Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5737023586

CHEMISTRY **5070/42**

Paper 4 Alternative to Practical **May/June 2019**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Write your answers in the spaces provided in the Question Paper.
Electronic calculators may be used.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **12** printed pages.

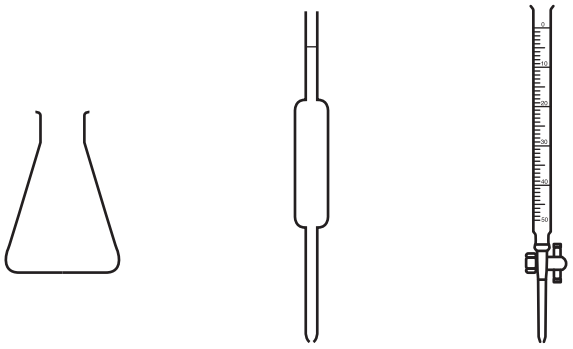
Cambridge Assessment International Education

1 Milk of Magnesia is a liquid medicine used to treat indigestion.

Milk of Magnesia contains magnesium hydroxide, $Mg(OH)_2$.

A student does a series of titrations to determine the percentage by mass of magnesium hydroxide in Milk of Magnesia.

Diagrams of some of the apparatus used by the student are shown.



A **B** **C**

(a) Name the three pieces of apparatus.

A .....

B .....

C .....

[3]

(b) The student:

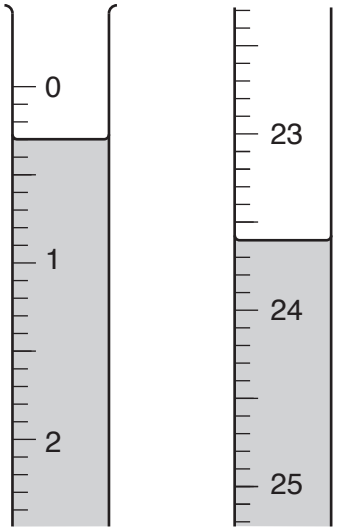
- puts 5.0 cm^3 of the Milk of Magnesia into apparatus **A** and adds some distilled water
- adds a few drops of a suitable indicator to the mixture in apparatus **A**
- fills apparatus **C** with 0.600 mol / dm^3 hydrochloric acid
- titrates the contents of apparatus **A** with the 0.600 mol / dm^3 hydrochloric acid until the indicator changes colour
- records the readings.

The student repeats the procedure three further times.

(i) The diagrams show parts of apparatus **C** with the liquid levels at the beginning and the end of titration 3.

titration 3

initial reading final reading



Record the values in the results table.

Complete the results table for each of titrations 1, 3 and 4.

titration number	1	2	3	4
final reading / cm^3	24.1	47.5		24.4
initial reading / cm^3	0.0	23.7		
volume of 0.600 mol / dm^3 hydrochloric acid used / cm^3		23.8		23.6
best titration results (✓)				

[3]

(ii) Tick (✓) the best titration results in the table.
Use these best titration results to calculate the average volume of 0.600 mol / dm^3 hydrochloric acid used.

average volume .....cm^3 [1]

(iii) Suggest why the volume of distilled water the student adds to apparatus **A** does not affect the results of the titrations.

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.....

..... [1]

(c) A second student does another series of titrations using the same method. This student obtains an average volume of 23.3 cm^3.

The equation for the reaction during the titration is shown.

$$Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$$

(i) Calculate the number of moles of 0.600 mol/dm^3 hydrochloric acid used by this second student.

..... moles [1]

(ii) Calculate the number of moles of magnesium hydroxide present in 5.0 cm^3 of the Milk of Magnesia.

..... moles [1]

(iii) Calculate the mass of magnesium hydroxide in 5.0 cm^3 of the Milk of Magnesia.
[A_r: Mg, 24; O, 16; H, 1]

.....g [2]

(iv) The density of the Milk of Magnesia is 2.34 g/cm^3.

$$\text{density in g/cm}^3 = \frac{\text{mass in g}}{\text{volume in cm}^3}$$

Calculate the mass of 5.0 cm^3 of the Milk of Magnesia.

.....g [1]

(v) Calculate the percentage by mass of magnesium hydroxide in the Milk of Magnesia.

.....% [1]

[Total: 14]

2 E150a and E150a and E155 are both brown food colourings.

Plan an investigation to find whether the brown food colouring in a soft drink is E150a or E155. The food colourings are both soluble in water.

You are provided with solutions of E150a, E155 and the brown food colouring from the soft drink. You also have access to the apparatus normally found in a chemistry laboratory.

You should draw a labelled diagram with your plan and include essential practical details.

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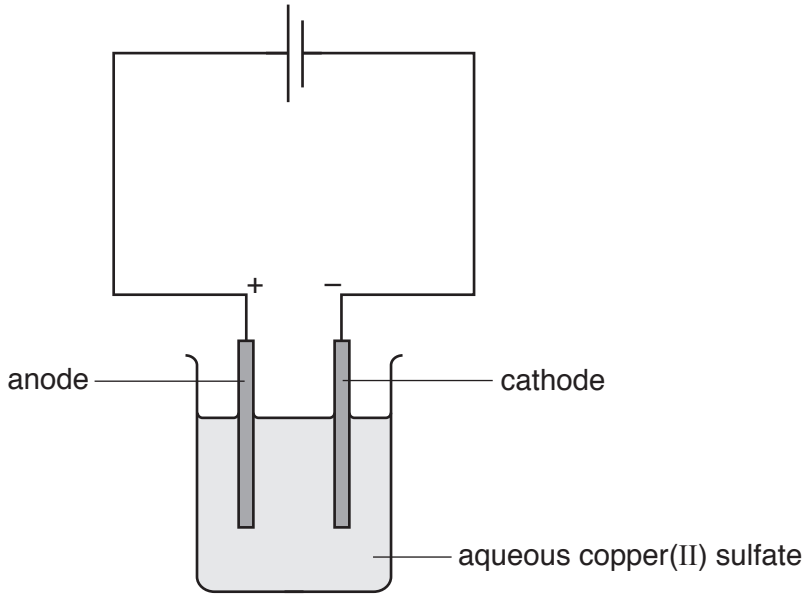
[6]

3 The apparatus shown is used for the electrolysis of aqueous copper(II) sulfate.



(a) Inert graphite electrodes are used for the electrolysis.

(i) Describe what is seen at each electrode during the electrolysis.

cathode .....

anode .....
[2]

(ii) Give a test and observation to identify the product at the anode.

test .....

observation .....
[2]

(iii) Describe what happens to the colour of the solution during the electrolysis. Explain your answer.

description .....

explanation .....

.....
[2]

(b) The electrolysis is repeated using copper electrodes in place of the inert graphite electrodes.

(i) Describe what happens to the colour of the solution during this electrolysis.

.....

..... [1]

(ii) State what happens to the mass of each electrode during this electrolysis.
Explain your answer.

mass of cathode .....

mass of anode .....

explanation .....

.....

.....
[3]

(iii) Suggest a practical use for the electrolysis of aqueous copper(II) sulfate.

..... [1]

[Total: 11]

[Turn over

4 Hydrogen peroxide, H_2O_2, reacts with iodide ions to produce water and iodine.
Acid must also be added for the reaction to occur.

$$H_2O_2(aq) + 2H^+(aq) + 2I^-(aq) \rightarrow 2H_2O(l) + I_2(aq)$$

(a) The initial reaction mixture is colourless.

State what is observed during this reaction.

.....

..... [1]

(b) The rate of this reaction is investigated by removing samples of the reaction mixture, of equal volumes, at timed intervals.

Each sample is added to an excess of powdered calcium carbonate in a flask to stop the reaction in the sample.

(i) Suggest why the reaction stops when the sample is added to calcium carbonate.

.....

..... [1]

(ii) Suggest why the calcium carbonate is powdered.

.....

..... [1]

(iii) State what is observed when a sample of the reaction mixture is added to calcium carbonate.

.....

..... [1]

(c) After each sample is added to calcium carbonate, the contents of this flask are titrated with aqueous sodium thiosulfate.

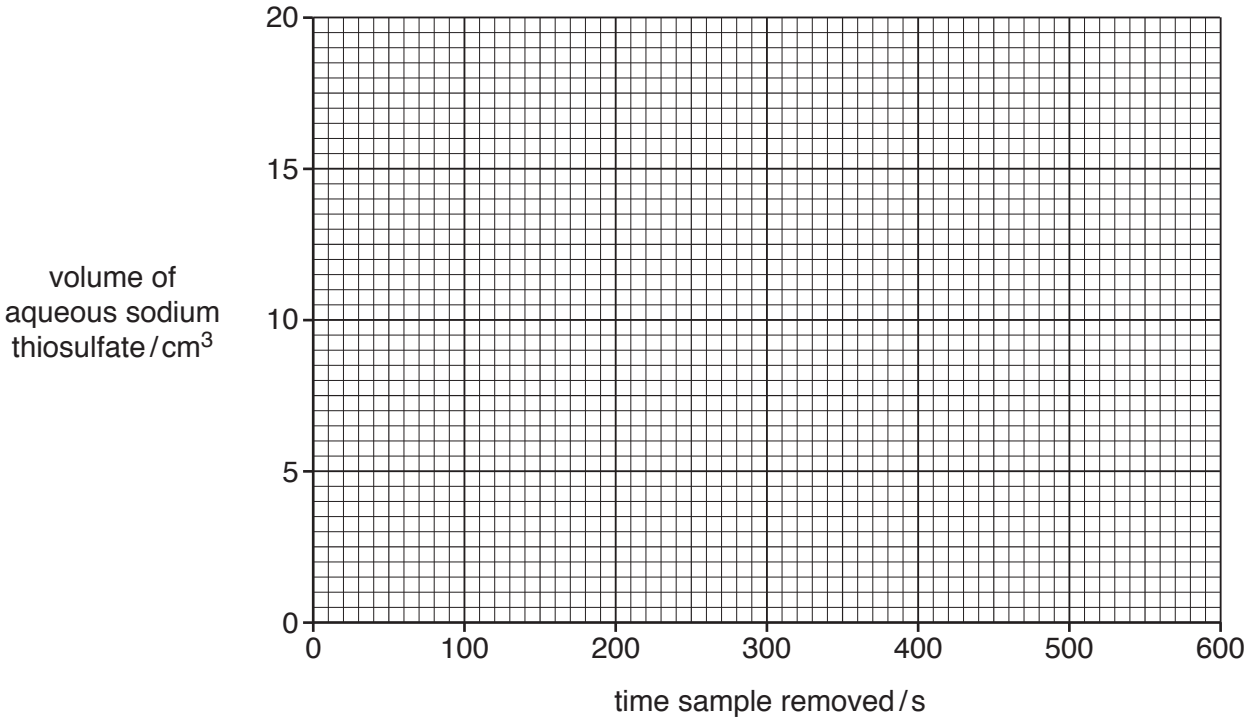
The sodium thiosulfate reacts with the iodine produced by the reaction between hydrogen peroxide and iodide ions.

The volume of aqueous sodium thiosulfate needed for each titration depends on the amount of iodine in the sample.

The results of the experiment are shown in the table.

time sample removed / s	0	100	200	300	400	500	600
volume of aqueous sodium thiosulfate needed for titration / cm^3	0	11.0	12.0	15.5	17.5	18.5	18.5

(i) Plot the results on the grid.



[2]

(ii) Draw a circle around the anomalous point on the grid. [1]

(iii) Use the points to draw a curve of best fit. [1]

(iv) Use the graph to determine the volume of aqueous sodium thiosulfate needed for a sample taken at 250 s.

volume .....cm^3 [1]

(v) Use the graph to determine the time at which a sample is taken if 6.0 cm^3 of aqueous sodium thiosulfate is needed.

time ..... s [1]

[Turn over

(vi) Describe and explain the difference in the slope of your curve at 50 seconds and at 400 seconds.

difference in slope .....

.....

explanation .....

.....

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.....

.....

[4]

[Total: 14]

5 Salts can be prepared in the laboratory in various ways.

Describe a suitable method to prepare a pure, dry sample of each of the named salts.

In your description you should include the names of any techniques, apparatus and chemicals used.

(a) Copper(II) sulfate
This method should use the reaction between an insoluble compound and a dilute acid.

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..... [5]

(b) Silver chloride
This method should use a precipitation reaction.

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..... [4]

[Total: 9]

[Turn over

6 The mineral alstonite contains two different cations but only one anion.

The table shows the tests a student does on a sample of alstonite.

Complete the table. Any gases formed should be named.

test	observations	conclusions	
(a) To a portion of alstonite in a boiling tube, add dilute hydrochloric acid until all the solid has dissolved. Use the resulting solution in tests **(b)**, **(c)** and **(d)**.	The solid dissolves. Effervescence is observed and the gas formed turns limewater milky.		[2]
(b) To a portion of the solution from **(a)** in a test-tube, add dilute sulfuric acid.		Alstonite contains Ba^{2+} ions.	[1]
(c) To a portion of the solution from **(a)** in a test-tube, add aqueous sodium hydroxide until in excess.		Alstonite may contain Ca^{2+} ions.	[2]
(d) To a portion of the solution from **(a)** in a test-tube, add aqueous ammonia.		Alstonite contains Ca^{2+} ions.	[1]

[Total: 6]