AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.3.1

Flame tests

Past-paper questions

Tier	**Foundation**
Question groups	**14**
Available paper years	**2007–2025**

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.

4.8.3.1 Flame tests

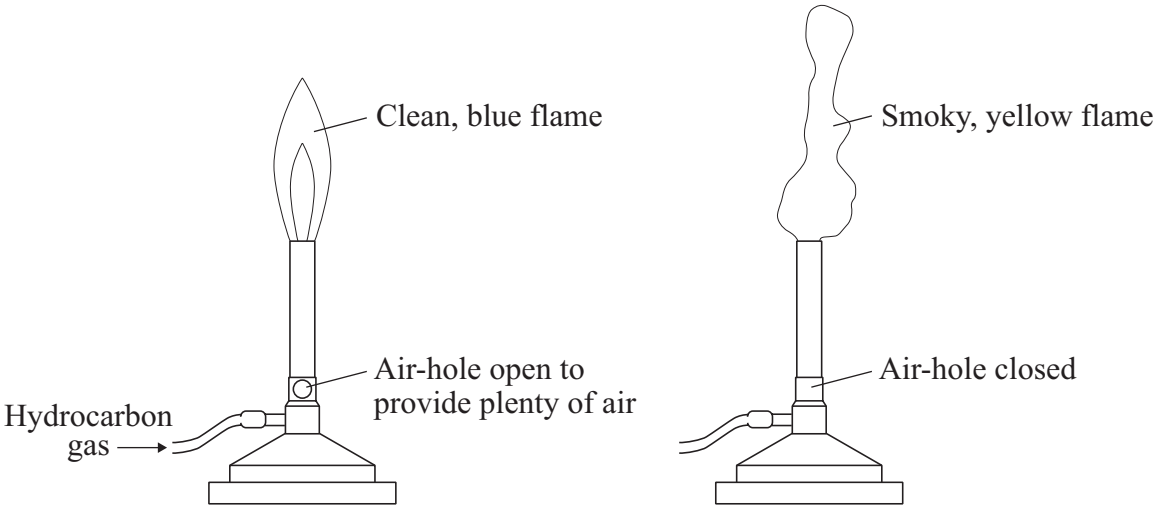
Question 01

November 2007 | CHY1A | Original Q3 | Legacy

QUESTION THREE

The diagram shows a hydrocarbon gas burning in a Bunsen burner.

The flame is different when the air-hole is open compared with when it is closed.



Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A carbon

B carbon monoxide

C carbon dioxide

D oxygen

With the air-hole open, the two main products of combustion are water and . . . **1** . . . .

Water is formed when hydrogen in the hydrocarbon gas reacts with . . . **2** . . . .

With the air-hole closed, another gas that is produced during combustion is . . . **3** . . . .

The yellow flame contains black specks of . . . **4** . . . .

4.8.3.1 Flame tests

Question 02

January 2008 | CHY3F | Original Q2 | Legacy

2 A bottle of washing soda was found in a school laboratory. The modern name of washing soda is sodium carbonate.



A student tested the washing soda to prove that it was sodium carbonate.

(a) The student did a flame test to show that washing soda is a sodium compound.

The student used a clean wire to put the washing soda into the flame.

(i) Why should the wire be clean when used for a flame test?

.....

(1 mark)

(ii) The table shows some properties of metals.

Two of these are properties that the wire must have if it is used for a flame test.

Put a tick (✓) next to the **two** correct properties.

Property	(✓)
Good electrical conductor	
High density	
High melting point	
Low boiling point	
Unreactive	

(2 marks)

4.8.3.1 Flame tests

Question 02 · continued

BLANK

(iii) Which **one** of the following flame colours shows that washing soda is a sodium compound?

Draw a ring around your answer.

brick-red **lilac** **yellow-orange**

(1 mark)

(b) The student used dilute hydrochloric acid to show that washing soda was a carbonate. Carbon dioxide gas was given off.

(i) Describe what you **see** happening when a gas is given off.

.....

.....

(1 mark)

(ii) The student used limewater to prove that the gas given off was carbon dioxide.

Complete this sentence by choosing the correct word from the box.

clear	**colourless**	**milky**

When carbon dioxide reacts with limewater, the limewater turns

..... .

(1 mark)

(c) Instrumental methods are used to identify chemicals.

Describe some advantages of instrumental methods compared with chemical tests by considering:

- the length of time needed to carry out a test
- the amount of chemical used.

.....

.....

.....

.....

.....

(2 marks)

8

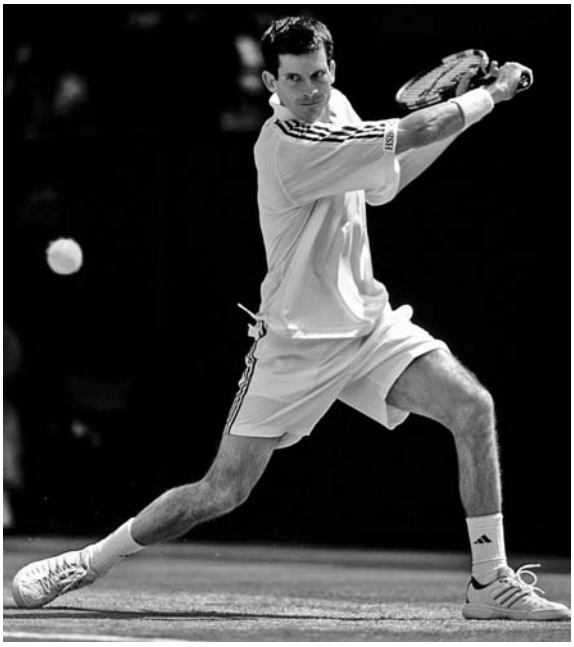
4.8.3.1 Flame tests

Question 03

June 2008 | CHY3F | Original Q3 | Legacy

3 The information in the box was on the internet.

Breathtaking Finish



Tim Henman used *smelling salts* to help revive his fortunes at Wimbledon yesterday.

The active chemical in *smelling salts* is ammonium carbonate, $(NH_4)_2CO_3$.

A student tested some *smelling salts* to prove that they contained ammonium ions and carbonate ions.

3 (a) Complete these sentences by choosing the correct substances from the box.

3 (a) (i) Test for carbonate ions.

ammonia	**carbon dioxide**	**hydrochloric acid**
limewater	**water**	

The student added ..... to the smelling salts.

A gas called ..... was given off.

This gas turned ..... milky.

(3 marks)

4.8.3.1 Flame tests

Question 03 · continued

for mark

3 (a) (ii) Test for ammonium ions.

ammonia	**carbon dioxide**	**hydrochloric acid**
litmus	**sodium hydroxide**	

The student added ..... to the smelling salts.

A gas called ..... was given off.

This gas turned ..... paper blue.

(3 marks)

3 (b) Suggest why ammonium ions **cannot** be identified using a flame test.

.....

.....

(1 mark)

7

4.8.3.1 Flame tests

Question 04

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)

4.8.3.1 Flame tests

Question 04 · 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

4.8.3.1 Flame tests

Question 05

June 2010 | CHY3F | Original Q4 | Legacy

4 Chemical tests can be used to detect and identify elements and compounds.

A jar of a chemical from 1870 is shown.



Copperas was a name used for iron(II) sulfate, $FeSO_4$. It does not contain any copper!

4 (a) A student tested solutions of copperas to show which ions it contained.

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

4 (a) (i) The student tested for iron(II) ions, Fe^{2+}

The student added a solution of

barium chloride.

silver nitrate.

sodium hydroxide.

The colour of the precipitate formed was

green.

red.

white.

The precipitate was a

liquid.

gas.

solid.

(3 marks)

4.8.3.1 Flame tests

Question 05 · continued

4 (a) (ii) The student tested for sulfate ions, SO_4^{2-}

The student added dilute hydrochloric acid and [barium chloride / silver nitrate / sodium hydroxide] solution.

The colour of the precipitate formed was [green. / red. / white.]

Sulfuric acid (H_2SO_4) should **not** be used instead of hydrochloric acid (HCl) when testing for sulfate ions. This is because sulfuric acid contains [chloride ions, Cl^- / nitrate ions, NO_3^- / sulfate ions, SO_4^{2-}]

(3 marks)

4 (b) A flame test can be used to identify the metal ions in a compound.

How do you carry out a flame test?

.....

.....

(1 mark)

4 (c) The elements in a compound can also be detected and identified using instrumental methods of analysis.

State **one** advantage of using instrumental methods compared with chemical tests.

.....

.....

(1 mark)

8

4.8.3.1 Flame tests

Question 06

January 2011 | CHY3F | Original Q2 | Legacy

2 Read the information in the box and then answer the questions.

> Seidlitz Powder is a medicine.
>
> Seidlitz Powder comes as two powders. One powder is wrapped in white paper and contains tartaric acid. The other powder is wrapped in blue paper and contains sodium hydrogencarbonate.
>
> The contents of the blue paper are dissolved in water and the contents of the white paper are added. This causes a reaction that produces carbon dioxide gas. The mixture is safe to drink when the reaction stops.

2 (a) Suggest why Seidlitz Powder comes as two separate powders.

.....

(1 mark)

2 (b) The reaction produces carbon dioxide gas.

2 (b) (i) What would you see during the reaction?

.....

(1 mark)

2 (b) (ii) Which state symbol in a chemical equation shows that carbon dioxide is a gas?

Draw a ring around **one** answer.

(s) **(l)** **(aq)** **(g)**

(1 mark)

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

Carbon dioxide can be identified because it turns [limescale / limestone / limewater] milky.

(1 mark)

4.8.3.1 Flame tests

Question 06 · continued

2 (c) Sodium hydrogencarbonate contains sodium ions. Sodium ions can be identified by flame tests.

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

Sodium ions give a [blue / red / yellow] flame.

(1 mark)

2 (d) Some Seidlitz Powder was bought on the Internet for £5. However, when tested, it was found to be only magnesium sulfate, worth a few pence.

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

2 (d) (i) The test for sulfate ions uses [barium chloride / silver nitrate / sodium hydroxide] solution.

(1 mark)

2 (d) (ii) A positive test for sulfate ions produces a [blue / red / white] precipitate.

(1 mark)

2 (d) (iii) Suggest **one** disadvantage of buying medicines on the Internet.

.....

.....

(1 mark)

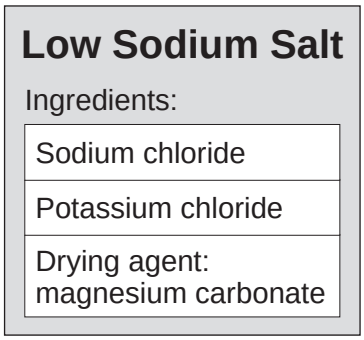
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4.8.3.1 Flame tests

Question 07

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)

4.8.3.1 Flame tests

Question 07 · 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

4.8.3.1 Flame tests

Question 08

June 2014 | CH3FP | Original Q6 | Legacy

6 (a) The colours of fireworks are produced by chemicals.

Figure 8



Three of these chemicals are lithium sulfate, potassium chloride and sodium nitrate.

6 (a) (i) A student wants to carry out flame tests on these three chemicals.

Describe how to carry out a flame test.

[2 marks]

.....

.....

.....

.....

6 (a) (ii) Draw **one** line from each chemical to the correct flame colour.

The first one has been done for you.

[2 marks]

Chemical	Flame colour
lithium sulfate	crimson
potassium chloride	
sodium nitrate	
	green
	yellow
	lilac

4.8.3.1 Flame tests

Question 08 · continued

6 (a) (iii) Dilute nitric acid and silver nitrate solution are added to solutions of the three chemicals.

A white precipitate forms in one of the solutions.

Which chemical produces the white precipitate?

[1 mark]

.....

6 (b) The student tests a fourth chemical, **X**.

6 (b) (i) The student adds sodium hydroxide solution to a solution of chemical **X**.

A blue precipitate is formed.

Which metal ion is in chemical **X**?

[1 mark]

.....

6 (b) (ii) The student adds dilute hydrochloric acid to a solution of chemical **X** and then adds barium chloride solution.

A white precipitate is formed.

Which negative ion is in chemical **X**?

Draw a ring around the correct answer.

[1 mark]

chloride **nitrate** **sulfate**

7

4.8.3.1 Flame tests

Question 09

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 ..... .

4.8.3.1 Flame tests

Question 09 · 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

4.8.3.1 Flame tests

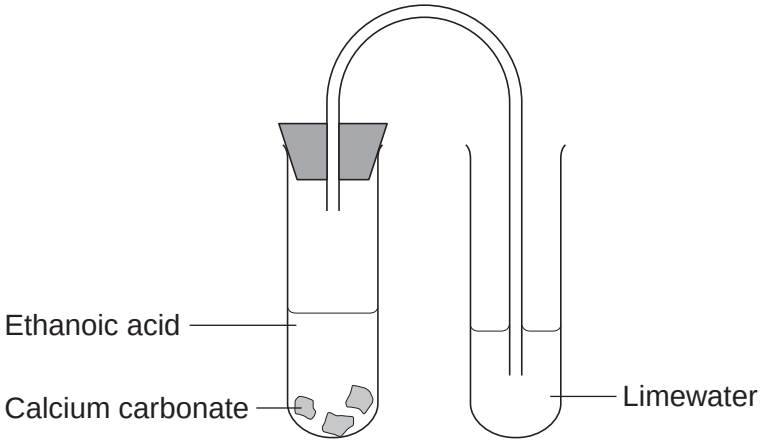
Question 10

June 2016 | CH3FP | Original Q5 | Legacy

5 This question is about reactions of ethanoic acid and the analysis of salts.

5 (a) **Figure 7** shows the apparatus used to investigate the reaction of ethanoic acid with calcium carbonate.

Figure 7



5 (a) (i) Describe a change that would be seen in each test tube.

Give a reason for each change.

[4 marks]

Test tube 1 _____

_____

_____

_____

Test tube 2 _____

_____

_____

_____

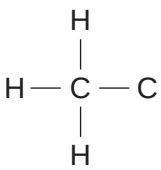
Question 5 continues on the next page

4.8.3.1 Flame tests

Question 10 · continued

5 (a) (ii) Complete the displayed structure of ethanoic acid.

[1 mark]



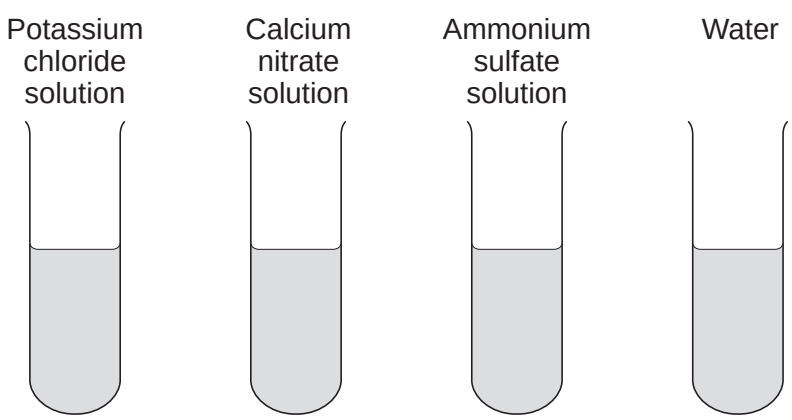
5 (a) (iii) Ethanoic acid is a carboxylic acid.
Complete the sentence.

[2 marks]

Carboxylic acids react with alcohols in the presence of an _____ catalyst to produce pleasant-smelling compounds called _____ .

5 (b) **Figure 8** shows four test tubes containing three different salt solutions and water.

Figure 8



Each solution and the water was tested with:

- silver nitrate in the presence of dilute nitric acid
- barium chloride in the presence of dilute hydrochloric acid.

4.8.3.1 Flame tests

Question 10 · continued

Complete the table of results.

[2 marks]

	Potassium chloride solution	Calcium nitrate solution	Ammonium sulfate solution	Water
Test with silver nitrate in the presence of dilute nitric acid			no change	no change
Test with barium chloride in the presence of dilute hydrochloric acid		no change	white precipitate	

5 (c) Flame tests can be used to identify metal ions.

5 (c) (i) Complete the following sentences.

[2 marks]

The flame colour for potassium ions is _____ .

The flame colour for calcium ions is _____ .

5 (c) (ii) Give **one** reason why a flame test would **not** show the presence of both potassium ions and calcium ions in a mixture.

[1 mark]

_____

_____

_____

12

4.8.3.1 Flame tests

Question 11

June 2018 | 8462/2F | Original Q8

0 8 This question is about chemicals in fireworks.

Coloured flames are produced because of the metal ions in the fireworks.

0 8 . 1 What colour flame would sodium ions produce?

[1 mark]

0 8 . 2 Name a metal ion that would produce a green flame.

[1 mark]

0 8 . 3 Some fireworks contain a mixture of metal ions.

Why is it difficult to identify the metal ions from the colour of the flame?

[1 mark]

4.8.3.1 Flame tests

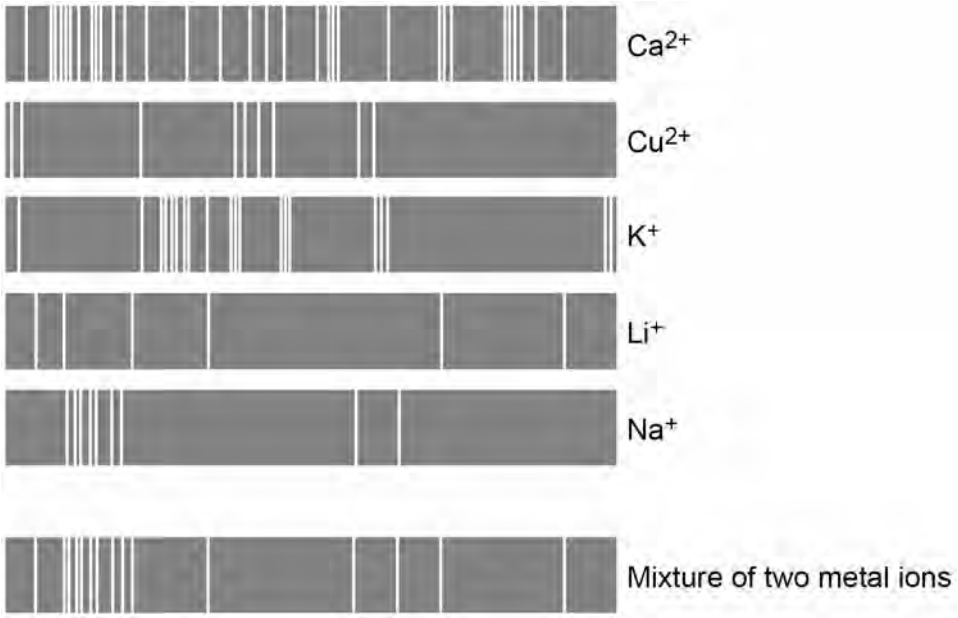
Question 11 · continued

0 8 . 4 Flame emission spectroscopy is used to identify metal ions in a firework.

Figure 8 shows:

- the flame emission spectra of five individual metal ions
- a flame emission spectrum for a mixture of two metal ions.

Figure 8



Which **two** metal ions are in the mixture?

[2 marks]

Tick **two** boxes.

Ca^{2+} ☐

Cu^{2+} ☐

K^+ ☐

Li^+ ☐

Na^+ ☐

Question 8 continues on the next page

4.8.3.1 Flame tests

Question 11 · continued

The compounds in fireworks also contain non-metal ions.

A scientist tests a solution of the chemicals used in a firework.

0 8 . 5 Silver nitrate solution and dilute nitric acid are added to the solution.

A cream precipitate forms.

Which ion is shown to be present by the cream precipitate?

[1 mark]

_____

0 8 . 6 Describe a test to show the presence of sulfate ions in the solution.

Give the result of the test if there are sulfate ions in the solution.

[3 marks]

Test _____

_____

_____

_____

Result _____

_____

4.8.3.1 Flame tests

Question 12

November 2020 | 8462/2F | Original Q8

0 8 This question is about chemical analysis.

A student tested copper sulfate solution and calcium iodide solution using flame tests.

This is the method used.

1. Dip a metal wire in copper sulfate solution.

2. Put the metal wire in a blue Bunsen burner flame.

3. Record the flame colour produced.

4. Repeat steps 1 to 3 using the same metal wire but using calcium iodide solution.

0 8 . 1 What flame colour is produced by copper sulfate solution?

[1 mark]

0 8 . 2 Calcium compounds produce an orange-red flame colour.

The student left out an important step before reusing the metal wire.

The student's method did **not** produce a distinct orange-red flame colour using calcium iodide solution.

Explain why.

[2 marks]

4.8.3.1 Flame tests

Question 12 · continued

0 8 . 3 The student added sodium hydroxide solution to:

- copper sulfate solution
- calcium iodide solution.

Give the results of the tests.

[2 marks]

Copper sulfate solution _____

_____

Calcium iodide solution _____

_____

0 8 . 4 To test for sulfate ions the student added dilute hydrochloric acid to copper sulfate solution.

Name the solution that would show the presence of sulfate ions when added to this mixture.

[1 mark]

_____

0 8 . 5 To test for iodide ions the student added dilute nitric acid to calcium iodide solution.

Name the solution that would show the presence of iodide ions when added to this mixture.

Give the result of the test.

[2 marks]

Solution _____

Result _____

_____

8

4.8.3.1 Flame tests

Question 13

June 2022 | 8462/2F | Original Q1

0 1 This question is about water.

A student investigated pure water.

The student measured:

- the boiling point of pure water
- the pH of pure water.

0 1 . 1 Complete the sentences.

Choose answers from the box.

[2 marks]

0	**4**	**7**	**10**	**25**	**100**

Pure water has a boiling point of _____ °C.

Pure water has a pH of _____.

0 1 . 2 What could the student use to measure the pH of pure water?

[1 mark]

_____

_____

4.8.3.1 Flame tests

Question 13 · continued

A different student investigated sea water.

Sea water contains dissolved solids.

This is the method used.

1. Measure a 50 cm^3 sample of the sea water.
2. Heat the sample until all the water has evaporated.
3. Measure the mass of solid that remains.
4. Repeat steps 1 to 3 three more times.

0 1 . 3 Which **two** pieces of equipment were needed in this investigation?

[2 marks]

Tick (✓) **two** boxes.

- Balance ☐
- Measuring cylinder ☐
- Ruler ☐
- Thermometer ☐
- Timer ☐

Question 1 continues on the next page

4.8.3.1 Flame tests

Question 13 · continued

0 1 . 4 **Table 1** shows the results.

Table 1

Sea water sample	Mass of solid that remained in grams
1	1.73
2	1.70
3	1.75
4	1.78

Calculate the mean mass of solid that remained.

[2 marks]

Mean mass = _____ g

0 1 . 5 A 50 cm^3 sample of sea water from a different source contained 1.50 g of dissolved solids.

Calculate the mass of dissolved solids in 1000 cm^3 of this sea water.

[2 marks]

Mass = _____ g

4.8.3.1 Flame tests

Question 13 · continued

Sodium chloride is a dissolved solid in sea water.

Sodium chloride contains sodium ions and chloride ions.

0 1 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

crimson	lilac	yellow

The student tested sea water for sodium ions using a flame test.

The colour of the flame was _____.

0 1 . 7 Complete the sentence.

Choose the answer from the box.

[1 mark]

brown	green	white

The student tested sea water for chloride ions by adding nitric acid and silver nitrate solution.

The colour of the precipitate formed was _____.

11

4.8.3.1 Flame tests

Question 14

June 2025 | 8462/2F | Original Q1

0 1 This question is about chemical analysis.

Some metal ions can be identified using a flame test.

0 1 . 1 Describe how to do a flame test using a metal wire and a Bunsen burner.

[2 marks]

0 1 . 2 Draw **one** line from each metal ion to the flame colour produced by the metal ion.

[2 marks]

Metal ion	Flame colour
	Crimson
	Green
Lithium	
	Lilac
Potassium	
	Orange-red
	Yellow

4.8.3.1 Flame tests

Question 14 · continued

0 1 . 3 Which gas is produced when carbonates are reacted with dilute acids?

[1 mark]

Tick (✓) **one** box.

Carbon dioxide ☐

Hydrogen ☐

Oxygen ☐

0 1 . 4 Which solution is used to test for sulfate ions?

[1 mark]

Tick (✓) **one** box.

Barium chloride solution ☐

Magnesium chloride solution ☐

Sodium chloride solution ☐

Precipitates are used to identify some ions.

0 1 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

gas	**liquid**	**solid**

A precipitate is a _____.

4.8.3.1 Flame tests

Question 14 · continued

0 1 . 6 Some metal ions in solution can be identified by adding sodium hydroxide solution.

Draw **one** line from each metal ion to the colour of the precipitate produced by the metal ion.

[2 marks]

Metal ion	Colour of precipitate
Copper(II)	Blue
	Brown
Magnesium	Green
	White
	Yellow

0 1 . 7 Dilute nitric acid and silver nitrate solution were added to a solution containing iodide ions.

Complete the sentence.

Choose the answer from the box.

[1 mark]

brown	**green**	**yellow**

The colour of the precipitate produced is _____.

10