

All questions are for separate science students only

Q1.

Potash alum is a chemical compound.

Potash alum contains potassium ions, aluminium ions and sulfate ions.

- (a) Which two methods can be used to identify the presence of potassium ions in potash alum solution?

Tick (✓) two boxes.

Flame emission spectroscopy

Flame test

Measuring boiling point of solution

Paper chromatography

Using litmus paper

(2)

- (b) Sodium hydroxide solution is used to test for some metal ions.

Sodium hydroxide solution is added to a solution of potash alum until a precipitate forms.

Complete the sentence.

Choose the answer from the box.

blue

brown

green

white

The colour of the precipitate formed is _____.

(1)

- (c) Complete the sentence.

Choose the answer from the box.

barium chloride
solution

limewater

red litmus paper

silver nitrate solution

Sulfate ions can be identified using dilute hydrochloric acid

and _____.

(1)

- (d) A solution of potash alum has a concentration of 258 g/dm³

Calculate the mass of potash alum needed to make 800 cm³ of a solution of potash alum with a concentration of 258 g/dm³

Give your answer to 3 significant figures.

Mass (3 significant figures) = _____ g

(4)

(Total 8 marks)

Q2.

Potash alum is a chemical compound.

The formula of potash alum is KAl(SO₄)₂

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

You should include the result of the test.

Test _____

Result _____

(2)

- (b) 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)

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.

(c) Give the result of this test.

(1)

(d) 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.

Additional step _____

Result _____

(2)

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

Give the result of the test.

Test _____

Result _____

(3)

(Total 9 marks)

Q3.

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.

(a) What flame colour is produced by copper sulfate solution?

(1)

(b) 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)

(c) The student added sodium hydroxide solution to:

- copper sulfate solution
- calcium iodide solution.

Give the results of the tests.

Copper sulfate solution -----

Calcium iodide solution -----

(2)

(d) 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)

- (e) 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.

Solution _____

Result _____

(2)
(Total 8 marks)

Q4.

This question is about drinking water.

There are two main steps in producing drinking water from fresh water.

- (a) Draw one line from each step to the reason for the step.

Step	Reason for step
	Desalination
Filtration	Improve taste
	Increase pH
Sterilisation	Kill bacteria
	Remove solids

(2)

- (b) Which two substances are used to sterilise fresh water?

Tick (✓) two boxes.

Ammonia

Chlorine

Hydrogen

Nitrogen

Ozone

(2)

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

- (c) Scientists tested a sample of the drinking water to show that it contained dissolved solids.

Which two methods show the presence of dissolved solids in the sample of drinking water?

Tick (✓) two boxes.

Add damp litmus paper to the sample.

Evaporate all water from the sample.

Measure the sample's boiling point.

Test the sample with a glowing splint.

(2)

- (d) Scientists tested two water samples from the drinking water supply.

The scientists tested one sample for aluminium ions and the other sample for sulfate ions.

Draw one line from each ion to the compound needed to identify the ion.

Ion	Compound needed to identify ion
Aluminium ion	Barium chloride
Sulfate ion	Copper sulfate
	Silver nitrate
	Sodium hydroxide
	Sulfuric acid

(2)

- (e) How could pure water be produced from drinking water that contained dissolved solids?

Tick (✓) one boxes.

- Chromatography
- Cracking
- Distillation
- Sedimentation

(1)

(Total 9 marks)

Q5.

This question is about lithium carbonate.

Lithium carbonate is used in medicines.

The figure shows a tablet containing lithium carbonate.

The substances in tablets are present in fixed amounts.

What name is given to mixtures like tablets?

(1)

(c) The tablet has a mass of 1.20 g and contains 700 mg of lithium carbonate.

Calculate the percentage by mass of lithium carbonate in this tablet.

Percentage by mass of lithium carbonate = _____%

(3)

(Total 10 marks)

Q6.

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

(a) Describe a test to show that the drinking water contained aluminium ions.

Give the result of the test.

Test _____

Result _____

(3)

(b) Describe a test to show that the drinking water contained sulfate ions.

Give the result of the test. Test

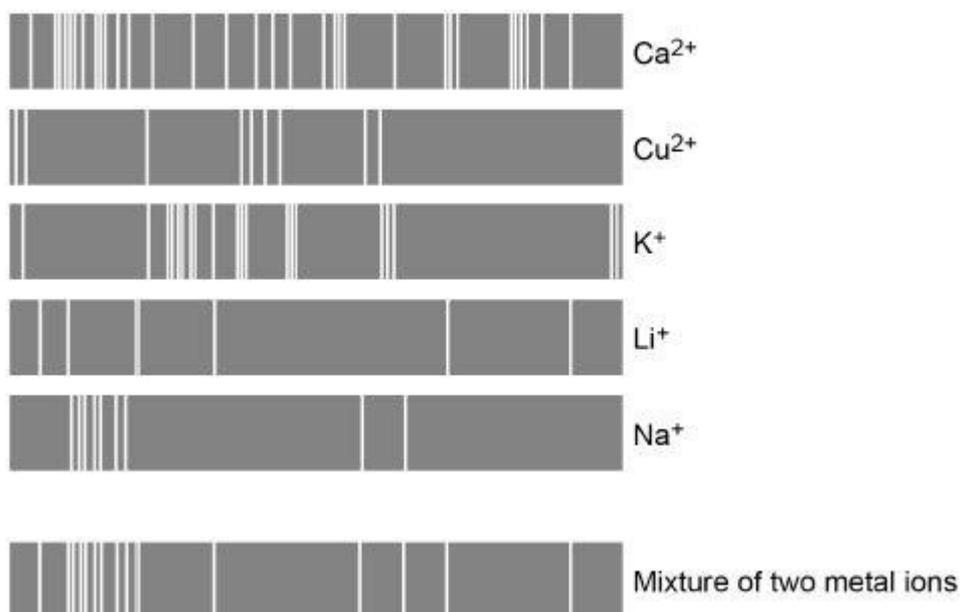
Result _____

(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.

Ca^{2+}	<input type="checkbox"/>
Cu^{2+}	<input type="checkbox"/>
K^{+}	<input type="checkbox"/>
Li^{+}	<input type="checkbox"/>
Na^{+}	<input type="checkbox"/>

(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)

Q8.

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 125g 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)

Q9.

This question is about mixtures and analysis.

- (a) Which two substances are mixtures?

Tick two boxes.

Air	<input type="checkbox"/>
Carbon dioxide	<input type="checkbox"/>
Graphite	<input type="checkbox"/>
Sodium Chloride	<input type="checkbox"/>
Steel	<input type="checkbox"/>

(2)

(b) Draw one line from each context to the correct meaning.

Context	Meaning
	A substance that has had nothing added to it
Pure substance in chemistry	A single element or a single compound
	A substance containing only atoms which have different numbers of protons
Pure substance in everyday life	A substance that can be separated by filtration
	A useful product made by mixing substances

(2)

(c) What is the test for chlorine gas?

Tick one box.

A glowing splint relights

A lighted splint gives a pop

Damp litmus paper turns white

Limewater turns milky

(1)

- (d) A student tested a metal chloride solution with sodium hydroxide solution.
A brown precipitate formed.

What was the metal ion in the metal chloride solution?

Tick one box.

Calcium

Copper(II)

Iron(II)

Iron(III)

(1)

(Total 6 marks)

Q10.

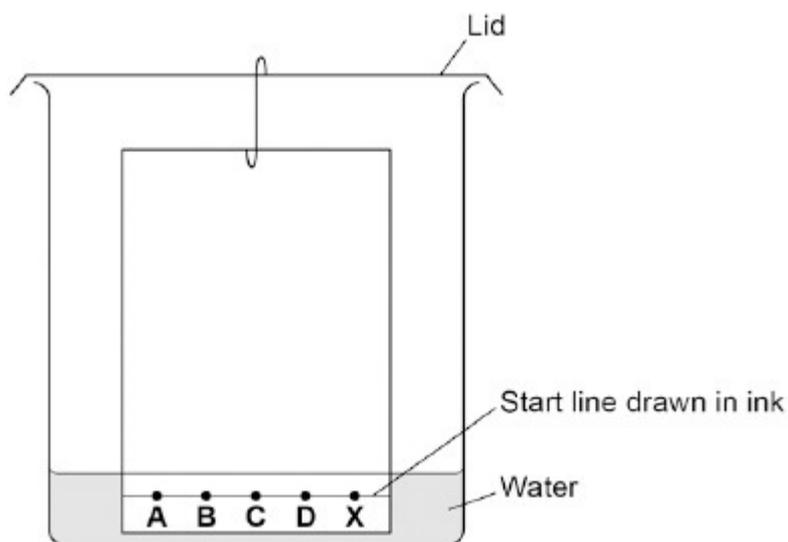
A student investigated food dyes using paper chromatography.

This is the method used.

1. Put a spot of food colouring X on the start line.
2. Put spots of four separate dyes, A, B, C and D, on the start line.
3. Place the bottom of the paper in water and leave it for several minutes.

Figure 1 shows the apparatus the student used.

Figure 1



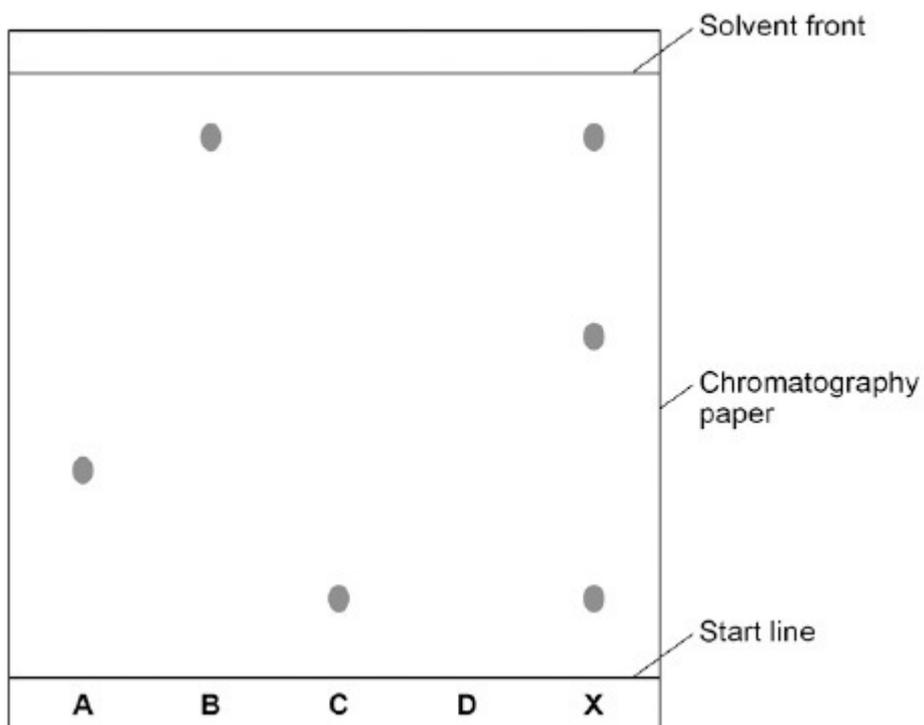
- (a) Write down two mistakes the student made in setting up the experiment and explain what problems one of the mistakes would cause.

(2)

- (b) Another student set up the apparatus correctly.

Figure 2 shows the student's results. The result for dye D is not shown.

Figure 2



Calculate the Rf value of dye A Give your answer to two significant figures.

Rf value = _____

(3)

- (c) Dye D has an Rf value of 0.80. Calculate the distance that dye D moved on the chromatography paper.

Distance moved by dye D = _____

(1)

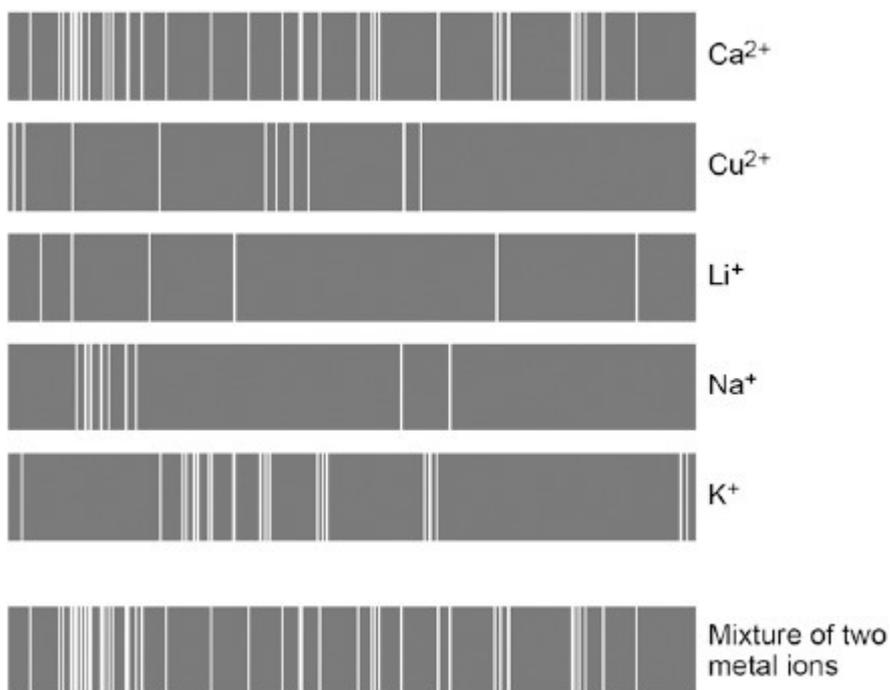
- (d) Explain how the different dyes in X are separated by paper chromatography.

(4)

- (e) Flame emission spectroscopy can be used to analyse metal ions in solution.

Figure 3 gives the flame emission spectra of five metal ions, and of a mixture of two metal ions.

Figure 3



Use the spectra to identify the two metal ions in the mixture.

(2)

- (f) Explain why a flame test could not be used to identify the two metal ions in the mixture.

(2)

- (g) Two students tested a green compound X. The students added water to compound X. Compound X did not dissolve.

The students then added a solution of ethanoic acid to compound X.

A gas was produced which turned limewater milky.

Student A concluded that compound X was sodium carbonate.

Student B concluded that compound X was copper chloride.

Which student, if any, was correct?

Explain your reasoning.

(4)

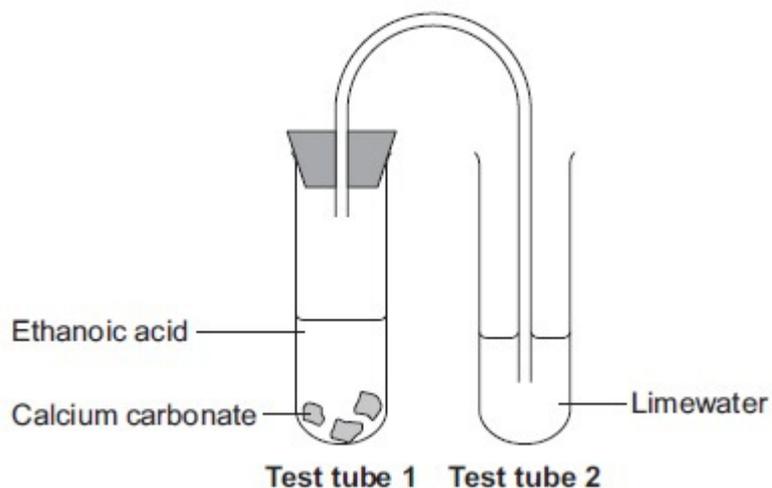
(Total 18 marks)

Q11.

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

- (a) Figure 1 shows the apparatus used to investigate the reaction of ethanoic acid with calcium carbonate.

Figure 1

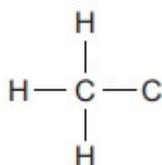


- (i) Describe a change that would be seen in each test tube. Give a reason for each change. Test tube 1

Test tube 2 -----

(4)

- (ii) Complete the displayed structure of ethanoic acid.



(1)

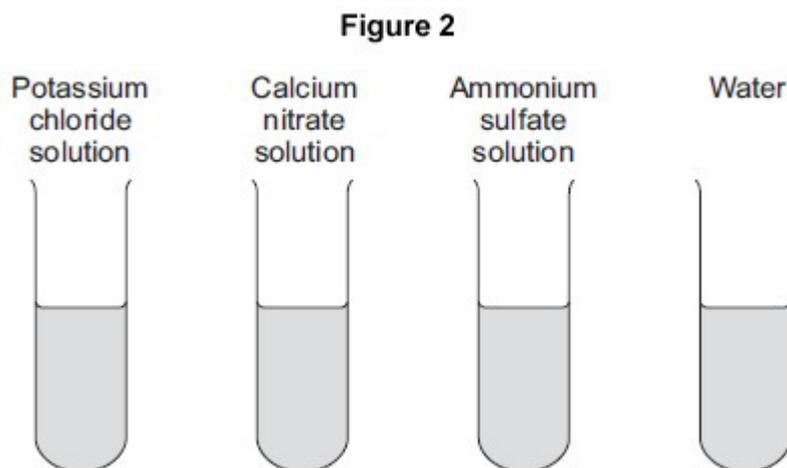
- (iii) Ethanoic acid is a carboxylic acid.
Complete the sentence.

Carboxylic acids react with alcohols in the presence of an

_____ catalyst to produce pleasant-smelling compounds called _____ .

(2)

- (b) Figure 2 shows four test tubes containing three different salt solutions and water.



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.

Complete the table of results.

	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	

(2)

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

- (i) Complete the following sentences.

The flame colour for potassium ions is _____ .

The flame colour for calcium ions is _____ .

(2)

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

(1)

(Total 12 marks)