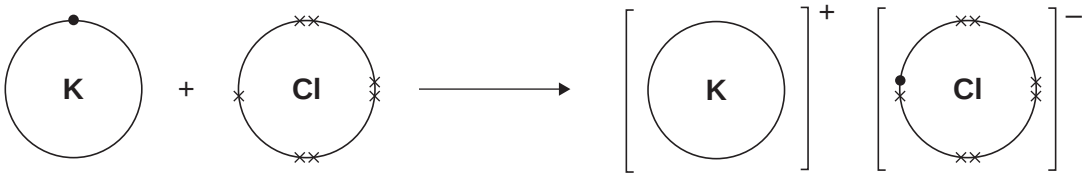
Potassium reacts with chlorine to produce potassium chloride.

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

4.4.2.3 Soluble salts

Question 13

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 13 · continued

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

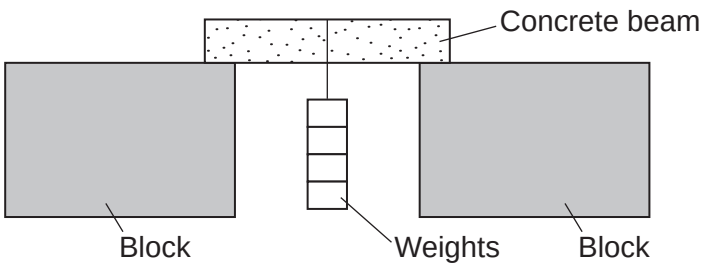
Concrete is made by mixing cement with water, sand and aggregate (small pieces of rock).

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

The students used this method:

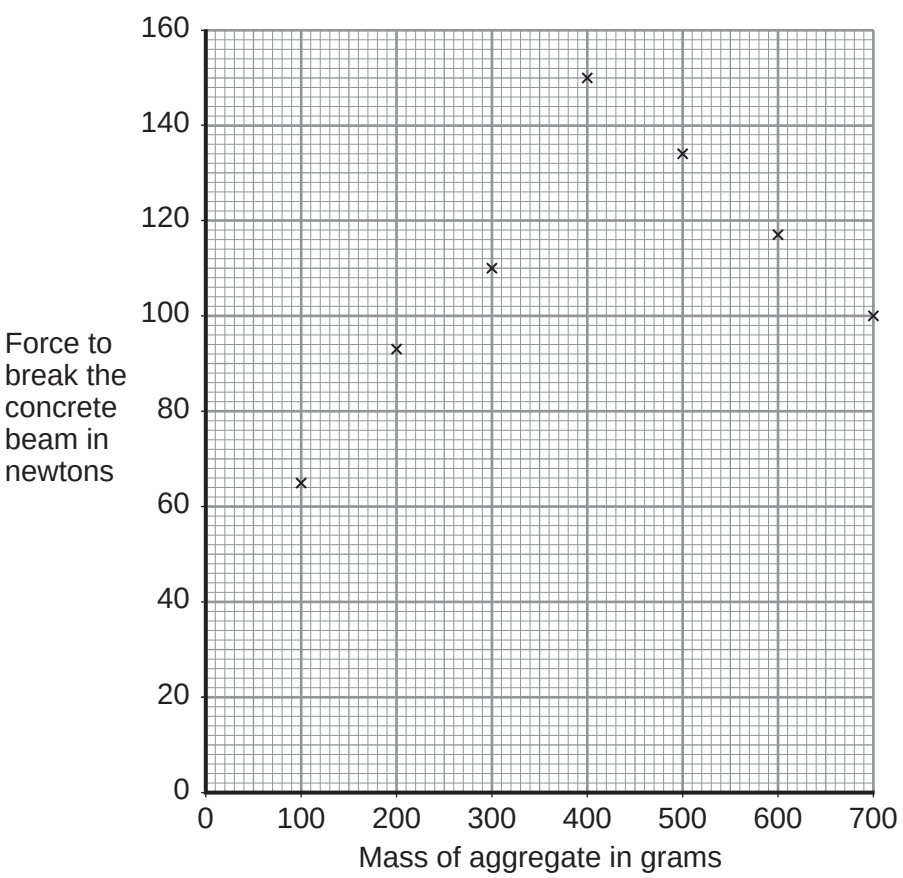
- use the same mass of cement and the same mass of sand but change the mass of aggregate to make seven different concrete mixtures
- use the different concrete mixtures to make beams of the same size
- add weights, as shown in **Figure 7**, until the concrete beam breaks.

Figure 7



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

Figure 8



4.4.2.3 Soluble salts

Question 13 · 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]

.....

.....

.....

.....

.....

.....

13

4.4.2.3 Soluble salts

Question 14

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.

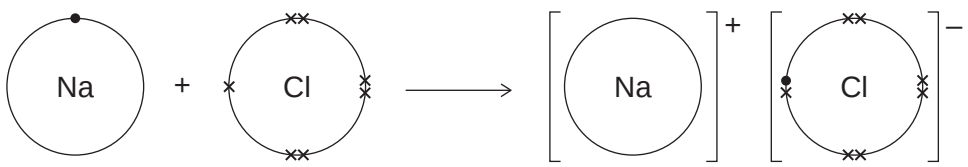
sodium + chlorine ⟶ sodium chloride

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]

.....

.....

.....

.....

.....

.....

Question 2 continues on the next page

4.4.2.3 Soluble salts

Question 14 · 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]

.....

4.4.2.3 Soluble salts

Question 14 · 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

4.4.2.3 Soluble salts

Question 15

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 ..... .

4.4.2.3 Soluble salts

Question 15 · 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

4.4.2.3 Soluble salts

Question 16

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 .....

4.4.2.3 Soluble salts

Question 16 · 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

4.4.2.3 Soluble salts

Question 17

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 = _____%

4.4.2.3 Soluble salts

Question 17 · 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 17 · 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.

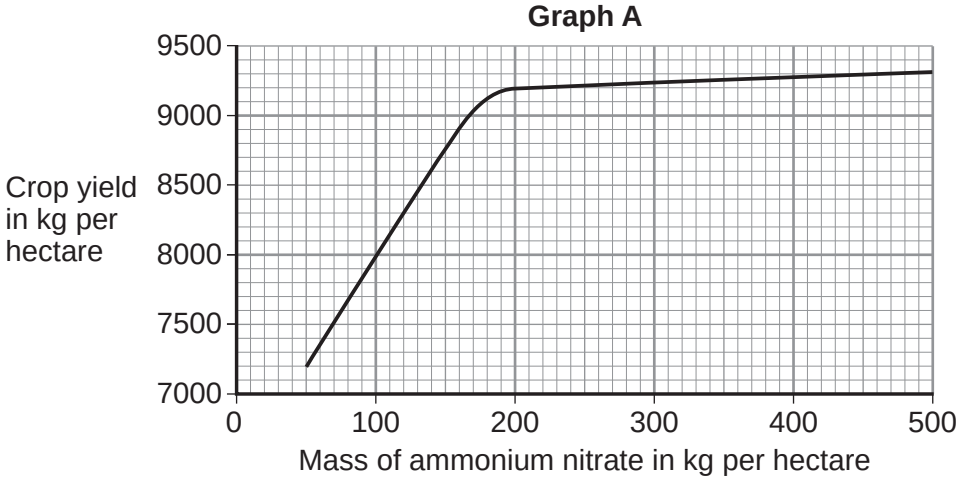
Rainwater dissolves ammonium nitrate in the soil.

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

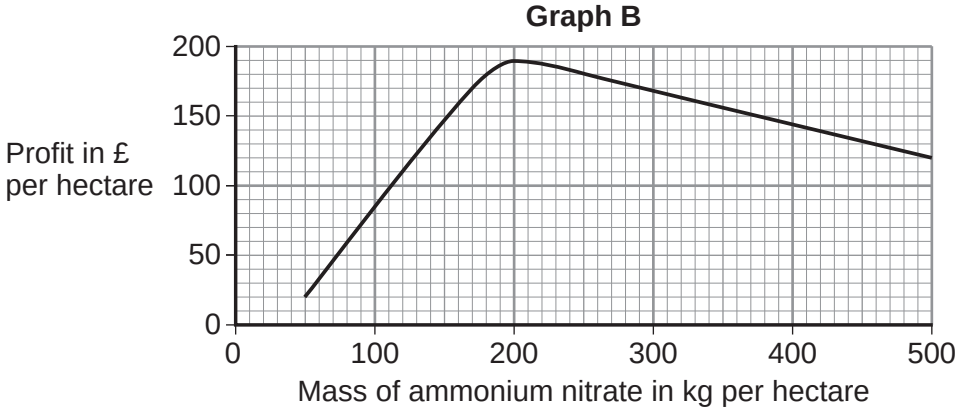
Figure 12 shows three graphs **A**, **B** and **C**. The graphs show information about the use of ammonium nitrate as a fertiliser. A hectare is a measurement of an area of land.

Figure 12

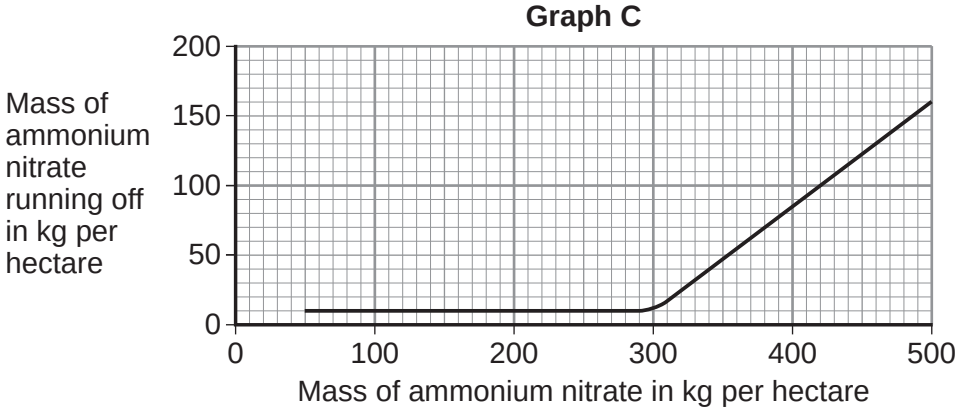
Graph A



Graph B



Graph C



4.4.2.3 Soluble salts

Question 17 · 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

4.4.2.3 Soluble salts

Question 18

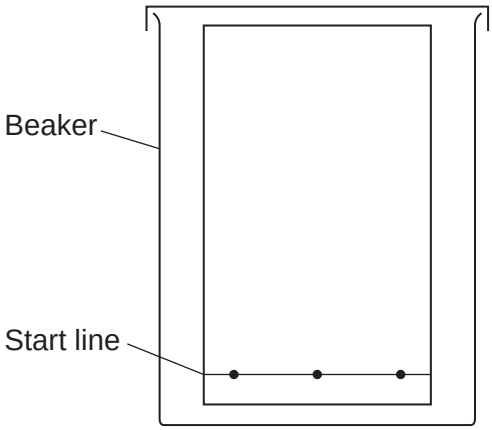
June 2017 | CH2FP | Original Q1 | Legacy

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**

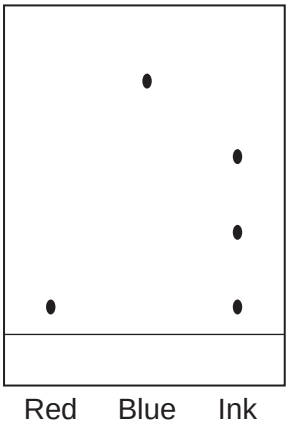
The water level should be _____ the start line drawn by the student.

4.4.2.3 Soluble salts

Question 18 · 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

4.4.2.3 Soluble salts

Question 18 · 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.

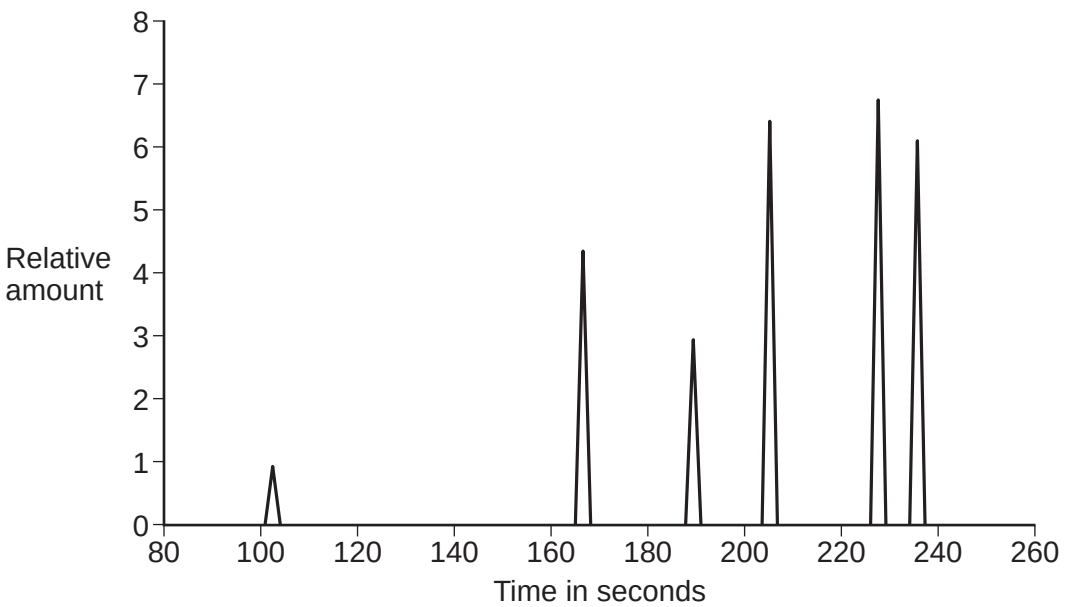
[1 mark]

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

4.4.2.3 Soluble salts

Question 19

June 2017 | CH2FP | Original Q2 | Legacy

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

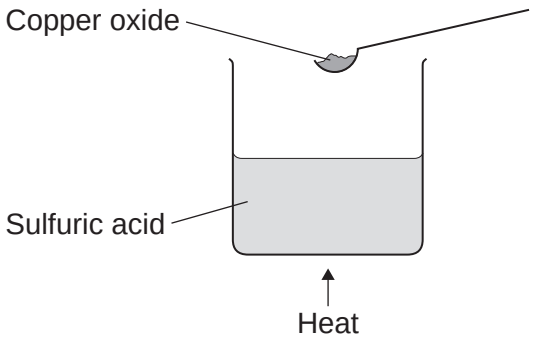
2 (a) A student added copper oxide to sulfuric acid to make copper sulfate.

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

4.4.2.3 Soluble salts

Question 19 · 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.

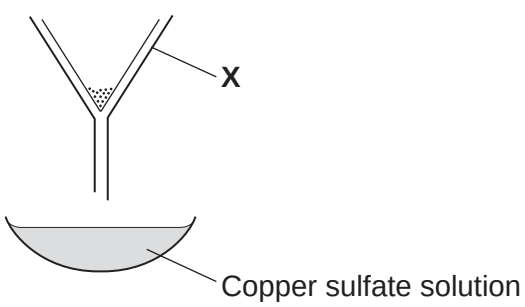
To make bigger copper sulfate crystals. ☐

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



4.4.2.3 Soluble salts

Question 19 · 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]

_____

4.4.2.3 Soluble salts

Question 19 · 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

4.4.2.3 Soluble salts

Question 20

June 2018 | 8462/1F | Original Q8

0 8 Soluble salts are formed by reacting metal oxides with acids.

0 8 . 1 Give **one** other type of substance that can react with an acid to form a soluble salt.

[1 mark]

0 8 . 2 Calcium nitrate contains the ions Ca^{2+} and NO_3^-

Give the formula of calcium nitrate.

[1 mark]

0 8 . 3 Describe a method to make pure, dry crystals of magnesium sulfate from a metal oxide and a dilute acid.

[6 marks]

4.4.2.3 Soluble salts

Question 21

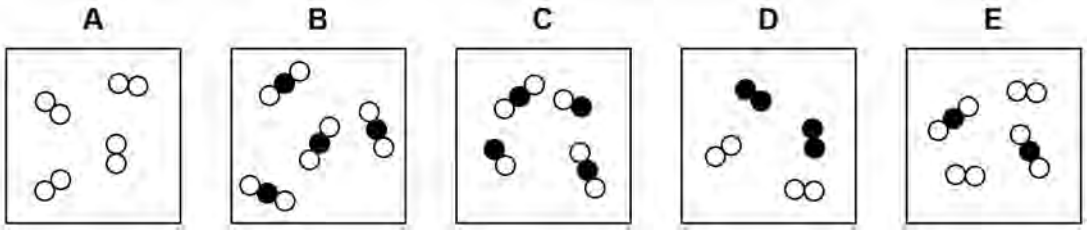
June 2019 | 8462/1F | Original Q3

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** ☐

4.4.2.3 Soluble salts

Question 21 · 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

4.4.2.3 Soluble salts

Question 21 · continued

June 2019 | 8462/1F | Original Q3

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

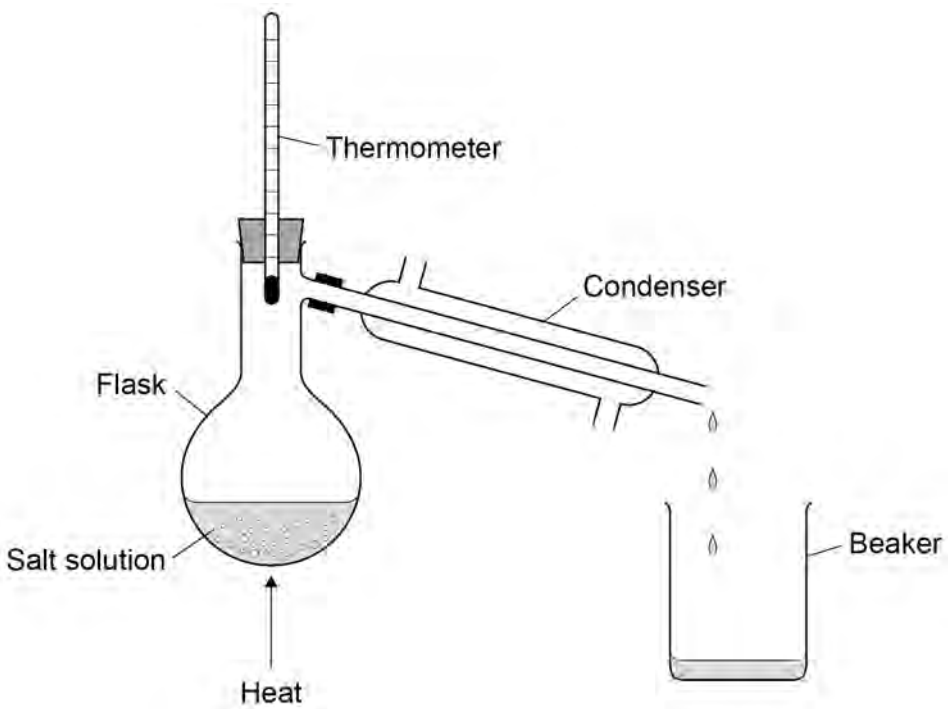
4.4.2.3 Soluble salts

Question 21 · continued

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 ☐

4.4.2.3 Soluble salts

Question 21 · 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

4.4.2.3 Soluble salts

Question 22

June 2019 | 8462/1F | Original Q9

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

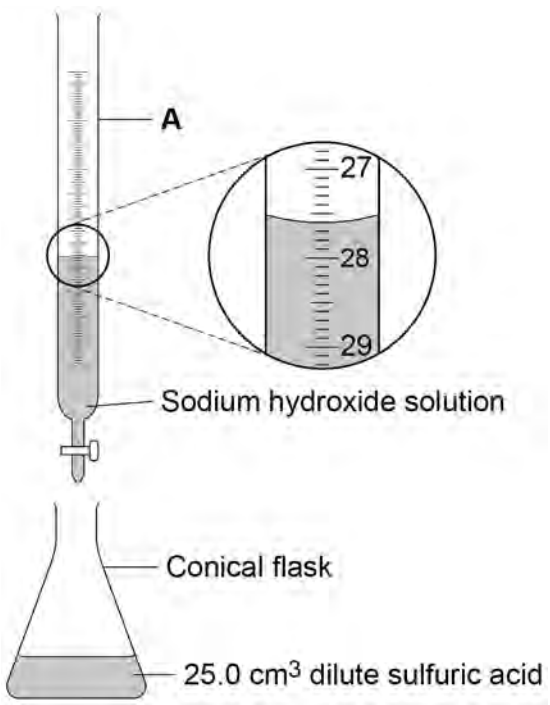
4.4.2.3 Soluble salts

Question 22 · 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

4.4.2.3 Soluble salts

Question 22 · 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

4.4.2.3 Soluble salts

Question 23

November 2020 | 8462/1F | Original Q4

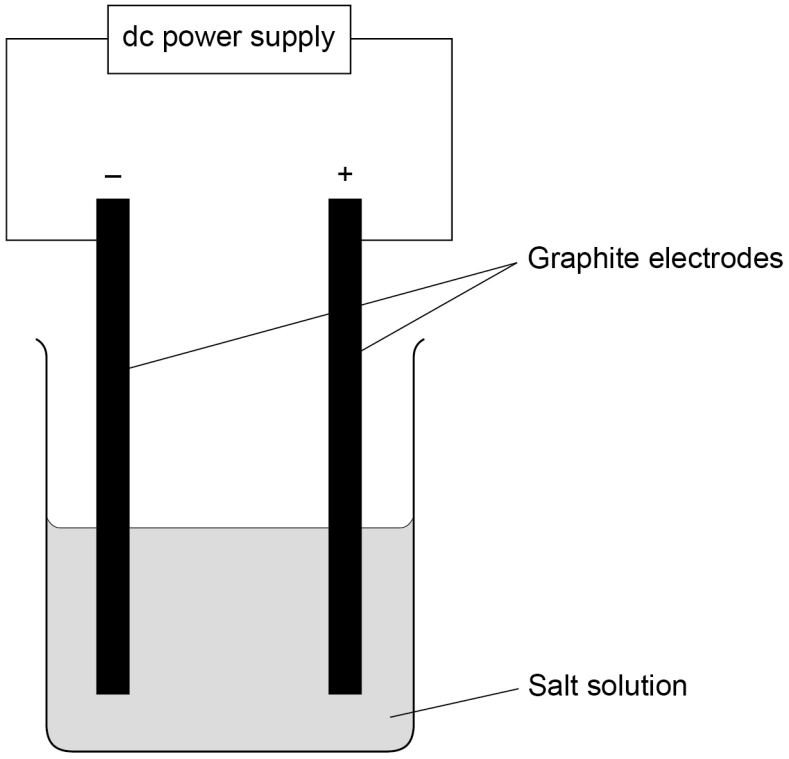
0 4 This question is about electrolysis.

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 _____

_____

4.4.2.3 Soluble salts

Question 23 · 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 _____

_____

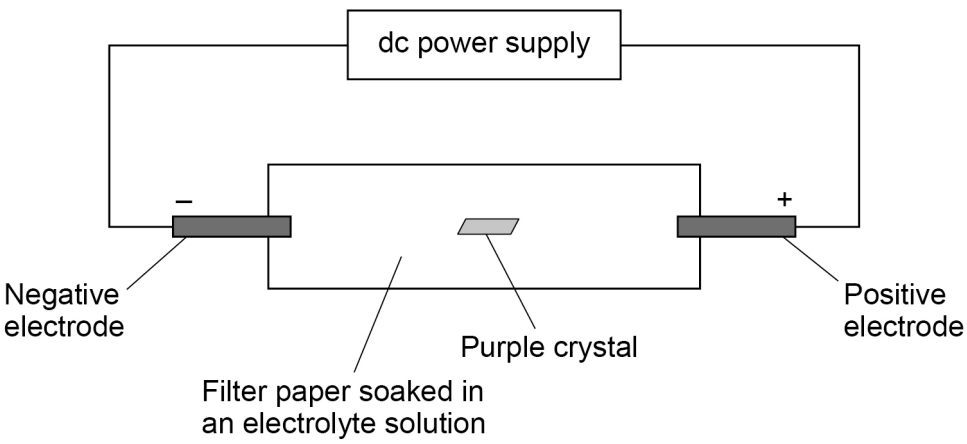
4.4.2.3 Soluble salts

Question 23 · 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

4.4.2.3 Soluble salts

Question 24

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]

_____

4.4.2.3 Soluble salts

Question 24 · continued

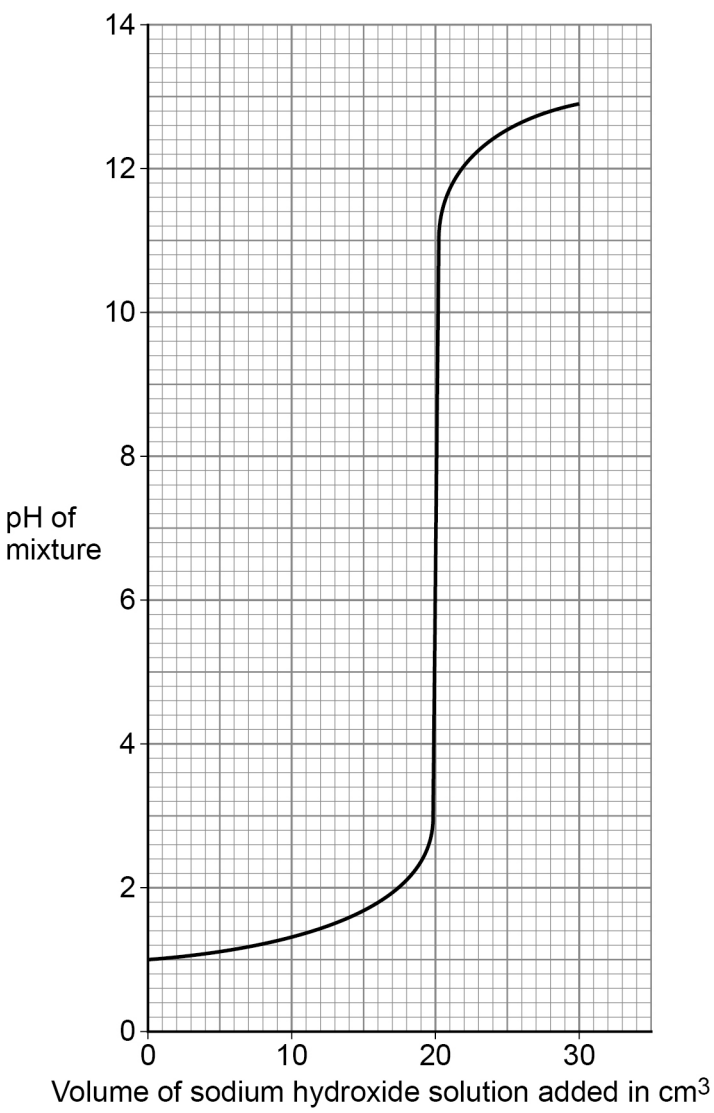
A student investigated how pH changes during a titration.

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



4.4.2.3 Soluble salts

Question 24 · continued

November 2020 | 8462/1F | Original Q7

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?

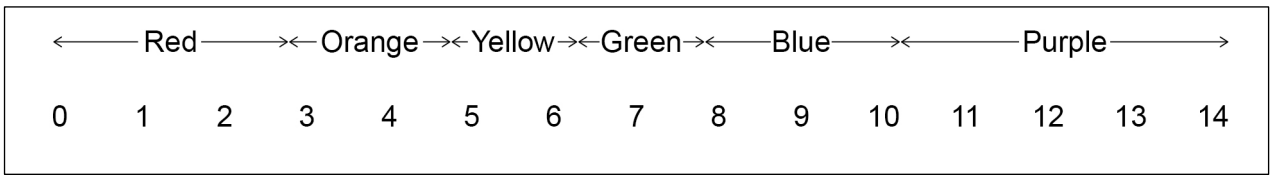
Use **Figure 10**.

[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]

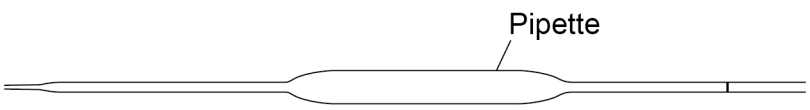
Colour = _____

Question 24 · 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

4.4.2.3 Soluble salts

Question 25

November 2021 | 8462/1F | Original Q7

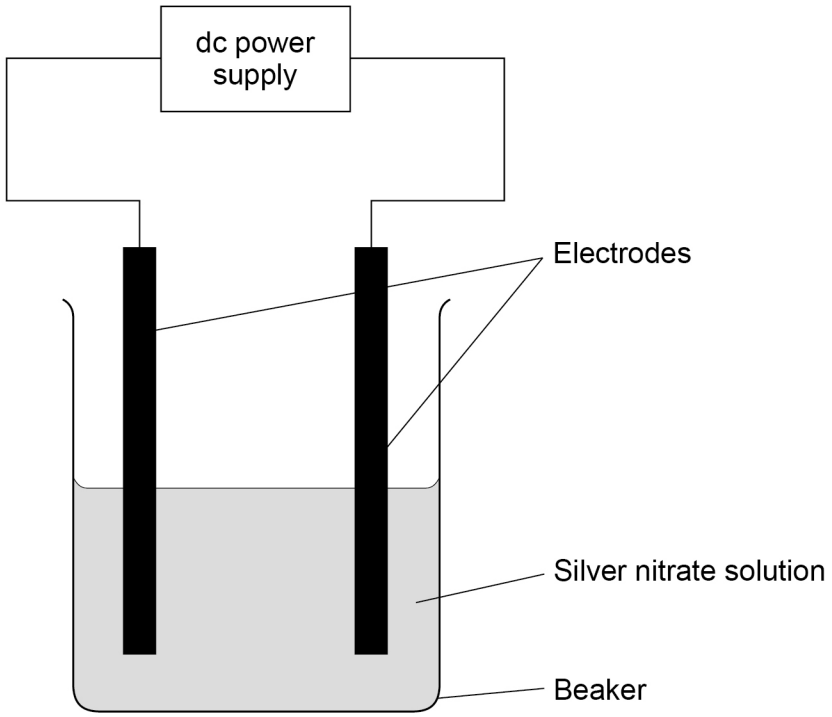
0 7 This question is about electrolysis.

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 25 · 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

4.4.2.3 Soluble salts

Question 25 · continued

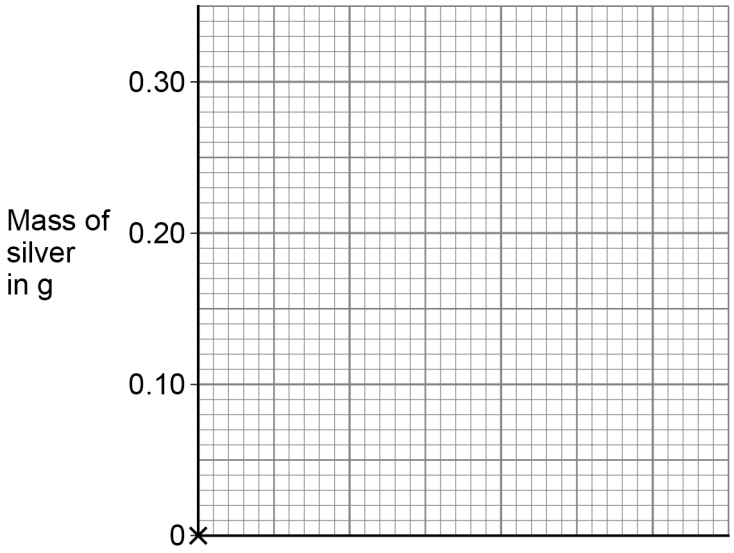
0 7 . 2 Draw a graph on **Figure 12**.

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

4.4.2.3 Soluble salts

Question 25 · 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

4.4.2.3 Soluble salts

Question 26

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

4.4.2.3 Soluble salts

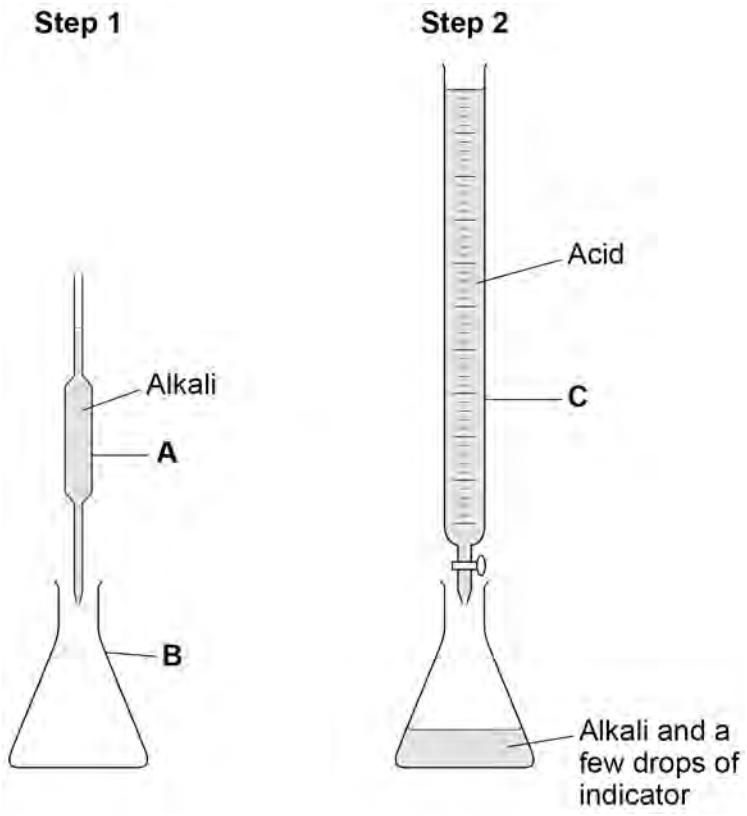
Question 27

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 _____

4.4.2.3 Soluble salts

Question 27 · 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

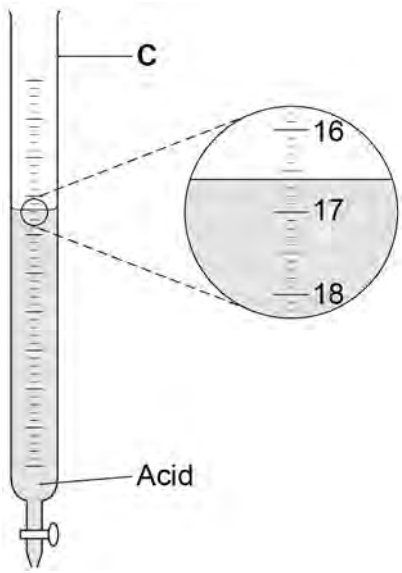
Question 2 continues on the next page

4.4.2.3 Soluble salts

Question 27 · 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 ☐

4.4.2.3 Soluble salts

Question 27 · 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

4.4.2.3 Soluble salts

Question 28

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]

_____

_____

4.4.2.3 Soluble salts

Question 28 · 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

4.4.2.3 Soluble salts

Question 28 · 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

4.4.2.3 Soluble salts

Question 29

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 _____

_____

Question 29 · continued

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

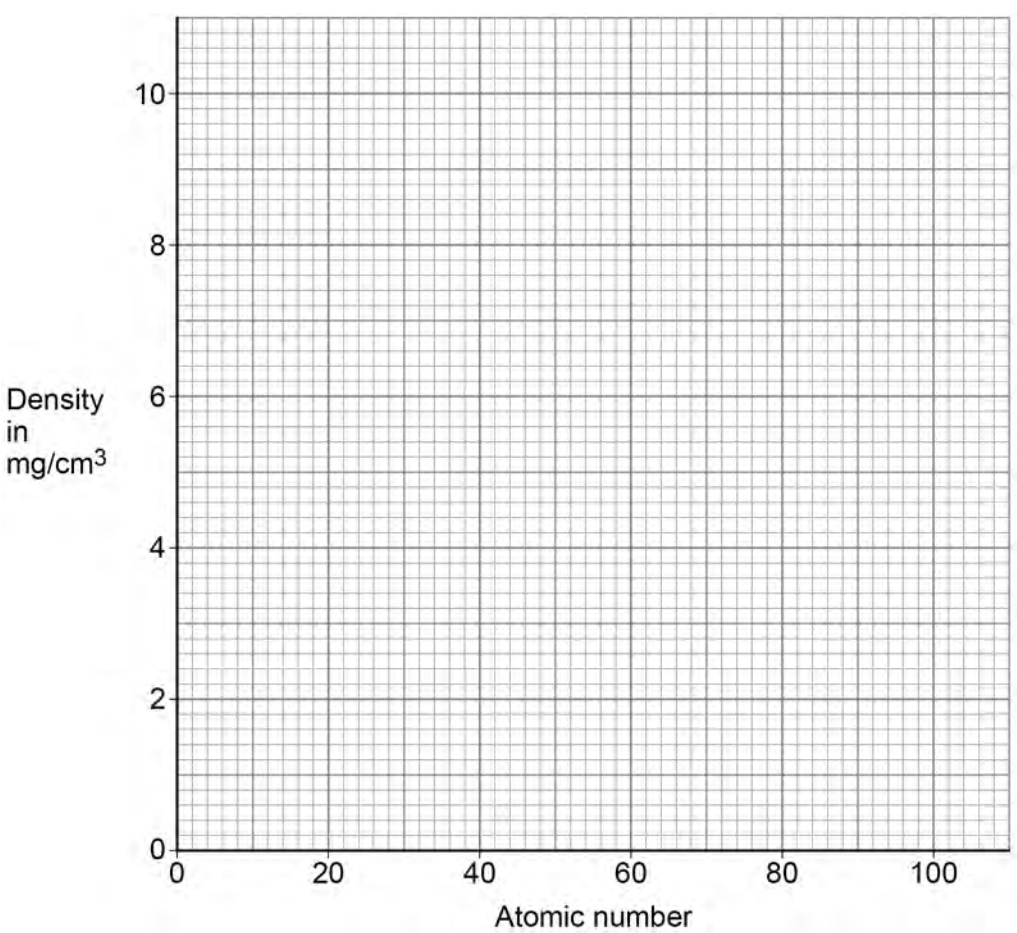
Table 4

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



4.4.2.3 Soluble salts

Question 29 · 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

4.4.2.3 Soluble salts

Question 30

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 _____

_____

Question 30 · 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

4.4.2.3 Soluble salts

Question 30 · continued

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

4.4.2.3 Soluble salts

Question 31

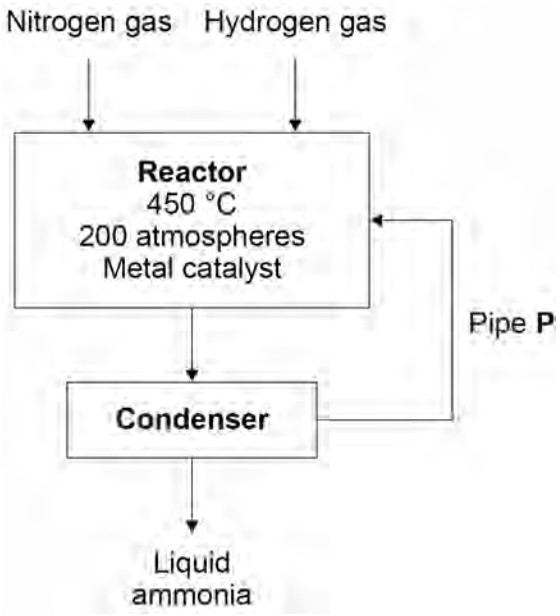
June 2024 | 8462/2F | Original Q9

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]

4.4.2.3 Soluble salts

Question 31 · 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 _____

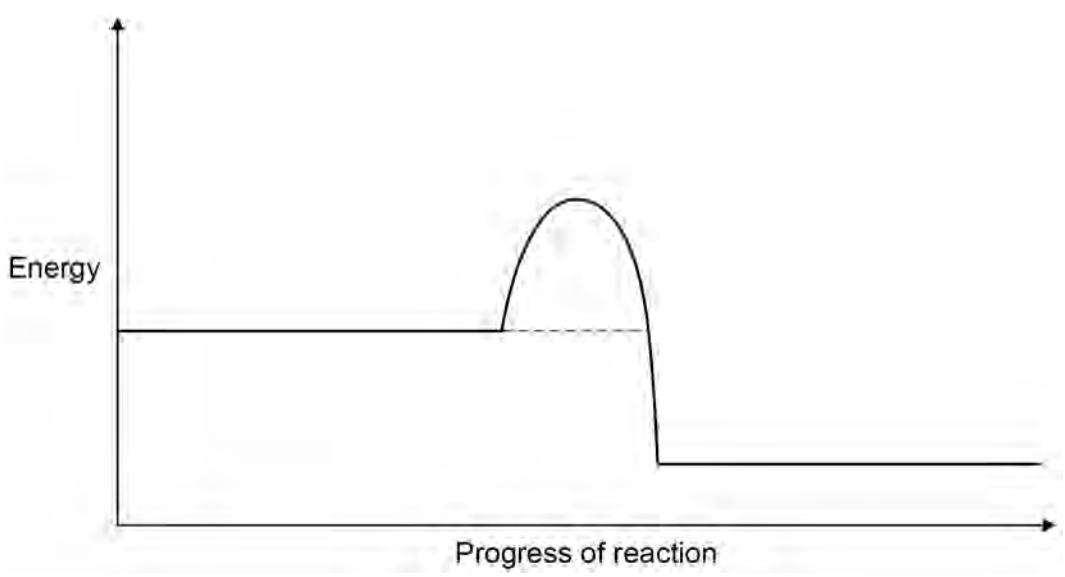
_____

Result _____

_____

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

Figure 11



4.4.2.3 Soluble salts

Question 31 · 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

4.4.2.3 Soluble salts

Question 32

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

Question 32 · continued

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

4.4.2.3 Soluble salts

Question 32 · continued

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

[1 mark]

Tick (✓) **one** box.

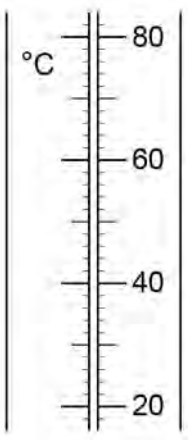
A copper can ☐

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 ☐

4.4.2.3 Soluble salts

Question 32 · 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 ☐

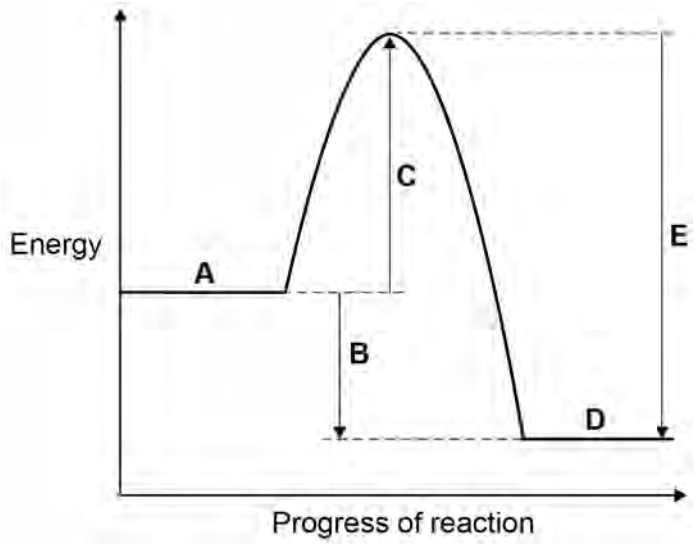
Increases ☐

4.4.2.3 Soluble salts

Question 32 · 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

4.4.2.3 Soluble salts

Question 33

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]

_____

4.4.2.3 Soluble salts

Question 33 · 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 33 · 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

4.4.2.3 Soluble salts

Question 33 · 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

4.4.2.3 Soluble salts

Question 34

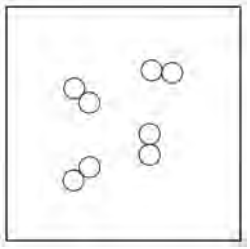
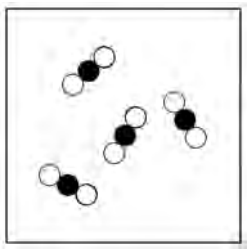
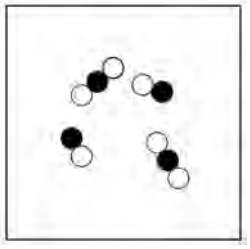
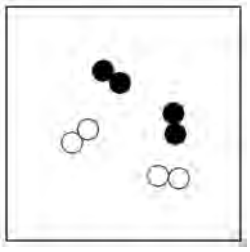
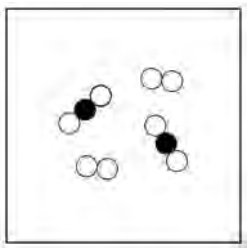
June 2025 | 8462/1F | Original Q7

0 7 This question is about mixtures.

0 7 . 1 Draw **one** line from each type of mixture to the representation of that mixture.

○ and ● represent atoms of different elements.

[2 marks]

Type of mixture	Representation
Mixture of compounds	
Mixture of a compound and an element	
	
	
	

4.4.2.3 Soluble salts

Question 34 · continued

0 7 . 2 A student had a mixture of salt and sand.

Salt is soluble in water.

Sand is insoluble in water.

Plan a method to obtain pure dry samples of salt and of sand from the mixture.

Figure 11 shows the chemicals and equipment that can be used.

[6 marks]

Figure 11



4.4.2.3 Soluble salts

Question 34 · continued

Extra space

0 7 . 3 A mixture of salt and sand contained 16.0 g of salt.

The student obtained 13.6 g of salt after separation from the mixture.

Calculate the percentage yield of the salt.

Use the equation

$$\% \text{ yield} = \frac{\text{mass of salt obtained}}{\text{mass of salt in mixture}} \times 100$$

[2 marks]

% yield = _____ %

10