



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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0620/05

For examination from 2020

SPECIMEN PAPER

1 hour 15 minutes

Candidates answer on the question paper.

Additional materials: As listed in the confidential instructions

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, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

Notes for use in qualitative analysis are provided on pages 9 and 10.

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 **9** printed pages and **1** blank page.

- 1 You are going to investigate the reaction between excess magnesium and two different dilute acids, **X** and **Y**.

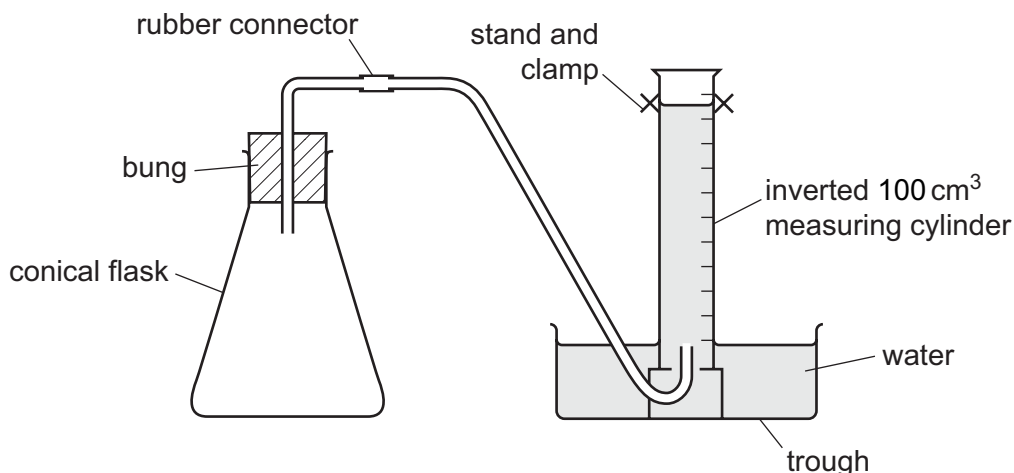
Read all the instructions below carefully before starting the experiments.

Instructions

You are going to carry out two experiments.

(a) Experiment 1

Set up the apparatus as shown in the diagram below.



Remove the bung from the conical flask and move the measuring cylinder away from the delivery tube without letting any water run out. Twist one of the strips of magnesium to break it into four pieces and place all four pieces into the conical flask.

Using a different measuring cylinder, measure 50 cm³ of dilute acid **X**. Pour it into the conical flask and replace the bung firmly. Place the measuring cylinder back over the delivery tube and start the timer. In the table, record the volume of gas collected in the measuring cylinder every 30 seconds for three minutes.

time / s	0	30	60	90	120	150	180
volume of gas / cm ³							

[2]

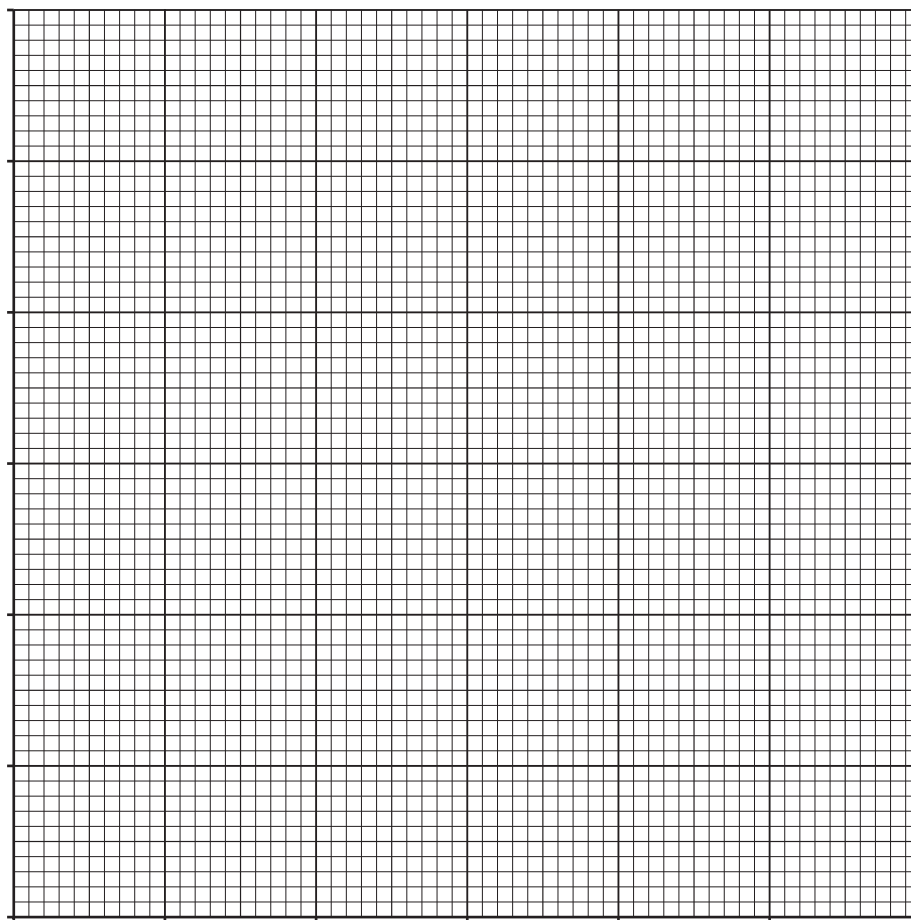
(b) Experiment 2

Repeat the whole of Experiment 1 using 50 cm³ of dilute acid **Y**. In the table, record the volume of gas collected in the measuring cylinder every 30 seconds for three minutes.

time / s	0	30	60	90	120	150	180
volume of gas / cm ³							

[2]

- (c) Plot the results you have obtained for both experiments on the grid below. For each set of results, draw a smooth line graph. Indicate clearly which line represents Experiment 1 and which line represents Experiment 2.



[4]

- (d) State which experiment had the faster rate of reaction **and** suggest why the rate was faster in this experiment.

.....
 [1]

- (e) From your graph, deduce the time required to collect 25 cm^3 of gas in Experiment 1. Show clearly **on the graph** how you worked out your answer.

..... [1]

- (f) The rate of this reaction can be calculated using:

$$\text{rate} = \frac{\text{volume of gas / cm}^3}{\text{time taken / s}}$$

For the experiment with the higher rate, calculate the rate of reaction for the first 30 seconds of the reaction. Deduce the units.

rate [2]

- (g) A student suggested that the magnesium should be rubbed with sandpaper before starting the experiment. Explain why the magnesium should be rubbed with sandpaper.

.....
 [2]

- (h) Give **one** advantage and **one** disadvantage of using a measuring cylinder to add the acids to the flask.

advantage
 disadvantage [2]

- (i) Suggest **and** explain one improvement to this experiment.

.....

 [1]

[Total: 17]

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- 2 You are provided with a mixture of two solids, **C** and **D**. Solid **C** is water-soluble and **D** is insoluble in water. Carry out the following tests on **C** and **D**, recording all of your observations at each stage.

Add 15 cm³ of distilled water to the mixture in the boiling tube. Stopper and shake the boiling tube for two minutes. Filter the contents of the tube, keeping the filtrate and residue for the following tests.

tests on the filtrate

- (a) (i) To about 1 cm³ of the solution, add a few drops of aqueous sodium hydroxide.

observation [1]

- (ii) Now add excess aqueous sodium hydroxide to the mixture.

observation [1]

- (b) To about 1 cm³ of the solution add an equal volume of aqueous ammonia.

observation [1]

- (c) To about 1 cm³ of the solution add excess aqueous sodium hydroxide.

Now add a small piece of aluminium foil and warm the mixture **carefully**. Test any gases given off.

observation
..... [2]

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

..... [2]

tests on the residue

Wash the residue in the filter paper with a little distilled water.

Using a spatula, transfer some of the solid residue from the filter paper into two test-tubes.

- (e) Heat the solid in the first test-tube gently and then strongly. Leave the test-tube to cool.

observation
..... [2]

- (f) (i) Add about 2 cm^3 of dilute hydrochloric acid to the second test-tube. Test any gases given off. Keep this liquid for (f)(ii).

observation
 [2]

- (ii) After two minutes, add an equal volume of distilled water and shake the test-tube. Decant off the liquid and divide the liquid into two approximately equal portions.

To the first portion add aqueous sodium hydroxide a little at a time until in excess.

observation
 [2]

- (iii) To the second portion add aqueous ammonia a little at a time until in excess.

observation
 [2]

- (g) Identify solid D.

.....

 [2]

[Total: 17]

3 E-numbers identify chemicals which are added to foods.

(a) E210 is benzoic acid. How could you show that a solution of benzoic acid is a weak acid?

test

result [2]

(b) E110 is Sunset Yellow.

Outline a method you could use to show the presence of E110 in a food colouring.

You may draw a diagram to help answer the question.

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

[Total: 6]

NOTES FOR USE IN QUALITATIVE ANALYSIS**Test for anions**

anion	test	test result
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
bromide (Br^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream ppt.
iodide (I^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify, then add aqueous barium nitrate	white ppt.
sulfite (SO_3^{2-})	add dilute hydrochloric acid, warm gently and test for the presence of sulfur dioxide	sulfur dioxide produced will turn acidified aqueous potassium manganate(VII) from purple to colourless

Test for aqueous cations

cation	effect of aqueous sodium hydroxide	effect of aqueous ammonia
aluminium (Al^{3+})	white ppt., soluble in excess giving a colourless solution	white ppt., insoluble in excess
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt., or very slight white ppt.
chromium(III) (Cr^{3+})	green ppt., soluble in excess	grey-green ppt., insoluble in excess
copper (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

Test for gases

gas	test and test results
ammonia (NH ₃)	turns damp, red litmus paper blue
carbon dioxide (CO ₂)	turns limewater milky
chlorine (Cl ₂)	bleaches damp litmus paper
hydrogen (H ₂)	'pops' with a lighted splint
oxygen (O ₂)	relights a glowing splint
sulfur dioxide (SO ₂)	turns acidified aqueous potassium manganate(VII) from purple to colourless

Flame tests for metal ions

metal ion	flame colour
lithium (Li ⁺)	red
sodium (Na ⁺)	yellow
potassium (K ⁺)	lilac
copper(II) (Cu ²⁺)	blue-green

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