

3.1.4 Qualitative Analysis

3. Barium chloride, BaCl_2 , is soluble in water.

i. Compare the electrical conductivities of solid and aqueous barium chloride.

Explain your answer in terms of the particles involved.

[2]

ii. Describe the use of aqueous barium chloride in qualitative analysis.

[2]

iii. Hydrated barium chloride can be crystallised from solution.

Hydrated barium chloride has the formula $\text{BaCl}_2 \cdot x\text{H}_2\text{O}$ and a molar mass of 244.3 g mol^{-1} .

Determine the value of x in the formula of $\text{BaCl}_2 \cdot x\text{H}_2\text{O}$.

Show your working.

$x = \dots\dots\dots$ [2]

3.1.4 Qualitative Analysis

4. Precipitation reactions can be used to distinguish between halide ions.

i. State the reagent needed for these precipitation reactions.

[1]

ii. How would the appearance of the precipitates allow you to distinguish between chloride, bromide and iodide ions?

Chloride
.....

Bromide
.....

Iodide
.....

[1]

5. i. Complete the electron configuration of a bromide ion.

1s²
.....

[1]

ii. A student adds a small volume of aqueous silver nitrate to an aqueous solution of bromide ions in a test-tube. The student then adds a similar volume of dilute aqueous ammonia to the same test-tube.

Describe what the student would see in the test-tube after the addition of aqueous ammonia.

[1]

iii. Write an ionic equation for any precipitation reaction which occurs in the student's tests.

Include state symbols.

[1]

3.1.4 Qualitative Analysis

6. A student carries out the following experiment to investigate the reaction between hexane and chlorine. The chlorine is made by reaction of aqueous sodium chlorate(I) with dilute hydrochloric acid.

Procedure	Observations
1 cm ³ of hexane is mixed with 1 cm ³ dilute aqueous sodium chlorate(I) in a test-tube.	The mixture forms two colourless layers.
1 cm ³ dilute hydrochloric acid is slowly added to the mixture.	The acid mixes with the lower layer, which turns a pale green colour.
The tube is then stoppered and shaken.	The pale green colour moves to the upper layer, leaving the lower layer colourless.
The tube is placed under a bright light and shaken at regular intervals for about 10 minutes. The stopper is loosened regularly to release any pressure.	The pale green colour slowly disappears leaving two colourless layers after about 10 minutes.

- i. The reaction between aqueous sodium chlorate(I) and dilute hydrochloric acid produces aqueous sodium chloride as well as chlorine.

Suggest an equation for this reaction.

----- [2]

- ii. Outline a simple practical test that would confirm the presence of chloride ions in the lower layer, and give the expected result.

test:

result:

----- [2]

- iii. Name the apparatus that could be used to separate the two liquid layers present at the end of the experiment.

----- [1]

3.1.4 Qualitative Analysis

7. Haloalkanes can undergo hydrolysis.

A student carries out an experiment to find the relative rate of hydrolysis of 1-chloropropane, C_3H_7Cl , 1-bromopropane, C_3H_7Br , and 1-iodopropane, C_3H_7I .

The student adds 2 cm^3 of ethanol to 2 cm^3 of aqueous silver nitrate to three test tubes labelled **A**, **B** and **C**.

The student adds 5 drops of a different haloalkane to each test-tube in rapid succession and shakes each tube. The student measures the time for a precipitate to form in each test-tube.

The results are shown below.

Test tube	Haloalkane	Time taken for reaction to take place
A	C_3H_7Cl	about half an hour
B	C_3H_7Br	a few minutes
C	C_3H_7I	a few seconds

- i. Write an **ionic** equation involving aqueous silver nitrate for formation of **one** of the precipitates.

[1]

- ii. What do the experimental results tell you about the carbon–halogen bond enthalpies?

[1]

- iii. How could the student modify their experiment so that it could be completed in less time?

[1]

END OF QUESTION PAPER