



A student has four solutions labelled **A**, **B**, **C** and **D**.
Each solution contains one compound from the following list:



The student does some simple tests to identify the compounds present.
The table shows the tests and observations.

Solution	Colour	Add sodium hydroxide solution	Add dilute nitric acid and silver nitrate solution
A	colourless	pungent gas given off	white precipitate
B	blue	blue precipitate	no change
C	colourless	no change	no change
D	green	green precipitate	white precipitate

(a) (i) What is the pungent gas formed by solution **A**?

Ammonia / NH_3 (1)

(ii) Which ion must be present in **A** for the white precipitate to form?

chloride / Cl^- (1)

(iii) Which ion must be present in **B** for the blue precipitate to form?

Copper (II) / Cu^{2+} / copper (1)

(iv) Which ion must be present in **D** for the green precipitate to form?

Iron (II) / Fe^{2+} / ferrous (1)

(b) (i) Which compound in the list can be identified using barium chloride solution?

CuSO_4 / copper (II) sulphate (1)

(ii) State **one** compound in the list that can be identified using a flame test.
State the colour of the flame.

Compound { KNO_3 OR CuSO_4
Flame colour { lilac green (2)

(colour dependant on correct compound)

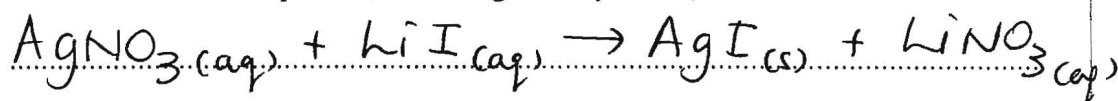


(c) Silver nitrate solution, $\text{AgNO}_3(\text{aq})$, is added to a solution of lithium iodide, LiI .

(i) Describe what is seen.

yellow precipitate
(ppt.)
(1)

(ii) Write the chemical equation, including state symbols, for the reaction.



1) reactants + states
(3)

2) product formula

3) product states

Q4

Leave blank

(2) (a) Sodium hydroxide reacts with both iron(II) chloride and with iron(III) chloride.

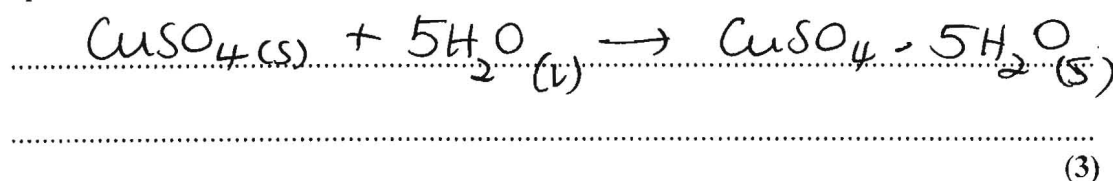
Describe how you could use sodium hydroxide solution to distinguish between solid samples of iron(II) chloride and iron(III) chloride. Give brief details of what you would do and what you would observe in each case.

- make chlorides into solution / add water
- green ppt
- brown ppt
- correct linking of at least one observation to a cation
(ie green ppt due to Fe^{2+}
OR brown ppt due to Fe^{3+}) (4)

Q7

(3) (a) When water is added to white anhydrous copper(II) sulphate, blue hydrated copper(II) sulphate is formed.

Write a chemical equation for the reaction that occurs. Include state symbols in the equation.



Q8



4

(a) A student carries out a test to show that a solution of hydrogen chloride contains chloride ions. First she adds dilute nitric acid.

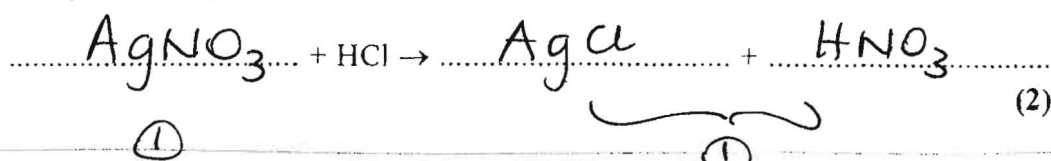
(i) Name the other solution she adds.

..... Silver nitrate (1)

(ii) Describe what she observes.

..... White precipitate
..... (ppt) (1)

(iii) Complete the equation to show the reaction that occurs.



Q5

5

(e) Describe simple tests that can be used to show that the solution produced in the reaction contains

(i) potassium ions

Test flame test / description of flame test
Result lilac (2)

(ii) sulphate ions

Test add dilute hydrochloric acid / HCl
..... and barium chloride / BaCl_2
Result white precipitate
..... (ppt) (3)

Q8

6

(a) A student added a piece of lithium to a trough of water. A piece of platinum wire is dipped into the solution formed and then held in a hot Bunsen flame.

(i) What colour does the flame become?

..... red (1)

(ii) What is the formula of the ion responsible for this colour?

..... Li^+ (1)



N 2 4 3 1 0 A 0 9 2 0

3

23

9

Turn over

7

Damp litmus paper is used to test for some gases.

Gas	Damp blue litmus paper	Damp red litmus paper
ammonia	stays blue	turns blue
carbon dioxide	turns red	stays red
chlorine	turns white	turns white
hydrogen	stays blue	stays red
sulphur dioxide	turns red	stays red

A student is given five gas jars, labelled **P, Q, R, S** and **T**, each containing one of the gases in the table above. Each gas was tested with damp litmus paper.

The student was told to use the information in the table above to write a conclusion. The results and conclusions are shown below.

Gas	Result	Conclusion
P	blue litmus turns red red litmus stays red	P must be carbon dioxide
Q	blue litmus turns white	Q has to be chlorine
R	blue litmus turns red red litmus stays red	R is sulphur dioxide
S	blue litmus stays blue red litmus turns blue	S can only be ammonia
T	blue litmus stays blue red litmus stays red	T must be hydrogen

(a) Identify **two** gases for which the conclusions are **definitely** correct.

any two { • Q / chlorine / Cl_2 • T / hydrogen / H_2
• S / ammonia / NH_3 (2)

(b) Identify **two** gases for which the conclusions are **possibly** correct.

• P / carbon dioxide / CO_2
• R / sulphur dioxide / SO_2 (2)

(Total 4 marks)

Q5

TOTAL FOR PAPER: 50 MARKS

END





The ions present in ionic compounds can be identified using simple tests.

The first table shows the flame test colours for three cations.

Cation	Flame test colour
lithium	red
sodium	yellow-orange
strontium	red

The next table shows three tests that may be used to identify anions in solution.

Anion	Result of tests when		
	nitric acid is added	magnesium sulphate solution is added	universal indicator is added
carbonate	effervescence	precipitate forms	blue
hydrogencarbonate	effervescence	no precipitate forms	dark green
hydrogensulphate	no effervescence	no precipitate forms	red
hydroxide	no effervescence	precipitate forms	blue
sulphate	no effervescence	no precipitate forms	green

Two ionic compounds, **P** and **Q**, are known to contain only anions and cations listed in the tables. They were analysed using some of the tests in the tables.

- (a) Compound **P** gave a yellow-orange flame test and produced effervescence when nitric acid was added.

Suggest **two** possible identities for compound **P**.

1 Sodium carbonate

2 Sodium hydrogen carbonate

(3)



(b) Compound **Q** gave a red flame test and caused universal indicator to turn blue.
A student concluded that compound **Q** was strontium hydroxide.

(i) Give **two** reasons why we cannot be certain this conclusion is correct.

1 Both Li and Sr give red flames

2 Both carbonate and hydroxide
turn UI blue

(2)

(ii) Using the information in the tables, give one further test that could be done to show that compound **Q** is a hydroxide. Give the expected result of the test.

Add (nitric) acid - does NOT fizz

(1)

Q4

(Total 6 marks)

9

(iv) Describe a test, and its result, to show that solution **P** contains chloride ions.

Test Add silver nitrate / AgNO_3 (solution)
and (dilute) nitric acid / HNO_3

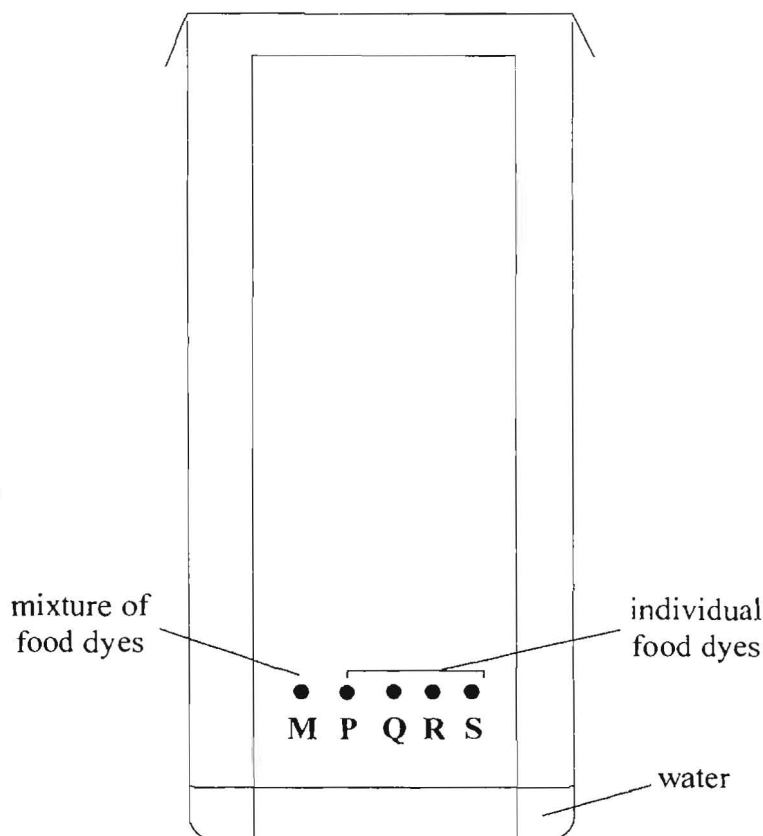
Result white precipitate

(3)

Q9



- 10 Paper chromatography can be used to separate a mixture of food dyes (**M**), and to identify the dyes by comparison. The diagram shows the apparatus used.



- (a) The food dyes are placed on the paper about 2 cm up from the bottom edge. Why is it important **not** to place them at the bottom of the paper?

They would dissolve (in the water)

(1)

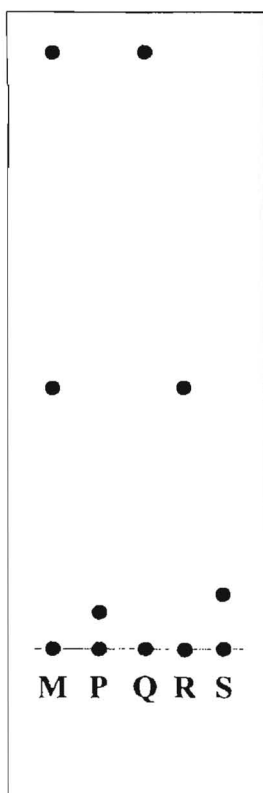
- (b) State **two** observations you would make during the experiment.

1 Water rises up paper

2 Colours separate / new colours appear /
dyes move up paper

(2)

- (c) At the end of the experiment the paper is removed and dried. The diagram shows the paper.



- (i) Measure the distance moved by food dye **R** during the experiment.

3.5 cm

(1)

- (ii) Which of the food dyes **P**, **Q**, **R** and **S** are present in **M**?

Q and R

(1)

- (iii) Food dyes **P** and **S** moved very little. Suggest **one** change you could make to this experiment to help them move further.

use another liquid / organic solvent /

use longer paper

(1)

(Total 6 marks)

Q2

