



Topic Test: OxfordAQA
International GCSE Chemistry 9202
Chemical Analysis

Name: _____

Class: _____

Date: _____

Time: **44 minutes**

Marks: **44 marks**

Comments:

- 1 (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

A line connects the box containing 'lithium sulfate' to the box containing 'crimson'.

(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)

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

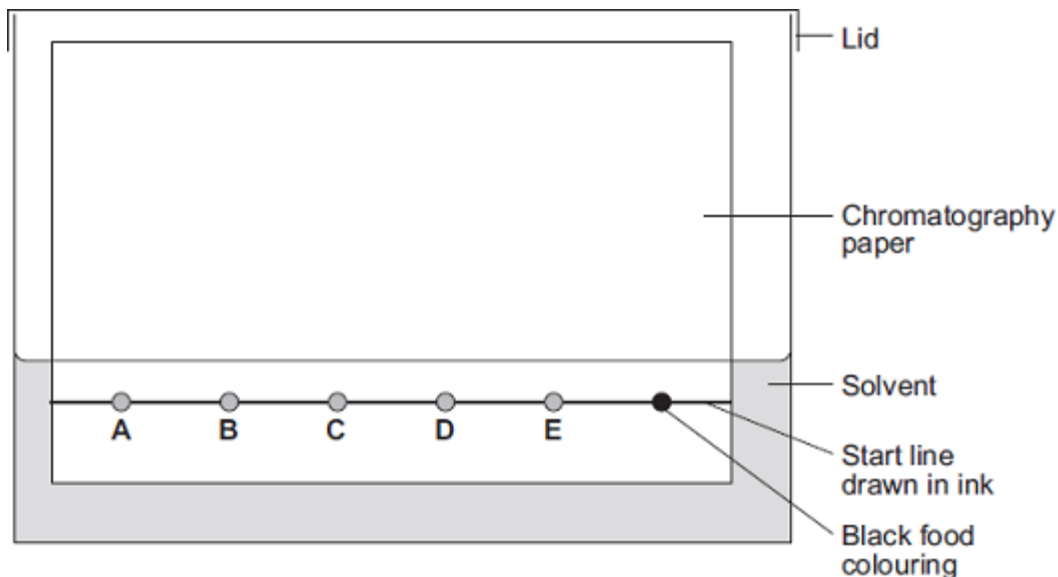
Chromatography can be used to separate components of a mixture.

(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.

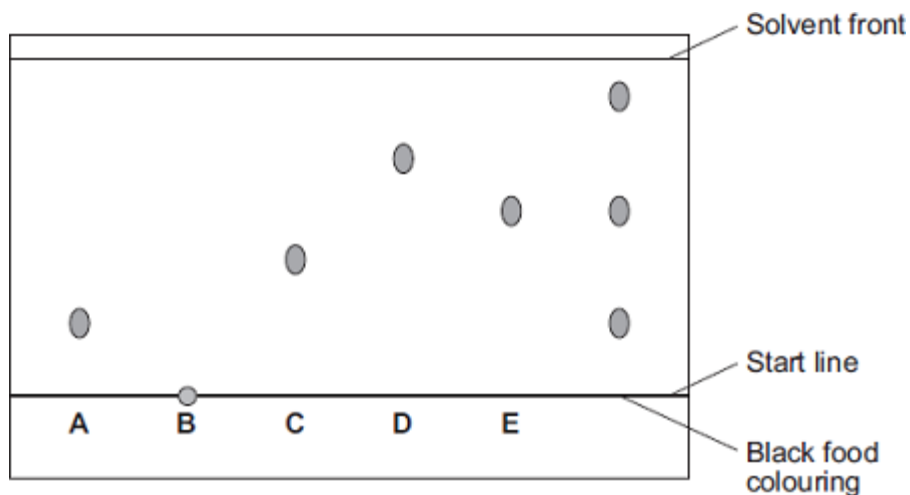
Identify the **two** errors and describe the problem each error would cause.

(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)

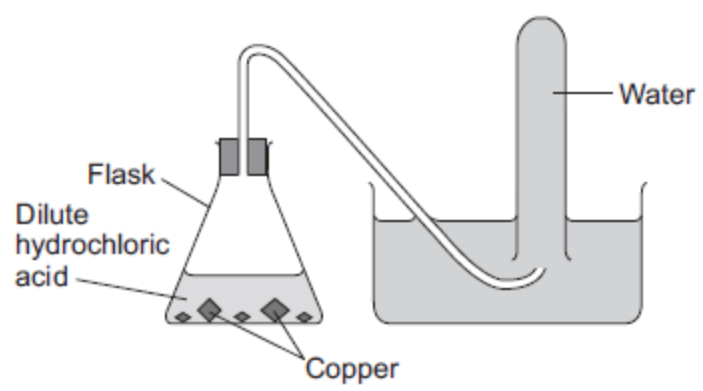
(Total 5 marks)

6

A student was trying to produce hydrogen gas.

Figure 1 shows the apparatus she used.

Figure 1



(a) No gas was produced.

The student's teacher said that this was because the substances in the flask did **not** react.

(i) Suggest why the substances in the flask did **not** react.

(1)

(ii) Which two substances could the student have put in the flask to produce hydrogen safely?

Tick (✓) **one** box.

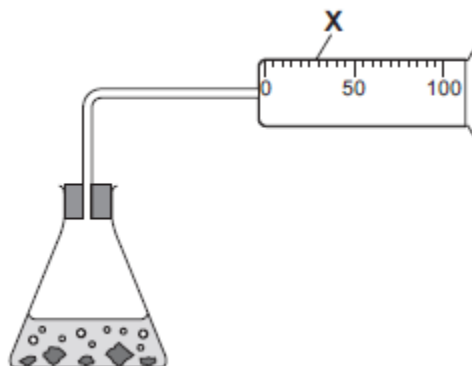
- Gold and dilute hydrochloric acid
- Potassium and dilute hydrochloric acid
- Zinc and dilute hydrochloric acid

(1)

- (b) Another student did produce hydrogen from two substances.

Figure 2 shows the apparatus the student used to collect and measure the volume of the hydrogen gas.

Figure 2



Give the name of the apparatus labelled **X**.

(1)

- (c) The student did the experiment four times. Her results are shown in the table below.

Experiment	Volume of hydrogen collected in one minute in cm^3
1	49
2	50
3	35
4	48

- (i) One of the results is anomalous.

Which result is anomalous? Write your answer in the box.

Give a reason for your choice.

(2)

(ii) Calculate the mean volume of hydrogen collected in one minute.

Mean volume = _____ cm³

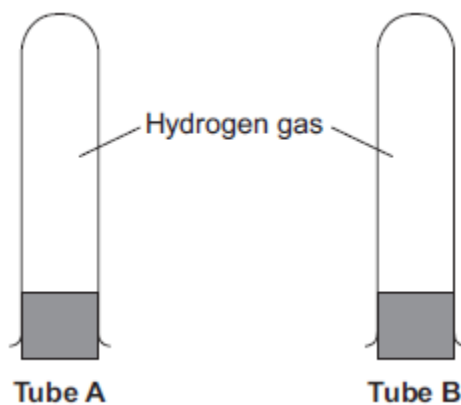
(2)

(iii) Give a reason why the experiment should be repeated several times.

(1)

(d) A teacher collected two tubes full of hydrogen gas, as shown in **Figure 3**.

Figure 3



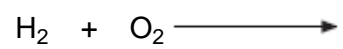
She tested tube **A** with a lighted splint as soon as she took the bung out.

She tested tube **B** with a lighted splint a few seconds after taking the bung out.

(i) Suggest why tube **B** gave a much louder pop than tube **A**.

(1)

- (ii) Complete and balance the chemical equation for the reaction that takes place when the hydrogen reacts in this test.



(2)

(Total 11 marks)

Mark schemes

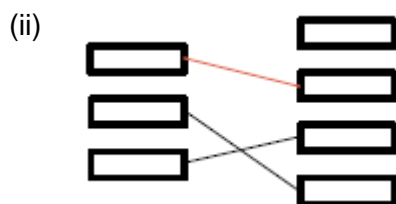
1

- (a) (i) *method of introducing sample into flame*
e.g. wire / splint / spray

1

clean wire or colourless flame
allow blue / roaring flame

1



1

1

- (iii) (potassium) chloride
allow KCl or Cl⁻

1

- (b) (i) copper
allow Cu²⁺

1

- (ii) sulfate

1

[7]

2

- (a) yellow / yellow orange orange

1

- (b) (i) zinc carbonate

1

- (ii) copper bromide

1

- (iii) magnesium sulphate

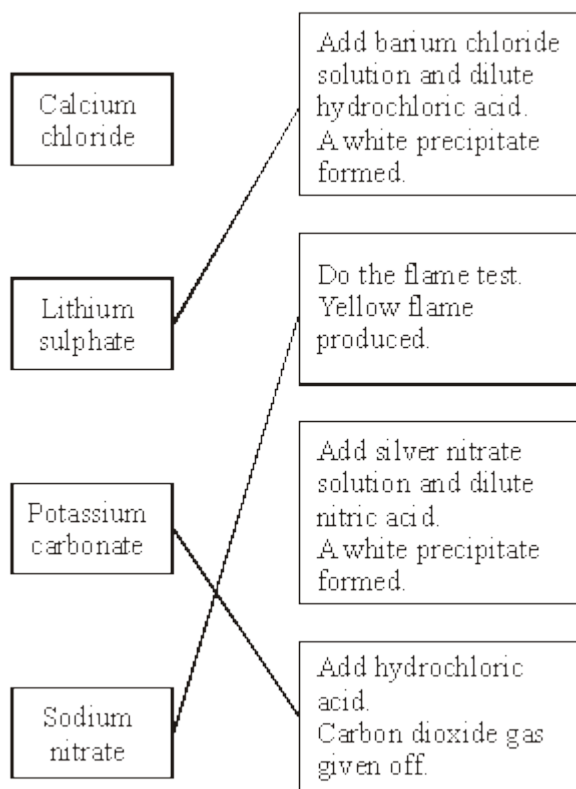
1

- (c) (white) precipitate / solid
do not accept cloudy or milky
do not accept residue
green precipitate = 0

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) copper is less reactive than hydrogen **or** copper is unreactive

1

(ii) Zinc and dilute hydrochloric acid

1

(b) (gas) syringe

1

(c) (i) 35

allow 3

1

because not close to others

*accept it is much lower than the others
ignore references to trends or patterns
dependent on the first mark*

1

(ii) $(49 + 50 + 48) / 3$

$= 49$

correct answer with or without working gains 2 marks

1

allow ecf from anomaly identified in (i) for 2 marks:

- Exp 1 anomalous gives 43.3*
- Exp. 2 anomalous gives 44*
- Exp. 4 anomalous gives 44.7*

answer of 45.5 or 46 (anomaly not excluded) gains 1 mark

*correct working **excluding anomaly** but with wrong answer gains 1 mark*

1

(iii) so that a mean can be calculated

*accept improves accuracy of the mean **or** so anomalies can be identified / discarded **or** to reduce effect of random errors
ignore makes it a fair test
ignore reliability, validity, repeatability, reproducibility*

1

(d) (i) idea of mixing with oxygen / air, letting air / oxygen in

accept converse

1

(ii) H₂O

do not accept incorrect additional products

1

balancing 2 ... (1) ... 2

allow fractions or multiples

dependent on first mark

1

[11]