



**Topic Test: OxfordAQA
International GCSE Combined
Science Chemistry 9204**

Chemical analysis

Name: _____

Class: _____

Date: _____

Time: **44 minutes**

Marks: **44 marks**

Comments:

1

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.

- (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
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- (i) Sodium ions give a _____ flame.

(1)

- (ii) Potassium ions give a _____ flame.

(1)

- (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)

(b) Draw a ring around the correct word to complete the sentences.

(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)

(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)

(Total 7 marks)

2

Chemical tests are used to identify compounds.

(a) What colour is produced by sodium compounds in flame tests?

(1)

(b) Chemical tests are carried out on these substances.

ammonium	copper bromide	magnesium sulphate
potassium nitrate	copper nitrate	zinc carbonate

Complete each sentence by choosing the correct substance from the box. You may use each substance once or not at all.

The substance which

- (i) reacts with dilute hydrochloric acid to produce carbon dioxide gas is

(1)

- (ii) in solution reacts with sodium hydroxide solution to form a blue precipitate is

(1)

- (iii) in solution reacts with barium chloride solution, in the presence of dilute hydrochloric acid, to form a white precipitate is

(1)

- (c) State what you **see** when sodium chloride solution reacts with silver nitrate solution in the presence of dilute nitric acid.

(1)

(Total 5 marks)

3

Chemical tests can be used to identify compounds.

- (a) List **A** gives the names of four compounds in solution. List **B** gives tests and the result of the tests.

Draw a straight line from each compound in List **A** to its test and test result in List **B**. The first one has been done for you.

List A Name of compound in solution	List B Test and result of the test
Calcium chloride	Add barium chloride solution and dilute hydrochloric acid. A white precipitate formed.
Lithium sulphate	Do the flame test. Yellow flame produced.
Potassium carbonate	Add silver nitrate solution and dilute nitric acid. A white precipitate formed.
Sodium nitrate	Add hydrochloric acid. Carbon dioxide gas given off.

(2)

- (b) State what you would **see** when sodium hydroxide solution reacts with copper sulphate solution.

(2)

(Total 4 marks)

4

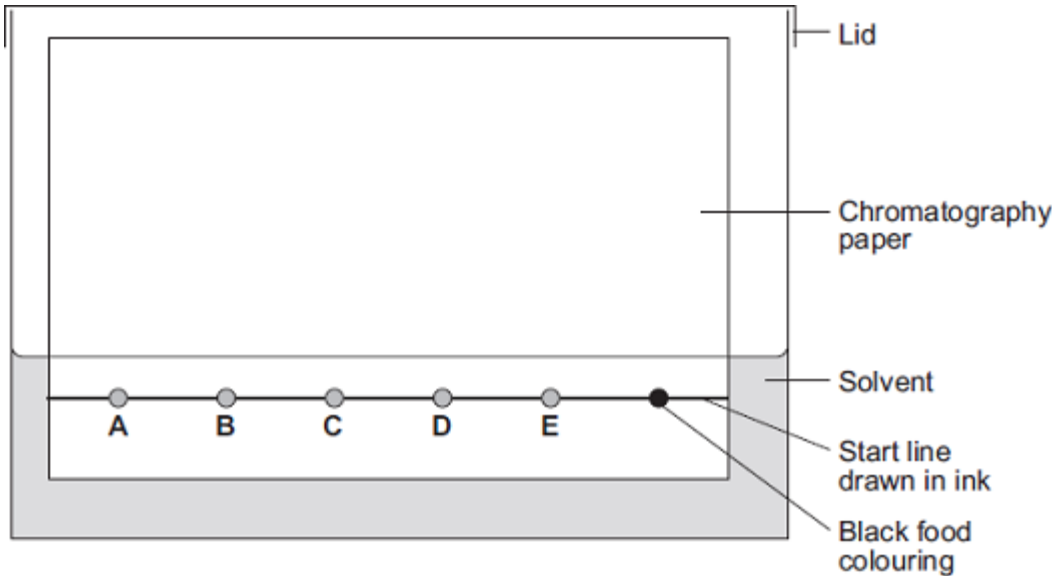
Chromatography can be used to separate components of a mixture.

(a) A student used paper chromatography to analyse a black food colouring.

The student placed spots of known food colours, **A**, **B**, **C**, **D** and **E**, and the black food colouring on a sheet of chromatography paper.

The student set up the apparatus as shown in **Diagram 1**.

Diagram 1



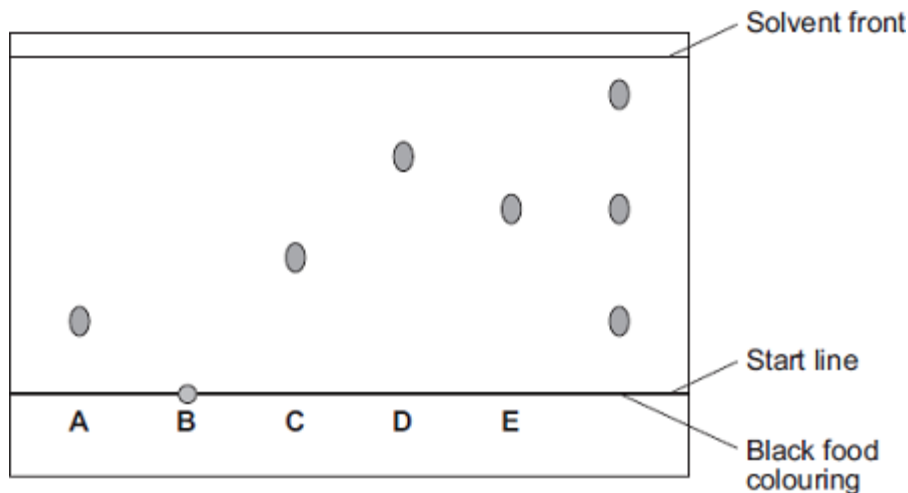
The student made **two** errors in setting up the apparatus. Identify the **two** errors and describe the problem each error would cause.

(4)

(b) A different student set up the apparatus without making any errors.

The chromatogram in **Diagram 2** shows the student's results.

Diagram 2



(i) What do the results tell you about the composition of the black food colouring?

(2)

(ii) Use **Diagram 2** to complete **Table 1**.

Table 1

	Distance in mm
Distance from start line to solvent front	_____
Distance moved by food colour C	_____

(2)

(iii) Use your answers in part **(b) (ii)** to calculate the R_f value for food colour **C**.

R_f value = _____

(1)

- (c) **Table 2** gives the results of chromatography experiments that were carried out on some known food colours, using the same solvent as the students.

Table 2

Name of food colour	Distance from start line to solvent front in mm	Distance moved by food colour in mm	R _f value
Ponceau 4R	62	59	0.95
Carmoisine	74	45	0.61
Fast red	67	27	0.40
Erythrosine	58	17	0.29

Which of the food colours in **Table 2** could be food colour **C** from the chromatogram?

Give the reason for your answer.

(2)

- (d) Two types of chromatography are gas chromatography and paper chromatography.

Give **one** advantage of gas chromatography compared with paper chromatography.

(1)

(Total 12 marks)

5

Chemical tests can be used to identify compounds.

The table shows the results of some tests carried out on three solutions, **A**, **B** and **C**.

Solution	Flame Test	Hydrochloric acid is added	Sodium hydroxide solution is added	Silver nitrate solution is added
A	Yellow	Carbon dioxide gas produced		
B	Brick-red		White precipitate insoluble in excess sodium hydroxide solution	White precipitate
C			Dark green precipitate	

Use the information in the table to identify solutions **A**, **B** and **C**.

Give the name of:

(a) solution **A**; _____

(2)

(b) solution **B**; _____

(2)

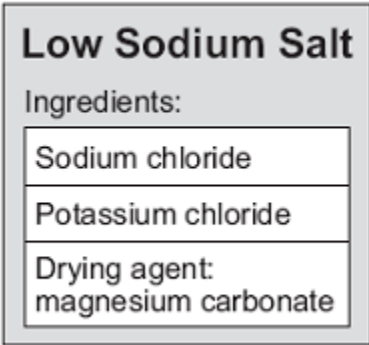
(c) the metal ion in solution **C**. _____

(1)

(Total 5 marks)

6

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



A student tests the low sodium salt for the substances on the label.

(a) (i) The same test can be used to identify sodium ions and potassium ions.

Describe the test.

Give the result of the test for sodium ions and for potassium ions.

(3)

(ii) It is difficult to identify potassium ions when sodium ions are present.

Suggest why.

(1)

(b) Describe how the student would test a solution of the low sodium salt for chloride ions.

Give the result of the test.

(3)

(c) To test for magnesium ions, the student adds a few drops of sodium hydroxide solution to a solution of the low sodium salt.

A white precipitate is produced.

This test also gives a white precipitate with aluminium ions and calcium ions.

(i) Describe how the student could confirm that the low sodium salt contains magnesium ions and **not** aluminium ions.

(2)

(ii) Describe a test the student could do to confirm that the low sodium salt does **not** contain calcium ions.

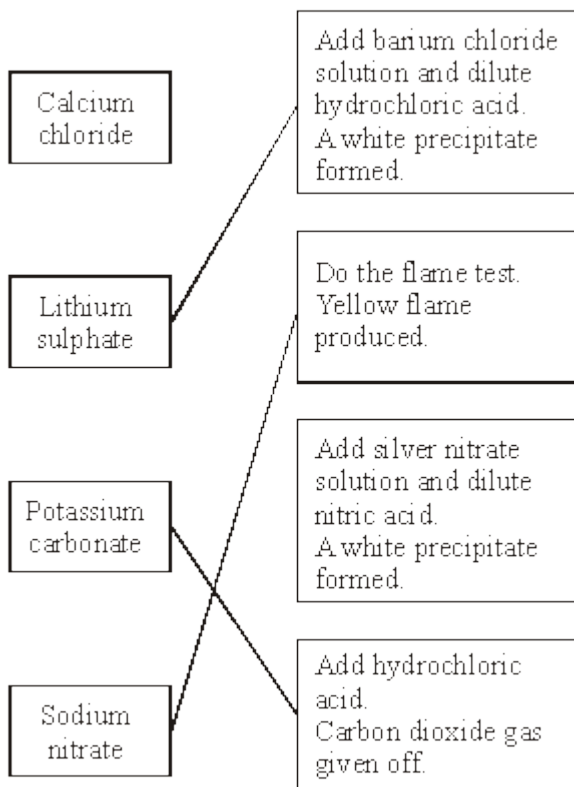
(2)

(Total 11 marks)

Mark schemes

1	(a) (i) yellow	1	
	(ii) lilac	1	
	(iii) melting point	1	
	(b) (i) barium chloride	1	
	solid	1	
	(ii) white	1	
	dissolved	1	[7]
2	(a) yellow / yellow orange orange	1	
	(b) (i) zinc carbonate	1	
	(ii) copper bromide	1	
	(iii) magnesium sulphate	1	
	(c) (white) <u>precipitate</u> / solid		
	<i>do not accept cloudy or milky</i>		
	<i>do not accept residue</i>		
	<i>green precipitate = 0</i>	1	[5]

3 (a)



all three correct = 2
one or two correct = 1

2

(b) blue

1

precipitate

solid

1

[4]

4 (a) start line drawn in ink

1

so it will run / dissolve in the solvent / split up

allow mixes with the spots

1

spots under solvent **or** solvent above spots / start line

1

so they will mix with solvent **or** wash off paper **or** colour the solvent **or** dissolve in the solvent

1

(b) (i) contains **A** and **E**

1

and one other (unknown substance)

if no other marks awarded, an answer saying it is made up of three colours gains 1 mark

1

(ii) 45 or 46

allow any value from 45 to 46

1

18

allow any value from 16 to 20

award 1 mark if numbers correct but in cm

1

(iii) 0.40

allow ecf from (b)(ii)

ignore units

1

(c) fast red

allow ecf from (b)(iii)

1

has same R_f value

allow none of them, as none has the same R_f value for 2 marks

1

(d) any **one** from:

- more accurate
- more sensitive
- uses small quantities of samples
- quicker / faster / more rapid
- can link to mass spectrometer (MS)

1

[12]

5

(a) sodium carbonate / sodium hydrogencarbonate / sodium bicarbonate

$Na_2CO_3 / NaHCO_3$

ie

sodium / sodium ions (1 mark)

carbonate / carbonate ions

(1 mark)

incorrect formula including Na and

$CO_3 = 1$ mark

2

(b) calcium chloride

$CaCl_2$

ie calcium / calcium ions (1 mark) chloride / chloride ions (1 mark)

incorrect formula including Ca and Cl = 1 mark

2

- (c) iron or iron(II) ions
Fe²⁺ ferrous ions
ignore anions
ignore nickel / chromium
do not accept iron(III) or ferric ions

1

[5]

6

- (a) (i) place sample in flame
accept flame test
accept any workable method
allow burn
ignore heat
- sodium: yellow (flame)
allow orange
- potassium: lilac (flame)
allow purple
- (ii) (lilac) colour (of potassium) obscured by (yellow) colour of sodium
allow difficult to see two colours
allow sodium colour is brighter
allow colours mix
- (b) acidify (with nitric acid)
*do **not** accept if acidified with anything other than nitric acid*
- add silver nitrate (solution)
- white precipitate
depends on second marking point
allow white solid
ignore silver chloride
ignore solution goes cloudy / milky
- (c) (i) add excess (sodium hydroxide)
allow add sodium hydroxide

1

1

1

1

1

1

1

1

aluminium (ions / hydroxide (re)dissolve

depends on first marking point

allow if aluminium, (white) precipitate / solid dissolves

allow magnesium (ions / hydroxide) do not (re)dissolve

1

(ii) place sample in flame

accept flame test

accept any workable method

allow burn

ignore heat

1

flame does not go red

accept calcium (ions / hydroxide would produce) red flame

allow magnesium (ions / hydroxide) (produce) no flame colour

1

[11]