

4: Acid, bases and salts – Topic questions

Paper 6

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
2	2016	June	61
3	2016	June	61
3	2016	March	62

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

- 2 A student investigated the reaction between aqueous sodium carbonate and two different solutions of dilute hydrochloric acid, **A** and **B**.
The reaction is:



Three experiments were carried out.

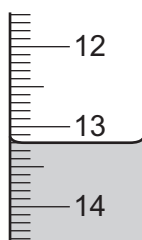
(a) Experiment 1

Using a measuring cylinder, 25 cm³ of aqueous sodium carbonate were poured into a conical flask.

Thymolphthalein indicator was added to the conical flask.

A burette was filled up to the 0.0 cm³ mark with solution **A** of dilute hydrochloric acid. **A** was added to the flask, until the solution just changed colour.

Use the burette diagram to record the reading in the table.



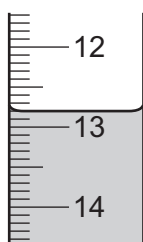
final reading

Experiment 2

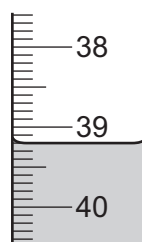
Experiment 1 was repeated using methyl orange indicator instead of thymolphthalein.

Methyl orange is red-orange in acidic solutions and yellow in alkaline solutions.

Use the burette diagrams to record the readings in the table and complete the table.



initial reading



final reading

	experiment 1	experiment 2
final burette reading / cm ³		
initial burette reading / cm ³		
difference / cm ³		

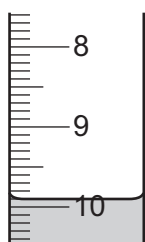
[4]

- (b) What colour change was observed in the flask in experiment 2?
from to [1]

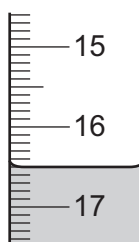
(c) *Experiment 3*

Experiment 1 was repeated using solution **B** of acid instead of solution **A**.

Use the burette diagrams to record the readings in the table and complete the table.



initial reading



final reading

	experiment 3
final burette reading / cm ³	
initial burette reading / cm ³	
difference / cm ³	

[2]

- (d) Suggest **one** observation, other than colour change, that is made when hydrochloric acid is added to sodium carbonate.

..... [1]

- (e) Complete the sentence below.

Experiment needed the largest volume of hydrochloric acid to change the colour of the indicator. [1]

- (f) What would be a more accurate method of measuring the volume of the aqueous sodium carbonate?

..... [1]

- (g) What would be the effect on the results, if any, if the solutions of sodium carbonate were warmed before adding the hydrochloric acid? Give a reason for your answer.

effect on results

reason [2]

- (h) (i) Determine the ratio of volumes of dilute hydrochloric acid used in experiments 1 and 3.

..... [1]

- (ii) Use your answer to (h)(i) to deduce how the concentration of solution **A** differs from that of solution **B**.

..... [1]

- (i) Suggest a **different** method, using standard laboratory chemicals, to determine which of the solutions of dilute hydrochloric acid, **A** or **B**, is more concentrated.

.....

.....

.....

.....

..... [3]

[Total: 17]

- 3 Two substances, **C** and **D**, were analysed. Solid **C** was a salt and solution **D** was an aqueous solution of chromium(III) chloride.
The tests on solid **C**, and some of the observations, are in the following table.

tests	observations
<u>tests on solid C</u> Solid C was added to distilled water in a test-tube and shaken to dissolve. The solution was divided into two portions in test-tubes, and the following tests carried out. Appearance of the solution. The pH of the first portion of the solution was tested.	colourless liquid pH = 7
Dilute nitric acid was added to the second portion of the solution followed by aqueous silver nitrate.	cream precipitate
A flame test was carried out on solid C .	yellow flame colour

- (a) Identify solid **C**.

..... [2]

- (b) Describe the appearance of solution **D**.

..... [1]

- (c) Tests were carried out on solution **D**.

Complete the observations for tests 1, 2 and 3.

- (i) test 1

Drops of aqueous sodium hydroxide were added to solution **D**.

Excess aqueous sodium hydroxide was then added to the mixture.

observations

..... [3]

(ii) test 2

Excess aqueous ammonia was added to solution **D**.

observations [2]

(iii) test 3

Dilute nitric acid was added to solution **D** followed by aqueous silver nitrate.

observations [1]

(d) Chromium(III) can be converted to chromium(VI). Chromium(VI) is hazardous.

Suggest **one** safety precaution when using chromium(VI).

..... [1]

[Total: 10]

- 3** Two solids, **L** and **M**, were analysed. Solid **L** was copper(II) chloride and solid **M** was a different salt.
The tests on the solids, and some of the observations, are shown.

tests on solid L

- (a)** Describe the appearance of solid **L**.

observation [1]

- (b)** Distilled water was added to solid **L** and shaken to dissolve.

The solution was divided into four equal portions in four test-tubes and the following tests carried out.

- (i)** Drops of aqueous ammonia were added to the first portion of the solution.

Excess ammonia solution was then added to the mixture and shaken.

observation
.....
.....
..... [4]

- (ii)** Excess aqueous sodium hydroxide was added to the second portion of the solution.

observation
..... [1]

- (iii)** Dilute nitric acid was added to the third portion of the solution followed by aqueous silver nitrate.

observation [1]

- (iv)** Dilute nitric acid was added to the fourth portion of the solution followed by aqueous barium nitrate.

observation [1]

tests on solid M

Tests are carried out and the following observations made.

tests on solid M	observations
Appearance of the solid.	white crystals
The solid was heated and the gas given off was tested with damp red litmus paper.	a sublimate formed on the sides of the test-tube litmus paper turned blue
Solid M was dissolved in water to form a solution. Aqueous sodium hydroxide was added to the solution and the mixture heated. The gas given off was tested.	pungent gas evolved pH paper showed pH 10
Dilute nitric acid was added to the solution followed by aqueous silver nitrate.	yellow precipitate

(c) Identify solid M.

.....
..... [2]

[Total: 10]

Question	Answer	Mark
2 (a)	final readings completed correctly: 13.2, 39.2; initial readings completed correctly: 0.0, 12.8; differences completed correctly: 13.2, 26.4; all readings and differences to 1 decimal place;	1 1 1 1
2 (b)	<u>yellow</u> to orange/red/pink	1
2 (c)	initial and final readings complete correctly: 9.9, 16.5 difference completed correctly: 6.6	1 1
2 (d)	bubbles/fizzing/effervescence	1
2 (e)	Experiment <u>2</u>	1
2 (f)	use a pipette/burette	1
2 (g)	effect on results: none owtte reason: no change in concentration owtte	1 1
2 (h) (i)	2:1	1
2 (h) (ii)	acid B is double the concentration of acid A ora acid B is more concentrated ora	1
2 (i)	any suitable correct and different method M1 method M2 reagents M3 result	1 1 1
		Total: 17
3 (a)	sodium bromide	1 1
3 (b)	green	1
3 (c) (i)	green precipitate with excess, green solution/clear/dissolves	1 1 1
3 (c) (ii)	grey-green precipitate	1 1
3 (c) (iii)	white precipitate	1
3 (d)	fume cupboard/protective clothing, e.g. gloves or goggles	1
		Total: 10

Question	Answer	Mark
3 (a)	white (solid/crystals/powder)	1
3 (b) (i)	no change	1
3 (b) (ii)	turns from purple/pink	1
	to colourless/white	1
3 (c)	yellow/orange (flame)	1
3 (d)	ammonia/ NH_3	1
3 (e)	ammonium/ NH_4^+	1
		Total: 7