



1.

This question is about chemicals in fireworks.

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

(a) What colour flame would sodium ions produce?

(1)

(b) Name a metal ion that would produce a green flame.

(1)

(c) Some fireworks contain a mixture of metal ions.

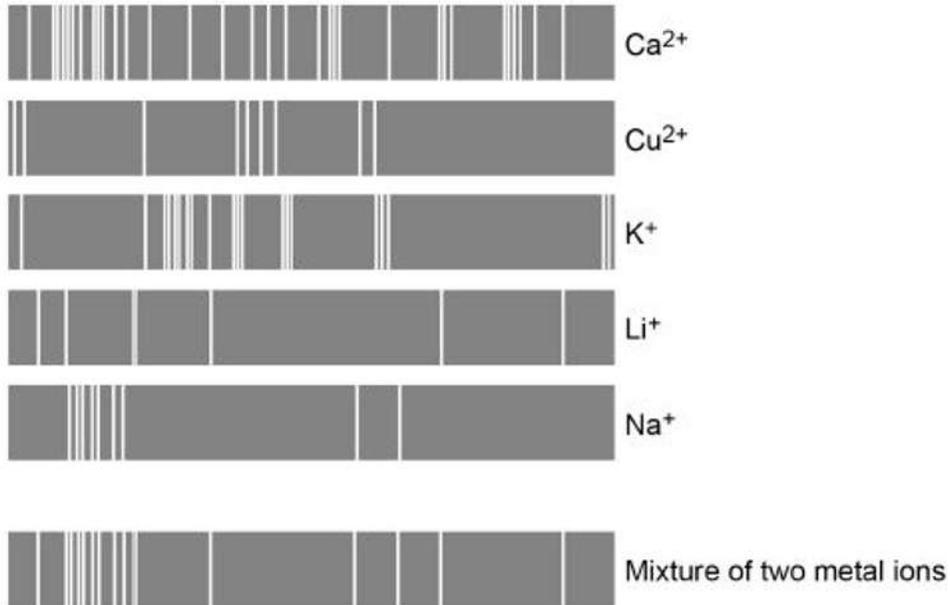
Why is it difficult to identify the metal ions from the colour of the flame?

(1)

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

The diagram below shows:

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



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



Tick **two** boxes.

Ca²⁺

Cu²⁺

K⁺

Li⁺

Na⁺

(2)

The compounds in fireworks also contain non-metal ions.

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

(e) 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)

(f) 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.

Test _____

Result _____

(3)

(Total 9 marks)



2.

Burgundy Mixture is a formulation used to kill fungi on grapevines.

It is made by mixing two compounds, **A** and **B**.

The ratio by mass of **A** : **B** in the mixture is 1 : 8

(a) Calculate the mass of **A** needed in a mixture containing 125 g of **B**.

Mass of **A** = _____ g

(2)

Scientists test a solution of compound **A**.

The table shows their results.

Test	Result
Add sodium hydroxide solution	Blue precipitate
Add dilute hydrochloric acid and barium chloride solution	White precipitate

(b) Which **two** ions are in compound **A**?

Choose the answers from the box.

bromide	chloride	copper
iron(II)	iron(III)	sulfate

_____ ions and _____ ions

(2)

(c) The scientists think that compound **B** is sodium carbonate.

Describe how the scientists can test a solution of **B** to see if sodium ions are present.

Give the result of the test if sodium ions are present.

(2)

(d) Describe how the scientists can test a solution of **B** to see if carbonate ions are present.

Give the result of the test if carbonate ions are present.



(3)

(Total 9 marks)

3.

This question is about chemical tests.

(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.

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

(2)



(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.

aluminium	magnesium	potassium
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The ions in the solution were ions of _____ .

(1)

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

A student used a flame test on low sodium salt.

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

(1)

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

(1)

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

(1)

(Total 6 marks)

4.

This question is about chemical analysis.



(a) A student has solutions of three compounds, **X**, **Y** and **Z**.

The student uses tests to identify the ions in the three compounds.

The student records the results of the tests in the table.

Compound	Test			
	Flame test	Add sodium hydroxide solution	Add hydrochloric acid and barium chloride solution	Add nitric acid and silver nitrate solution
X	no colour	green precipitate	white precipitate	no reaction
Y	yellow flame	no reaction	no reaction	yellow precipitate
Z	no colour	brown precipitate	no reaction	cream precipitate

Identify the **two** ions present in each compound, **X**, **Y** and **Z**.

X _____

Y _____

Z _____

(3)

5.

A student was investigating a magnesium salt, **X**.

The student found that **X**:

- has a high melting point
- does not conduct electricity
- dissolves in water and the solution conducts electricity.

(a) (i) What is the type of bonding in magnesium salt **X**?

(1)

(ii) Explain why solid **X** does **not** conduct electricity but a solution of **X** does conduct electricity.

(2)

(b) The student dissolved **X** in water.

The student added dilute nitric acid and silver nitrate solution to the solution of **X**.

A white precipitate was formed.

Salt **X** contains chloride ions.

Explain why a white precipitate was formed.

(2)





(c) The student dissolved **X** in water.

The student added a few drops of sodium hydroxide solution to the solution of **X**.

A white precipitate was formed.

(i) Salt **X** contains magnesium ions.

Name **two** other metal ions that would give a white precipitate when a few drops of sodium hydroxide solution are added.

1. _____

2. _____

(2)

(ii) Describe the **two** further tests the student would have to do to show that salt **X** contains magnesium ions, and **not** the two metal ions you identified in part (c) (i).

Give the expected results of each test.

(4)

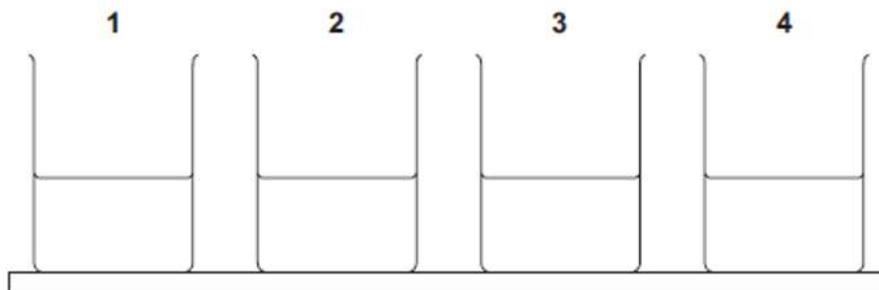
(Total 11 marks)

6.

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



A group of students had four different colourless solutions in beakers 1, 2, 3 and 4, shown in the figure below.



The students knew that the solutions were

- sodium chloride
- sodium iodide
- sodium carbonate
- potassium carbonate

but did **not** know which solution was in each beaker.

The teacher asked the class to plan a method that could be used to identify each solution.

She gave the students the following reagents to use:

- dilute nitric acid
- silver nitrate solution.

7.

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



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

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

Describe how to carry out a flame test.

(2)

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

The first one has been done for you.

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

(2)



- (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)

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

- (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)

- (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.

chloride

nitrate

sulfate

(1)

(Total 7 marks)

8.

Four bottles of chemicals made in the 1880s were found recently in a cupboard during a Health and Safety inspection at Lovell Laboratories.



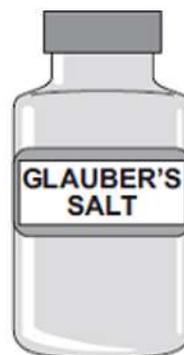
Sodium carbonate



Sodium chloride



Sodium nitrate



Sodium sulfate

The chemical names are shown below each bottle.

(a) You are provided with the following reagents:

- aluminium powder
- barium chloride solution acidified with dilute hydrochloric acid
- dilute hydrochloric acid
- silver nitrate solution acidified with dilute nitric acid
- sodium hydroxide solution.
- limewater
- red litmus paper



(i) Describe tests that you could use to show that these chemicals are correctly named.

In each case give the reagent(s) you would use **and** state the result.

Test and result for carbonate ions:

Test and result for chloride ions:

Test and result for nitrate ions:

Test and result for sulfate ions:

(4)

(ii) Suggest why a flame test would **not** distinguish between these four chemicals.

(1)

(b) Instrumental methods of analysis linked to computers can be used to identify chemicals.

Give **two** advantages of using instrumental methods of analysis.

(2)

(Total 7 marks)