

This question is about chemicals in fireworks.

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

1.1 What colour flame would sodium ions produce?

[1 mark]

1.2 Name a metal ion that would produce a green flame.

[1 mark]

1.3 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]

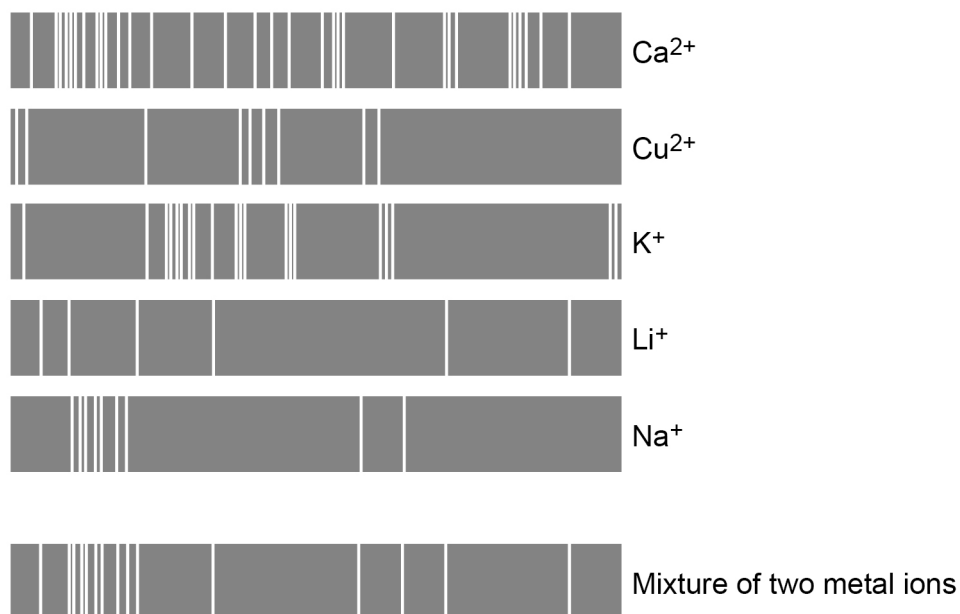
1.4

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

Figure 1 shows:

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

Figure 1



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

[2 marks]

Tick **two** boxes.

Ca²⁺

☐

Cu²⁺

☐

K⁺

☐

Li⁺

☐

Na⁺

☐

The compounds in fireworks also contain non-metal ions.

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

1.5 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]

1.6 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

2.1

Lithium carbonate contains lithium ions and carbonate ions.

A student tested the tablet for lithium ions and for carbonate ions.

The student used:

- a metal wire
- dilute hydrochloric acid
- limewater.

Plan an investigation to show the presence of lithium ions **and** of carbonate ions in the tablet.

You should include the results of the tests for the ions.

[6 marks]

0 7

A large amount of aluminium sulfate was accidentally added to the drinking water supply at a water treatment works.

[3.1 Describe a test to show that the drinking water contained aluminium ions.

Give the result of the test.

[3 marks]

Test _____

Result _____

[3.2 Describe a test to show that the drinking water contained sulfate ions.

Give the result of the test.

[2 marks]

Test _____

Result _____

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.

4.1 What flame colour is produced by copper sulfate solution?

[1 mark]

4.2 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]

4.3 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 _____

4.4 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]

4.5 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 _____

0 7

Potash alum is a chemical compound.

The formula of potash alum is $\text{KAl}(\text{SO}_4)_2$

[5.1

Give a test to identify the Group 1 metal ion in potash alum.

You should include the result of the test.

[2 marks]

Test _____

Result _____

[5.2

Name **one** instrumental method that could identify the Group 1 metal ion **and** show the concentration of the ion in a solution of potash alum.

[1 mark]

A student identifies the other metal ion in potash alum.

The student tests a solution of potash alum by adding sodium hydroxide solution until a change is seen.

[5.3

Give the result of this test.

[1 mark]

[5.4

This test gives the same result for several metal ions.

What additional step is needed so that the other metal ion in potash alum can be identified?

Give the result of this additional step.

[2 marks]

Additional step _____

Result _____

[5.5

Describe a test to identify the presence of sulfate ions in a solution of potash alum.

Give the result of the test.

[3 marks]

Test _____

Result _____

Copper sulfate is a compound of copper.

Copper sulfate solution contains copper(II) ions and sulfate ions.

- 6.1 A solution can be added to copper sulfate solution to show the presence of copper(II) ions.

Name the solution added.

Give the result of the test.

[2 marks]

Name of solution added _____

Result _____

- 6.2 Describe **one** test to show the presence of sulfate ions in copper sulfate solution.

Give the result of the test.

[2 marks]

Test _____

Result _____

This question is about chemical analysis.

Potassium bromide is used in medicine.

A scientist tested a sample of medicine to show the presence of potassium ions and of bromide ions.

The sample is soluble in water.

7.1

Plan a method the scientist could use to show that the sample of medicine contains potassium ions **and** bromide ions.

The scientist has:

- a Bunsen burner
- a metal wire
- test tubes
- a dropping pipette
- distilled water
- dilute nitric acid
- silver nitrate solution.

You should give the results of the tests.

[6 marks]

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The scientist could also use an instrumental method to show the presence of potassium ions in the medicine.

- 7.2 Which instrumental method could be used to show the presence of potassium ions in the medicine?

[1 mark]

- 7.3 Give **one** advantage of using this instrumental method instead of a chemical test.

[1 mark]

8.1 Describe a test to show the presence of copper(II) ions in a solution of copper(II) sulfate.

Give the result of the test.

[2 marks]

Test _____

Result _____
