Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2770353343

CHEMISTRY **0620/63**

Paper 6 Alternative to Practical **May/June 2021**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

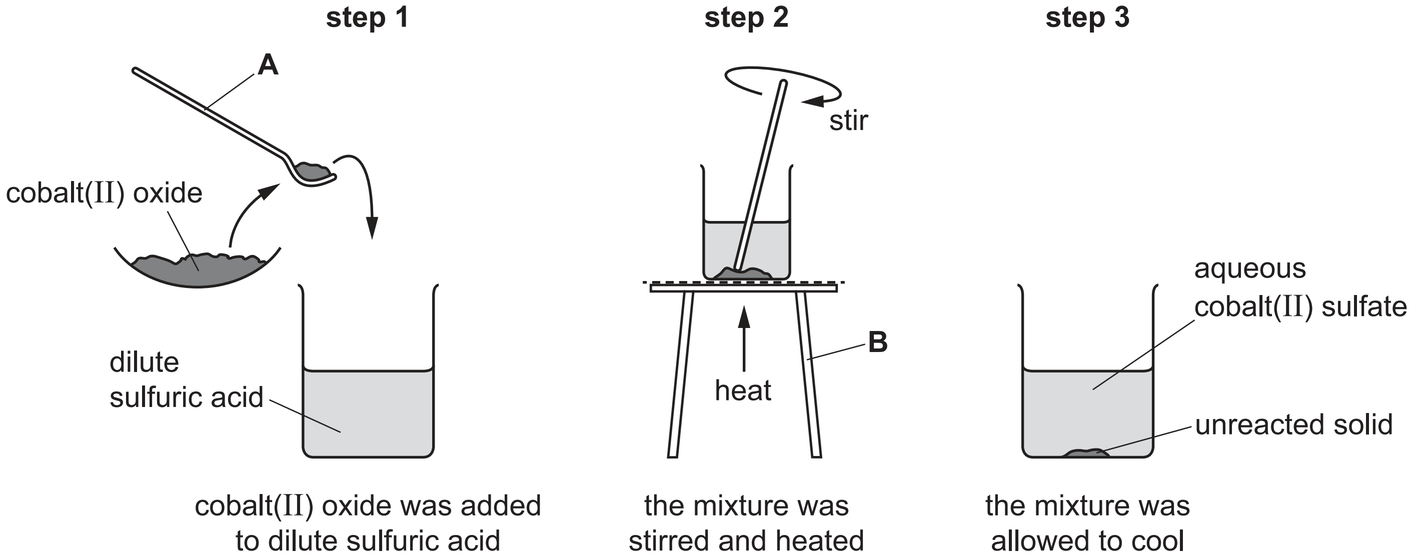
INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Any blank pages are indicated.

1 Cobalt(II) sulfate is a soluble salt. It can be made by reacting insoluble cobalt(II) oxide with dilute sulfuric acid.

A student made a sample of hydrated cobalt(II) sulfate using the following steps.



(a) Name the items of apparatus labelled **A** and **B**.

A ....

B .... [2]

(b) **(i)** Suggest why the mixture was heated in **step 2**.

....

.... [1]

(ii) Name an item of apparatus that can be used to heat the mixture in **step 2**.

.... [1]

(c) Name the reactant which was in excess.
Explain your answer.

....

.... [1]

(d) Additional steps are required to obtain pure cobalt(II) sulfate.

(i) The unreacted solid is removed from the aqueous cobalt(II) sulfate.

Name the process used to remove the unreacted solid.

.... [1]

(ii) Describe how crystals of hydrated cobalt(II) sulfate could be made from the solution obtained in **(i)**.

....

....

....

.... [2]

[Total: 8]

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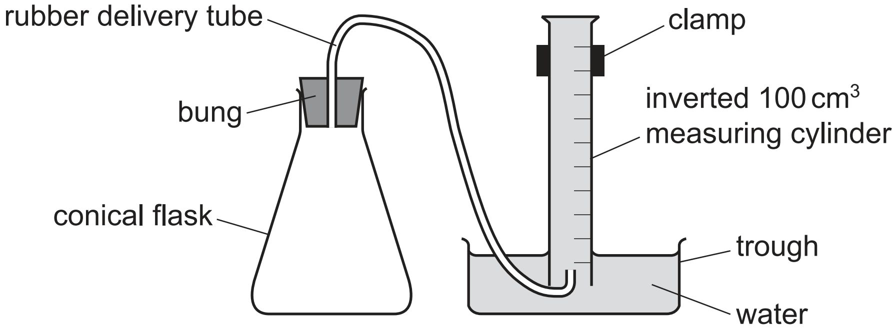
2 A student investigated the rate at which hydrogen gas was made when magnesium reacted with dilute sulfuric acid.

Five experiments were carried out using the apparatus shown.



Experiment 1

- Using a measuring cylinder, 25 cm^3 of dilute sulfuric acid was poured into a conical flask.
- Using a different measuring cylinder, 30 cm^3 of distilled water was poured into the conical flask.
- The apparatus was set up as shown in the diagram.
- The bung was removed from the conical flask.
- A coiled length of magnesium ribbon was added to the conical flask, the bung was replaced immediately and a timer started.
- The volume of gas collected in the inverted measuring cylinder after 30 seconds was measured.

Experiment 2

- Experiment 1 was repeated using 20 cm^3 of distilled water instead of 30 cm^3.

Experiment 3

- Experiment 1 was repeated using 10 cm^3 of distilled water instead of 30 cm^3.

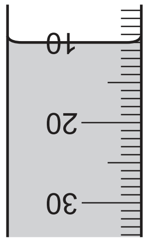
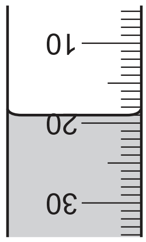
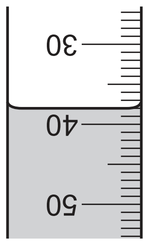
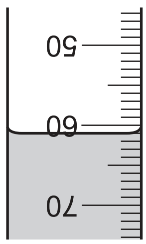
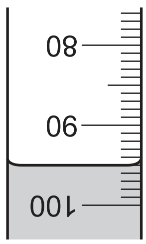
Experiment 4

- Experiment 1 was repeated using 5 cm^3 of distilled water instead of 30 cm^3.

Experiment 5

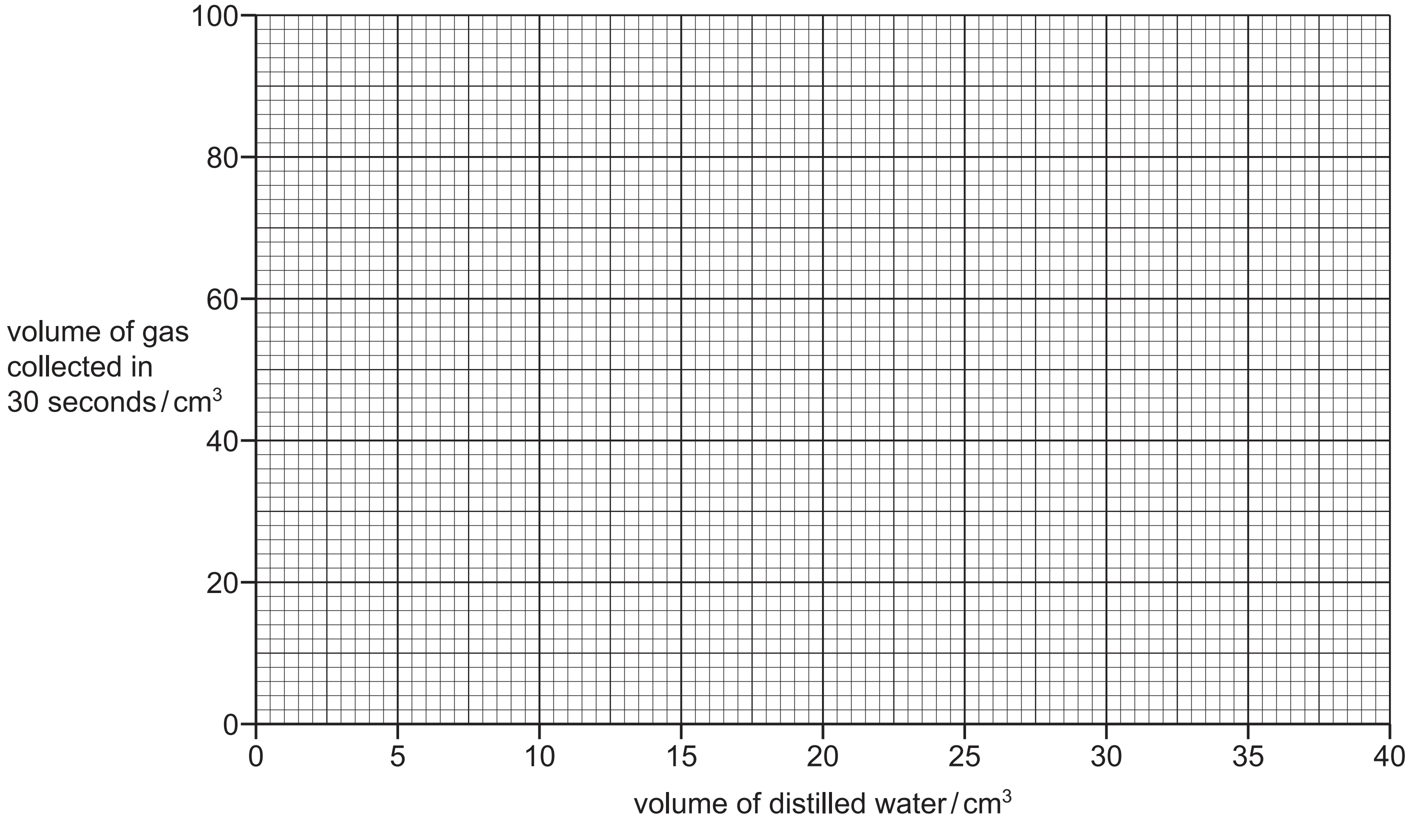
- Experiment 1 was repeated without adding any distilled water to the dilute sulfuric acid.

(a) Use the information in the description of the experiments and the inverted measuring cylinder diagrams to complete the table.

experiment	volume of dilute sulfuric acid / cm^3	volume of distilled water / cm^3	inverted measuring cylinder diagram	volume of gas collected in 30 seconds / cm^3
1				
2				
3				
4				
5				

[4]

(b) Plot the results from Experiments 1 to 5 on the grid. Draw a smooth curve of best fit.



[3]

(c) Extrapolate (extend) the line on your graph and deduce the volume of gas that would be collected in 30 seconds if 35 cm^3 of distilled water was added to the dilute sulfuric acid.

.... cm^3
[2]

(d) The rate of reaction can be calculated using the equation shown.

$$\text{rate of reaction} = \frac{\text{volume of gas collected}}{\text{time taken to collect the gas}}$$

(i) Use this equation to calculate the rate of reaction in Experiment 3. Give the units for the rate you have calculated.

rate = ...

units = ...

[2]

(ii) State which Experiment, 1, 2, 3, 4 or 5, had the highest rate of reaction.

.... [1]

(e) The volume of the dilute sulfuric acid was measured using a measuring cylinder. A 25 cm^3 pipette could have been used instead of a measuring cylinder.

(i) State **one** advantage of using a 25 cm^3 pipette instead of a measuring cylinder.

.... [1]

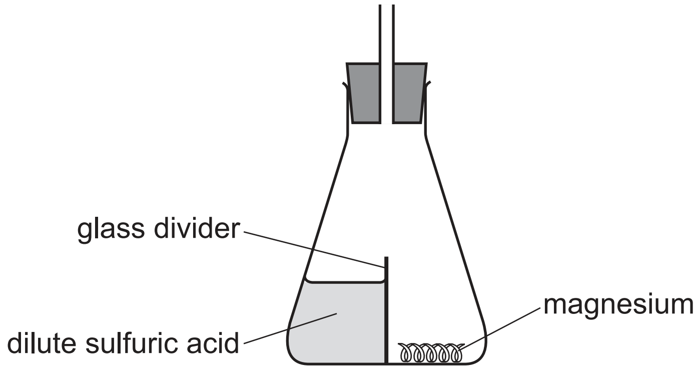
(ii) State **one** disadvantage of using a 25 cm^3 pipette instead of a measuring cylinder.

.... [1]

(f) Name another item of apparatus, which can be used instead of an inverted measuring cylinder, to collect and measure the volume of gas made in the reaction.

.... [1]

(g) The diagram shows a modified conical flask that could be used in this investigation.



Explain the advantage of using this type of conical flask instead of the type used in the investigation.

....

....

.... [2]

[Total: 17]

3 Solid **I** and solid **J** were analysed. Solid **I** was chromium(III) chloride.

tests on solid I

Complete the expected observations.

Solid **I** was placed in a boiling tube and about 10 cm^3 of distilled water was added to the boiling tube. The mixture was shaken to dissolve solid **I** and form solution **I**. Solution **I** was divided into four portions in four test-tubes.

(a) Aqueous sodium hydroxide was added dropwise and then in excess to the first portion of solution **I**.

observations ....

....

.... [2]

(b) Aqueous ammonia was added dropwise and then in excess to the second portion of solution **I**.

observations ....

....

.... [2]

(c) About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous silver nitrate were added to the third portion of solution **I**.

observations .... [1]

(d) About 1 cm^3 of dilute nitric acid followed by a few drops of aqueous barium nitrate were added to the fourth portion of solution **I**.

observations .... [1]

tests on solid J

tests	observations
test 1 A flame test was carried out on solid **J**.	lilac flame
The remaining solid **J** was placed in a boiling tube and about 10 cm^3 of distilled water was added to the boiling tube. The mixture was shaken to dissolve solid **J** and form solution **J**. **test 2** About 5 cm^3 of dilute nitric acid was added to solution **J**. Any gas produced was tested.	effervescence the gas turned limewater milky
test 3 A few drops of aqueous silver nitrate were added to the mixture formed in **test 2**.	no visible change

(e) Identify the gas formed in **test 2**.

.... [1]

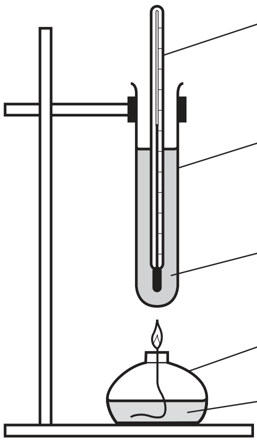
(f) Identify solid **J**.

....

.... [2]

[Total: 9]

4 The energy given out when different liquid alcohols are burned can be compared using the apparatus shown.



Describe how the apparatus shown can be used to compare the amount of energy given out by three different liquid alcohols, ethanol, propanol and butanol. Your answer should include how the results can be used to determine which fuel gives out the most energy.

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.... [6]