UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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|---|---|
| CANDIDATE NAME | |

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|---|---|---|---|
| CENTRE NUMBER | | CANDIDATE NUMBER | |

*8722154538*

**CO-ORDINATED SCIENCES** **0654/53**

Paper 5 Practical Test **May/June 2010**

**2 hours**

Candidates answer on the Question Paper.

Additional Materials: As listed in Instructions to Supervisors

**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 a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Chemistry practical notes for this paper are printed on page 12.

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.

| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| Total | |

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

IB10 06_0654_53/3RP


UNIVERSITY of CAMBRIDGE International Examinations

For
iner's

1 This question is about variation in leaves.

**(a)** You are provided with 20 leaves of the same species. Measure the length ***l*** of each le in millimetres as shown in Fig. 1.1a. If the lamina does not meet the petiole evenly on either side of the leaf use the longer measurement. See Fig. 1.1b.

Enter your measurements in Table 1.1.

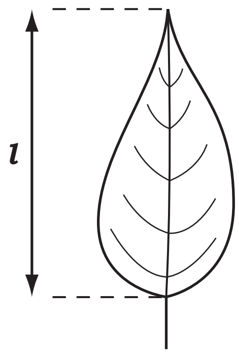



**Fig. 1.1a**

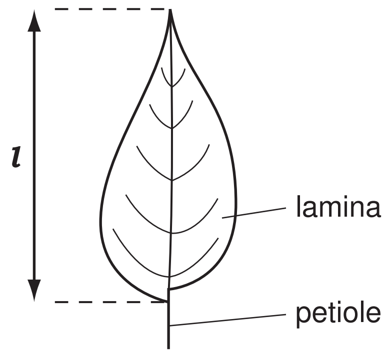



**Fig. 1.1b**

**Table 1.1**

| length of leaf *l* / mm | | | |
|---|---|---|---|
| **1** | | **11** | |
| **2** | | **12** | |
| **3** | | **13** | |
| **4** | | **14** | |
| **5** | | **15** | |
| **6** | | **16** | |
| **7** | | **17** | |
| **8** | | **18** | |
| **9** | | **19** | |
| **10** | | **20** | |

[2]

**(b)** Calculate the average (mean) length of the 20 leaves. Show your working.

average = .......................... mm [2]

**(c) (i)** Enter the number of leaves in each range in Table 1.2 below.

**Table 1.2**

| **range / mm** | **number of leaves in range** | **range / mm** | **number of leaves in range** |
|---|---|---|---|
| 30 - 34 | | 90 - 94 | |
| 35 - 39 | | 95 - 99 | |
| 40 - 44 | | 100 - 104 | |
| 45 - 49 | | 105 - 109 | |
| 50 - 54 | | 110 - 114 | |
| 55 - 59 | | 115 - 119 | |
| 60 - 64 | | 120 - 124 | |
| 65 - 69 | | 125 - 129 | |
| 70 - 74 | | 130 - 139 | |
| 75 - 79 | | 140 - 144 | |
| 80 - 84 | | 145 - 149 | |
| 85 - 89 | | 150 - 154 | |

**(ii)** Use the information you have entered in Table 1.2 to draw a bar chart on the grid provided. Use the **number of leaves in range** as the vertical axis and the **range / mm** as the horizontal axis. Choose suitable scales for your data.

[3]

**(d)** The difference between the greatest length and the smallest length is the range.

Complete the following.

the greatest length = .................................................. mm

the smallest length = .................................................. mm

the range = .................................................. mm [1]

**(e)** Use the grid provided on page 5 to estimate the area of **one** of the leaves. The area of each square is 1 $cm^2$.

- Place the leaf on the grid provided.
- Carefully draw round the leaf then remove it.
- Write the letter **C** in the **complete** squares. Count the number of complete squares.

number of complete (**C**) squares = ..................................

- Write the letter **P** in any incomplete squares that have an area of half a square or more.

number of incomplete (**P**) squares = ..................................

- Ignore the rest of the squares.
- Add **C** + **P** to estimate the area of the leaf.

leaf area = .................................. $cm^2$ [1]

For
iner's

[2]

**(f)** The leaves in the sample were all of the same species yet they showed variation in length.

Suggest and explain a reason for this.

reason ..........................................................................................................................

explanation ..........................................................................................................................

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

**2** You are going to find the specific heat capacity of the material of a can. The specific heat capacity of a material is the heat energy required to raise 1 g of the material by 1 ºC.

**(a)** Find the mass of the can to the nearest gram.

Record its mass below.

mass of can, $\mathbf{m_1}$ = .................................. g [1]

**(b)** Place the lagging around the can. Place the thermometer inside the can and leave for two minutes. Read the temperature, $\mathbf{t_1}$, to the nearest 0.5 ºC and record it below.

temperature of can, $\mathbf{t_1}$ = .................................. ºC [1]

**(c) (i)** Heat enough water in a beaker to about one-third fill the can. When the temperature is just above 70 ºC, remove the Bunsen. As soon as the temperature of the water has cooled to exactly 70.0 ºC pour the water into the can. Read the temperature, $\mathbf{t_2}$, to the nearest 0.5 ºC of the water after exactly **two minutes**. Record this temperature.

temperature of water, $\mathbf{t_2}$ = .................................. ºC [1]

**(ii)** Remove the lagging and pour the water into a measuring cylinder. Record the volume.

volume of water = .................................. $cm^3$ [1]

**(iii)** 1 $cm^3$ of water has a mass of 1 g. Calculate the mass, $\mathbf{m_2}$, of the volume of water you recorded in **(c)(ii)**.

mass of water, $\mathbf{m_2}$ = .................................. g [1]

**(d)** Calculate

**(i)** $\mathbf{t_3}$, the fall in temperature of the hot water, $\mathbf{t_3}$ = (70.0 - $\mathbf{t_2}$).

$\mathbf{t_3}$ = .................................. ºC

**(ii)** $\mathbf{t_4}$, the rise in temperature of the can, $\mathbf{t_4}$ = ($\mathbf{t_2}$ - $\mathbf{t_1}$).

$\mathbf{t_4}$ = .................................. ºC [2]

For Examiner's

**(e) (i)** Use the equation to calculate the specific heat capacity, **shc**, of the material of the can.

$$\mathbf{shc} \times \mathbf{m_1} \times \mathbf{t_4} = \mathbf{m_2} \times \mathbf{t_3} \times \mathbf{4.2}$$

specific heat capacity of the material of the can = .............................. $J\,g^{-1}\,{}^{o}C^{-1}$ [4]

**(ii)** Use your answer from **(e)(i)** to calculate the specific heat capacity in $J\,kg^{-1}\,{}^{o}C^{-1}$.

specific heat capacity of the material of the can = ........................... $J\,kg^{-1}\,{}^{o}C^{-1}$ [1]

**(f)** The teacher said that the specific heat of a liquid, in joules per kilogram of the liquid per degree, can be found by placing an electrical heater in the liquid and measuring the temperature rise.

What other measurements would be needed to calculate the specific heat capacity of the liquid?

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

.................................................................................................................................. [3]

**3** You are going to investigate the rate of reaction between magnesium and hydrochloric acid.

Read through the procedure before starting the experiment.

**(a) (i)** Set up the apparatus as shown in Fig. 3.1.

- Fill the 100 $cm^3$ measuring cylinder and trough with water.

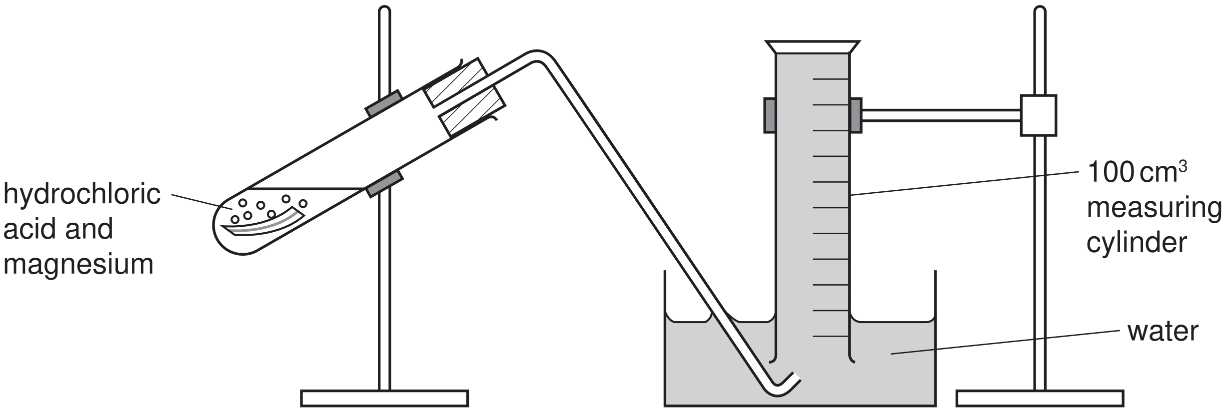



**Fig. 3.1**

**(ii)**
- Place 20 $cm^3$ of the hydrochloric acid in the large test-tube.
- Cut 6 cm of magnesium ribbon from the length provided.
- Loosely fold the piece of magnesium ribbon and place it in the acid contained in the test-tube. Immediately replace the stopper and delivery tube and start the timer.
- Read the volume of gas in the measuring cylinder after 20, 40, 60 and 80 seconds.
- Record the volumes in Table 3.1. [2]

**(b) (i)** You will now repeat the procedure using the same length of magnesium but different volumes of acid and water.

- Wash out the contents of the test-tube.
- Refill the measuring cylinder with water.
- Place 16 $cm^3$ of hydrochloric acid in the test-tube and 4 $cm^3$ of water.
- Cut 6 cm of magnesium ribbon and place it in the acid. Replace the stopper and delivery tube.
- Immediately start the timer.
- Read the volume of gas in the measuring cylinder after 20, 40, 60 and 80 seconds.
- Record the volumes in Table 3.1.

**(ii)** Repeat the experiment **two** more times using volumes of acid and water as in Table 3.1. Record the results in Table 3.1.

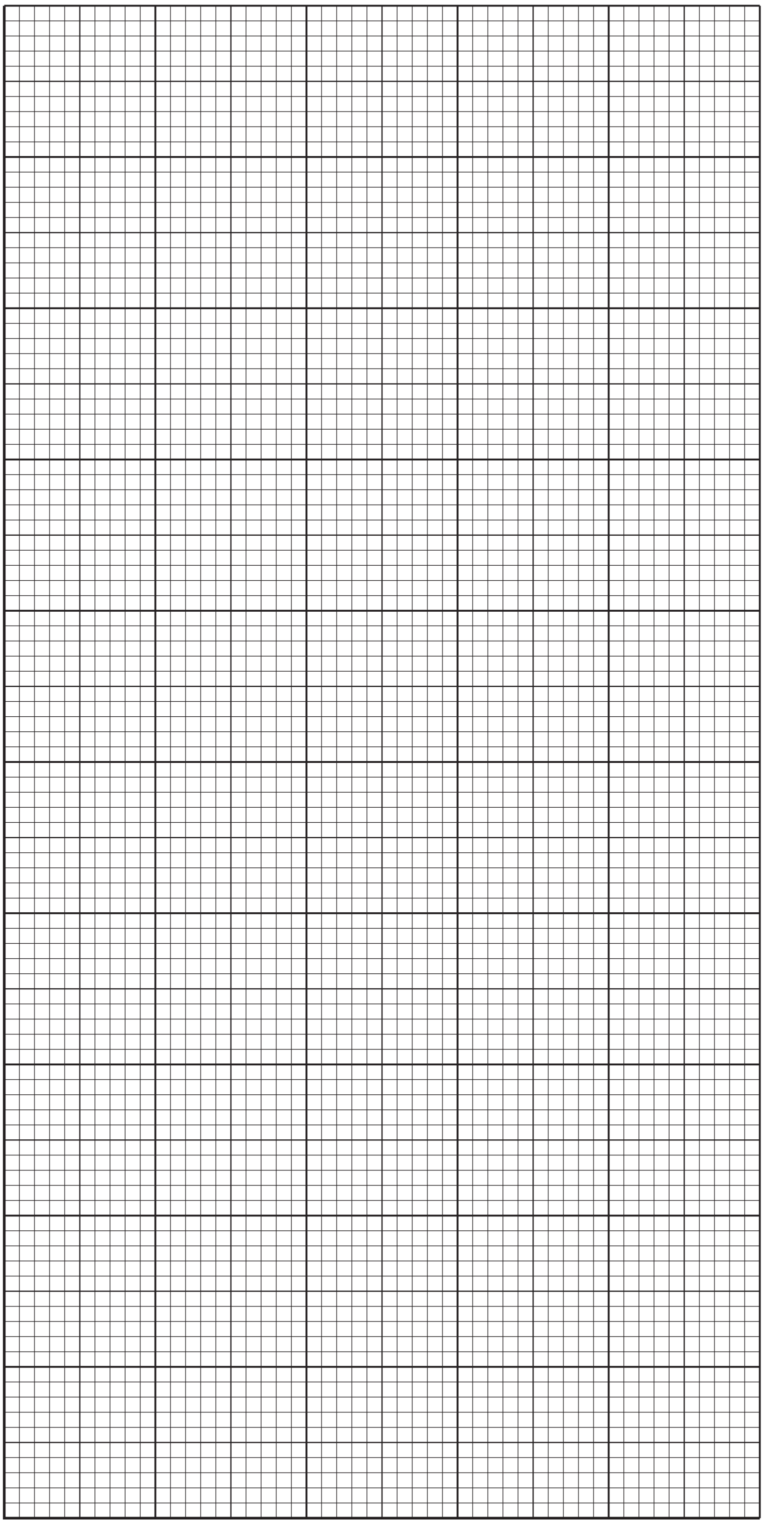


**Table 3.1**

| volume of 2 mol / $dm^3$ hydrochloric acid / $cm^3$ | volume of water / $cm^3$ | concentration of acid in the mixture / mol / $dm^3$ | volume of gas collected / $cm^3$ after | | | |
|---|---|---|---|---|---|---|
| | | | **20 s** | **40 s** | **60 s** | **80 s** |
| 20 | 0 | 2.0 | | | | |
| 16 | 4 | 1.6 | | | | |
| 12 | 8 | | | | | |
| 4 | 16 | | | | | |

**(c)** Complete column 3 in Table 3.1. [1]

**(d)** Draw a graph of volume of gas collected **after 40 s** (vertical axes) against concen of hydrochloric acid. Include the origin in your plots and draw a smooth curve.



[4]

*For Examiner's*

**(e)** How is the rate of reaction affected by concentration of acid? Explain how your results enable you to decide this.

..................................................................................................................................................

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

**(f)** Had any of the reactions finished by the time 80 s had been reached? Explain your answer.

..................................................................................................................................................

..................................................................................................................................................

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

**(g)** The teacher said that if powdered magnesium is used in the experiment instead of a metal strip, the results will be different.

Describe an experiment to find what would be different. Suggest what the difference might be.

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

.................................................................................................................................................. [3]

## CHEMISTRY PRACTICAL NOTES

### 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. |
| 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 chloride *or* aqueous barium nitrate | white ppt. |

### Test for aqueous cations

| *cation* | *effect of aqueous sodium hydroxide* | *effect of aqueous ammonia* |
|---|---|---|
| ammonium ($NH_4^+$) | ammonia produced on warming | - |
| copper(II) ($Cu^{2+}$) | 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 |