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## 0620/61

May/June 2022

**1 hour**

You must answer on the question paper.

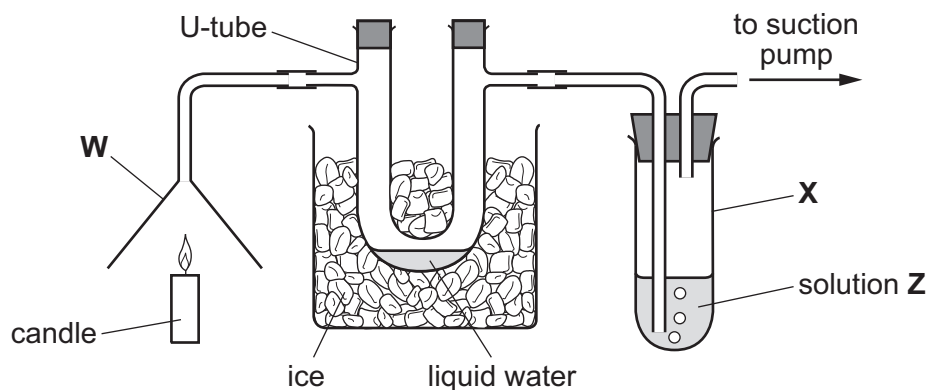
No additional materials are needed.

- 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.

- 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 The apparatus in the diagram was used to show that when a candle is burned both water and carbon dioxide are formed. The gases produced when the candle burns are passed through the apparatus using a suction pump.



- (a) Name the items of apparatus labelled **W** and **X**.

**W** .....

**X** .....

[2]

- (b) Suggest why ice is placed around the U-tube.

.....

..... [1]

- (c) Describe how to test the liquid collected in the U-tube to show it is water.

.....

..... [1]

- (d) Solution **Z** is used to show that carbon dioxide is produced.

Identify solution **Z**.

..... [1]

- (e) Both water and carbon dioxide were made.

Identify **one** element that must be in the compound that makes up the candle.

..... [1]

- (f) Describe how the apparatus could be changed to see if sulfur dioxide is made.  
Give the observations if sulfur dioxide is made.

change .....

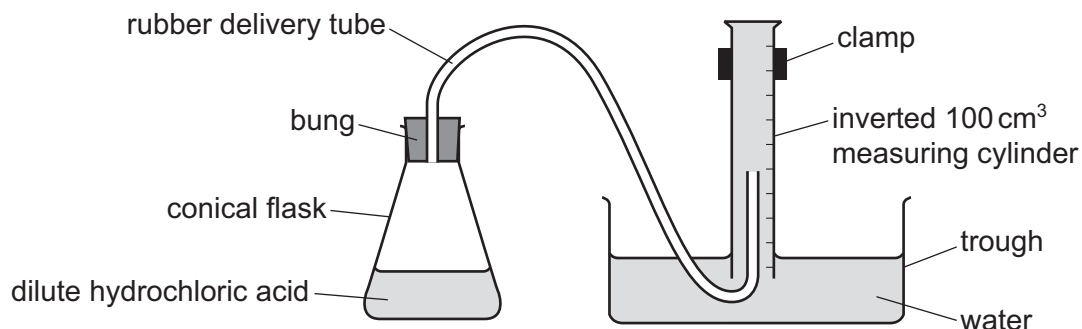
observation .....

[2]

[Total: 8]

- 2 A student investigated the rate at which hydrogen gas is made when magnesium reacts with two different solutions of dilute hydrochloric acid, **C** and **D**, with different concentrations. The dilute hydrochloric acid was in excess in both experiments.

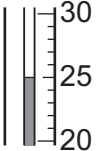
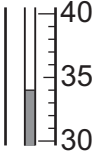
Two experiments were done using the apparatus shown.

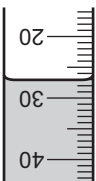
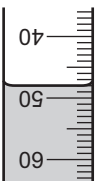
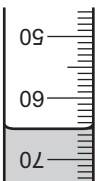
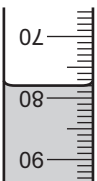
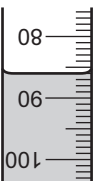
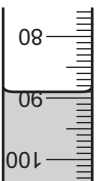
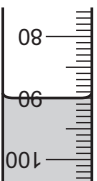
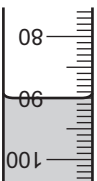


*Experiment 1*

- A measuring cylinder was used to pour  $50\text{ cm}^3$  of dilute hydrochloric acid **C** into a conical flask.
- The initial temperature of the dilute hydrochloric acid was measured using a thermometer.
- The apparatus was set up as shown in the diagram.
- The bung was removed from the conical flask and a coiled 5 cm length of magnesium ribbon was added to the flask. The bung was replaced immediately and a timer started.
- The volume of gas collected in the inverted measuring cylinder was recorded every 20 seconds for 160 seconds.
- The final temperature of the dilute hydrochloric acid in the flask was measured using a thermometer.

- (a) Use the thermometer diagrams and the diagrams of inverted measuring cylinders to complete the tables.

initial		final	
thermometer diagram	temperature / °C	thermometer diagram	temperature / °C
			

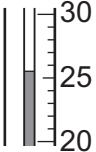
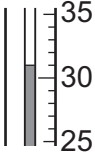
time / s	20	40	60	80	100	120	140	160
diagrams of inverted measuring cylinder								
volume of gas collected / cm <sup>3</sup>								



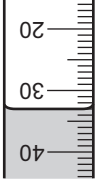
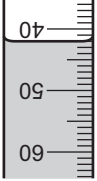



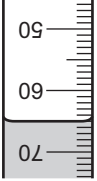
[2]

(b) *Experiment 2*

- Experiment 1 was repeated using 50 cm<sup>3</sup> of dilute hydrochloric acid **D** instead of dilute hydrochloric acid **C**.

Use the thermometer diagrams and the diagrams of inverted measuring cylinders to complete the tables.

initial		final	
thermometer diagram	temperature / °C	thermometer diagram	temperature / °C
			

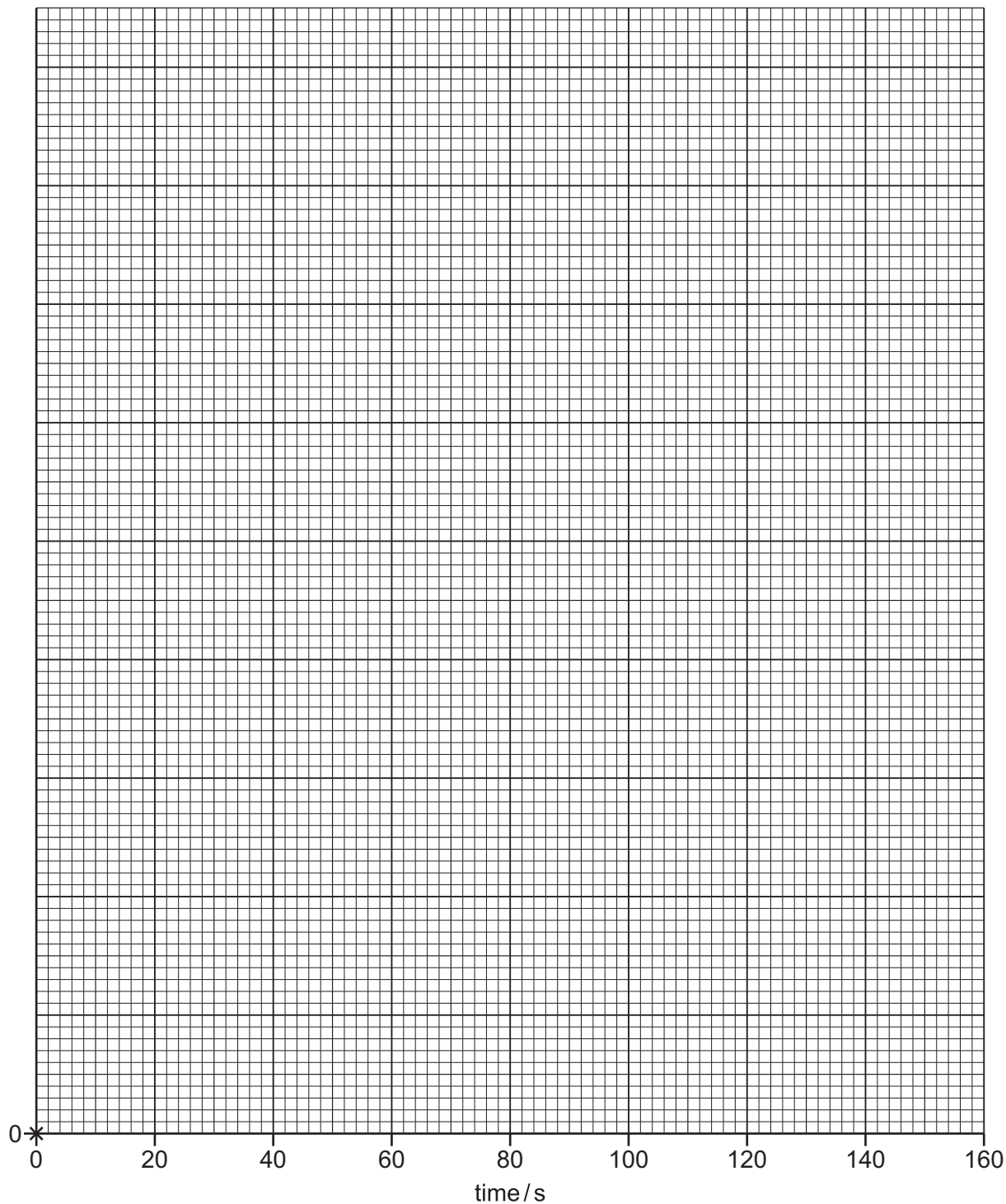
time / s	20	40	60	80	100	120	140	160
diagrams of inverted measuring cylinder								
volume of gas collected / cm <sup>3</sup>								

[3]

- (c) Complete a suitable scale on the  $y$ -axis and plot your results from Experiments 1 and 2 on the grid.

Draw **two** smooth line graphs. The lines must pass through (0,0). Clearly label your lines.

volume of  
gas collected  
/cm<sup>3</sup>



[5]

- (d) **From your graph**, deduce the volume of gas that was collected after 50 seconds in Experiment 2.

Show clearly **on the grid** how you worked out your answer.

volume of gas = ..... [3]

- (e) Explain what can be deduced about the concentrations of dilute hydrochloric acid **C** and dilute hydrochloric acid **D**.

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

- (f) (i) State what happens to the temperature of the dilute hydrochloric acid during Experiment 1.

..... [1]

- (ii) State what effect this temperature change has on the total volume of gas made when the reaction has finished.

..... [1]

- (iii) Describe a change that can be made to the apparatus or reagents to reduce the temperature change of the acid in Experiment 1.

..... [1]

- (g) Suggest why it is important to replace the bung in the conical flask immediately after adding the magnesium ribbon.

.....  
..... [1]

- (h) State the advantage of measuring the volume of gas collected every 10 seconds rather than every 20 seconds.

..... [1]

[Total: 20]

- 3 Solid **E** and solution **F** were analysed. Solid **E** was ammonium sulfate. Tests were done on each substance.

**tests on solid E**

Complete the expected observations.

Solid **E** was dissolved in water to form solution **E**. Solution **E** was divided into three approximately equal portions in one boiling tube and two test-tubes.

- (a) Aqueous sodium hydroxide was added to the first portion of solution **E** in a boiling tube. The mixture formed was warmed. Any gas produced was tested.

observations .....

.....

identity of gas .....

[2]

- (b) To the second portion of solution **E**, about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate were added.

observations ..... [1]

- (c) To the third portion of solution **E**, about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate were added.

observations ..... [1]

**tests on solution F**

tests	observations
<p>Solution <b>F</b> was divided into two equal portions in two test-tubes.</p> <p><b>test 1</b></p> <p>A strip of universal indicator paper was placed in the first portion of solution <b>F</b>.</p>	<p>the universal indicator paper turned orange</p>
<p><b>test 2</b></p> <p>The second portion of solution <b>F</b> was added to solid sodium carbonate in a boiling tube. Any gas made was tested.</p>	<p>effervescence and the solid disappeared</p> <p>limewater turned milky</p>

**(d)** Deduce the pH of solution **F**.

..... [1]

**(e)** Identify the positive ion in solution **F**.

..... [1]

[Total: 6]



- (1 dm<sup>3</sup> = 1000 cm<sup>3</sup>)

[6]

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