UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

4373149320

CO-ORDINATED SCIENCES **0654/63**

Paper 6 Alternative to Practical **May/June 2012**

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

Answer **all** questions.

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	
4	
5	
6	
Total	

This document consists of **16** printed pages and **4** blank pages.

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UNIVERSITY *of* CAMBRIDGE
International Examinations

[Turn over

For Examiner's Use

1 (a) A student investigated the digestion of fat in milk by the enzyme lipase. Lipase breaks down fat into fatty acids.

- He labelled three large test-tubes **A**, **B** and **C** and placed the tubes into a water bath.

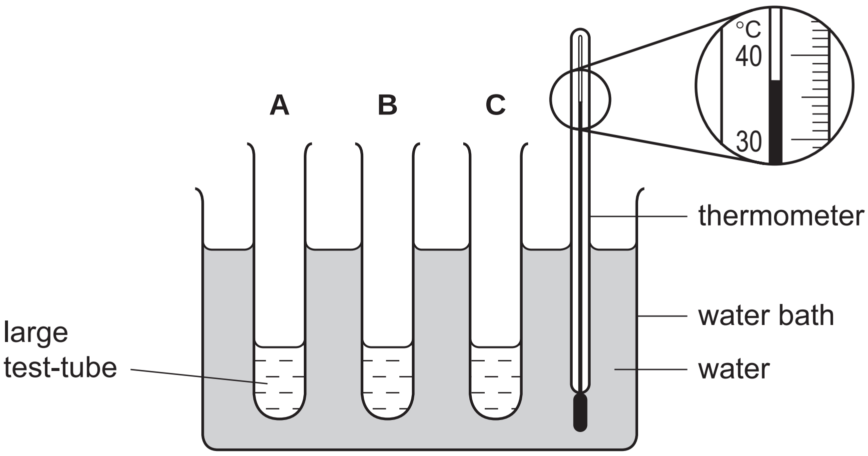

Fig. 1.1

(i) Fig. 1.1 shows the apparatus used. Read and record the temperature to which he set the water bath.

Suggest why this temperature was chosen.

temperature .... °C

reason ....

.... [2]

- He measured out and placed 7 cm^3 of sodium carbonate solution into each of the three tubes **A**, **B** and **C**.
- He then measured out and placed 5 cm^3 of full fat milk into each of the tubes.
- He placed 5 drops of phenolphthalein indicator solution into each of the tubes. The mixtures in the tubes all turned pink.
- The tubes were left in the water bath for 10 minutes.
- After 10 minutes, he added 1 cm^3 of lipase solution to each tube. The mixture in each tube was mixed thoroughly.
- A timer was started and the time was recorded when each mixture turned colourless.

(ii) Fig. 1.2 shows the time at which each tube turned colourless.

Record, in Table 1.1, the times taken in seconds for each mixture to turn colourless.

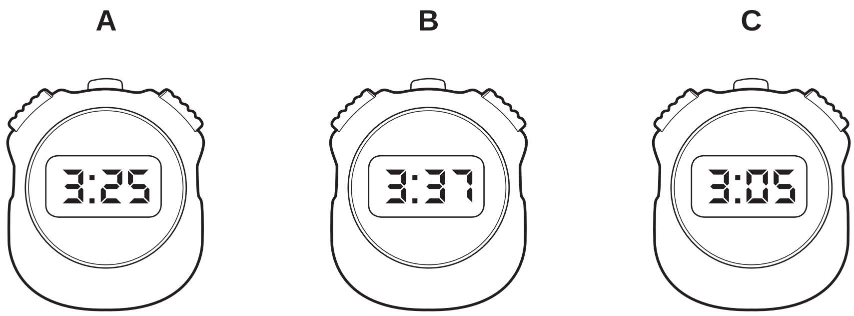

Fig. 1.2

Table 1.1

tube	**A**	**B**	**C**
time taken for mixture to turn colourless / s			

[2]

(iii) Calculate the average time taken in seconds for the milk to change from pink to colourless.

average time = ... s [1]

(b) Lipase breaks down fat into fatty acids. Sodium carbonate is a weak alkali. Phenolphthalein is an indicator. If the mixture has a pH of above 8, it is pink. If the pH is less than 8, it is colourless.

Explain why the mixture in the tubes turned from pink to colourless.

....

....

.... [2]

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(c) Suggest why the tubes were placed into the water bath for 10 minutes before adding the lipase.

.... [1]

(d) Suggest and explain how the student could perform an additional experiment to show that lipase is an enzyme that breaks down fats.

....

....

....

.... [2]

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Please turn over for Question 2.

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2 You are going to find the density of the material used to make a plastic pipe as shown in Fig. 2.1.

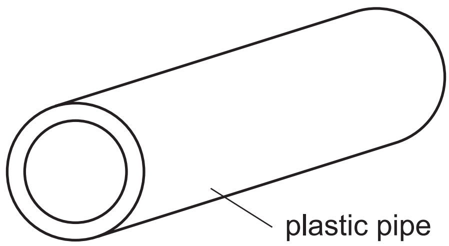

Fig. 2.1

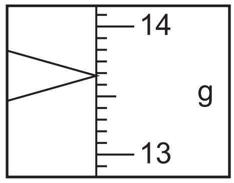

Fig. 2.2

(a) Use Fig. 2.2, which shows a balance reading, to record the mass, **M**, of the piece of pipe to the nearest 0.1 g.

M = ... g [1]

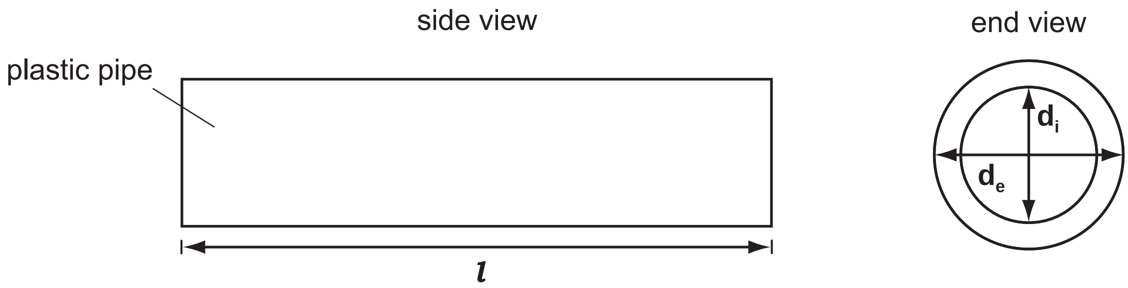

Fig. 2.3

(b) (i) Use a ruler and Fig. 2.3 to measure the length, l, the external diameter, $\mathbf{d_e}$, and the internal diameter, $\mathbf{d_i}$, of the piece of pipe to the nearest 0.1 cm.

length, l = ... cm

external diameter, $\mathbf{d_e}$ = ... cm

internal diameter, $\mathbf{d_i}$ = ... cm [3]

(ii) Use your values of the external diameter, $\mathbf{d_e}$, and the internal diameter, $\mathbf{d_i}$, to calculate **k**, using the formula given below.

$$\mathbf{k} = \mathbf{d_e}^2 - \mathbf{d_i}^2$$

k = ... cm^2 [2]

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(iii) Use your values in **(b)(i)** and **(b)(ii)** to calculate **V**, in cm^3, the volume of the piece of pipe.

Use the formula given below.

$$\mathbf{V} = \frac{\pi \mathbf{k} \boldsymbol{l}}{4}$$

V = ... cm^3 [2]

(c) Use your values of the mass, **M**, and the volume, **V**, of the piece of pipe, to calculate **D**, the density of the material used.

Show clearly any formula you use.

D = ... g/cm^3 [2]

[Turn over

3 **(a)** A student is investigating how much heat is produced in the reaction between solid **A** and solution **B**.

- He places 25 cm^3 of solution **B** in a plastic cup.
- He measures the temperature.
- He adds a sample solid **A** to solution **B** and starts the stopclock.
- He measures the temperature of the mixture every half minute for seven minutes, stirring throughout, and records the values in Table 3.1.

Table 3.1

time / min	temperature / °C
0	
0.5	52.0
1.0	52.0
1.5	50.0
2.0	49.0
2.5	
3.0	46.0
3.5	44.5
4.0	
4.5	42.5
5.0	41.5
5.5	40.5
6.0	39.5
6.5	38.5
7.0	38.0

Read the thermometers in Fig. 3.1, which show the temperatures of the mixture at 0, 2.5 and 4.0 minutes, and record the values in Table 3.1. [3]

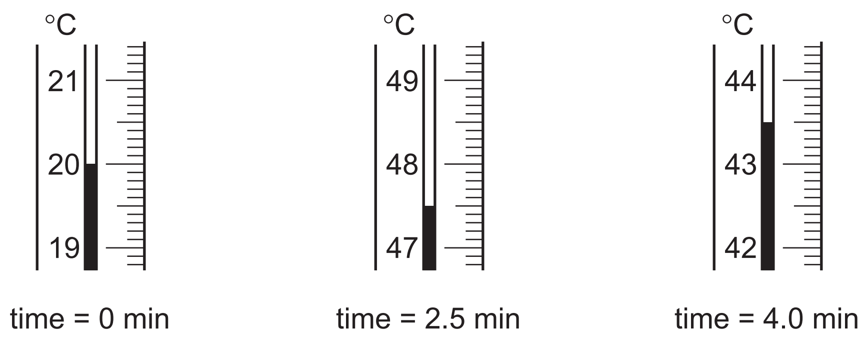

Fig. 3.1

(b) (i) Use the data in Table 3.1 to plot a graph of temperature (vertical axis) against time on the grid below. Draw a smooth curve through the points.

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[4]

(ii) Use your graph to find the maximum temperature rise, Δ**T**, in this reaction.

Δ**T** = ... °C [1]

(iii) Calculate **E**, the energy given out by the reaction using the formula given below.

E = volume of solution **B** $\times$ 4.2 $\times$ Δ**T**

E = ... J [2]

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4 **(a)** A student was testing the theory that caffeine speeds up heart rate. Caffeine is a drug found in coffee and other drinks.

The student measured her heart rate by counting the number of pulse beats in her wrist over a period of 30 seconds.

- The student took the first reading just before drinking any coffee. This was the reading at a time 0 minutes. She recorded this number in Table 4.1.
- She drank a cup of strong coffee and waited for 5 minutes before taking the next reading and recording it in Table 4.1.
- The student then took readings every 5 minutes, each time recording the number of beats in Table 4.1.

Table 4.1

time after drinking coffee / min	**number of beats in 30 s**	**number of beats per minute**
0	36	
5	39	
10	42	
15	45	
20	45	
25	37	
30	36	

(i) Complete Table 4.1 to show the number of beats per minute for each reading. [1]

(ii) On the grid provided, plot a graph of **number of beats per minute** (vertical axis) against **time after drinking coffee**. Draw the best curve through the points.

[3]

(iii) The student found that caffeine increased heart rate. From your graph find out how long it took, to the nearest minute, to have the maximum effect.

Show how you do this on your graph.

time to maximum effect = ... minutes [1]

(b) (i) The student was told not to do any exercise during the time the readings were taken.

Explain why this was necessary.

....

.... [1]

For Examiner's Use

(ii) The student wanted to repeat the experiment to check the reliability.

Describe **two** quantities the student would need to keep the same to make sure it is a fair test.

....

....

.... [2]

(iii) Describe **one** way in which the student could have obtained a more accurate value for the maximum rate of heart beat.

Explain your answer.

....

....

.... [2]

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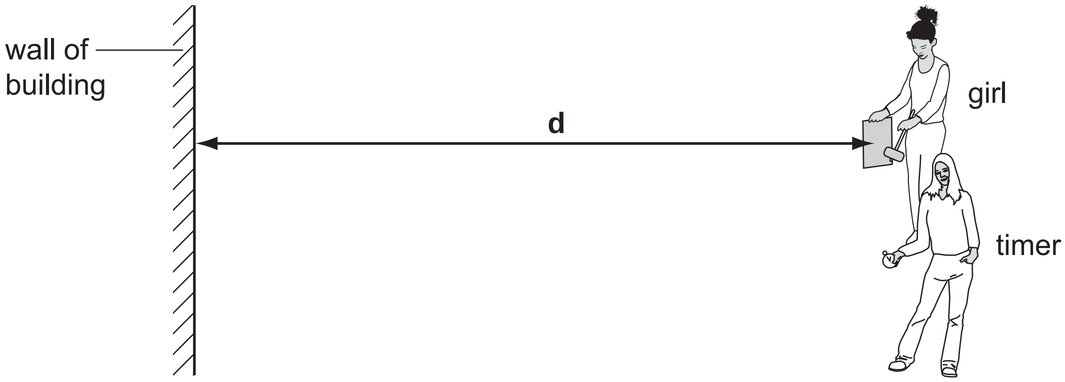
Please turn over for Question 5.

5 While walking between certain buildings a teenager notices that there is a clear echo of her talking. She asks a friend to help her to use this effect to find the speed of sound.

She makes a loud noise by hitting a metal sheet with a metal hammer. She asks her friend to start a stopclock when she hits the metal sheet and stop it when she hears the echo.



scale: 1 cm = 30 metres

Fig. 5.1

(a) (i) Use a ruler to measure the distance, **d**, in centimetres, from the girl to the wall in Fig. 5.1.

.... cm [1]

(ii) Use the scale shown to calculate the actual distance in metres, travelled by the noise from the girl to the timer.

actual distance travelled by the noise = ... m [2]

Table 5.1

experiment	1	2	3	4	5
time / s	1.59	1.83	1.75	1.89	2.95

(iii) Table 5.1 shows the times of five repeats of the experiment.

The time for experiment **5** is much longer than the others, and should be discarded.

Suggest a reason that may have caused this longer time.

....

.... [1]

(iv) Calculate the average time in seconds, using data from experiments **1**, **2**, **3** and **4**.

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average time = ... seconds [1]

(v) Calculate the speed of sound, by dividing the distance found in **(a)(ii)** by the time found in **(a)(iv)**.

speed of sound = ... m/s [2]

(vi) The actual speed of sound in the air is 343 m/s.

Comment on the accuracy of your value.

....

.... [1]

(b) The speed of sound in water is 1497 m/s.

Suggest why the speed of sound in water is much faster than the speed in air.

....

....

.... [2]

6 A student is investigating the reaction between a piece of magnesium ribbon and hydrochloric acid.

She sets up the apparatus as in Fig. 6.1.

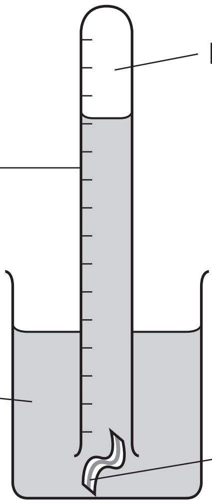

Fig. 6.1

(a) The magnesium ribbon starts reacting and hydrogen gas is given off.

Describe a test for hydrogen and give the expected result.

test ....

result .... [2]

(b) (i) She notices that the magnesium ribbon begins to rise up the graduated tube, even though magnesium is denser than the acid.

Suggest a reason for the magnesium ribbon rising.

....

.... [1]

(ii) Another student suggests putting a piece of another metal over the magnesium ribbon to stop it rising. He gives her pieces of iron, zinc and copper to choose from. She thinks the piece of copper would be the best choice.

Give a reason why a piece of copper would be the best choice to stop the magnesium rising.

....

.... [1]

Another student uses a piece of pottery to stop the magnesium from rising.

The students measure the volume of hydrogen given off over a period of time, using the same length of magnesium ribbon and the same volume and concentration of acid.

The results are shown in Fig. 6.2.

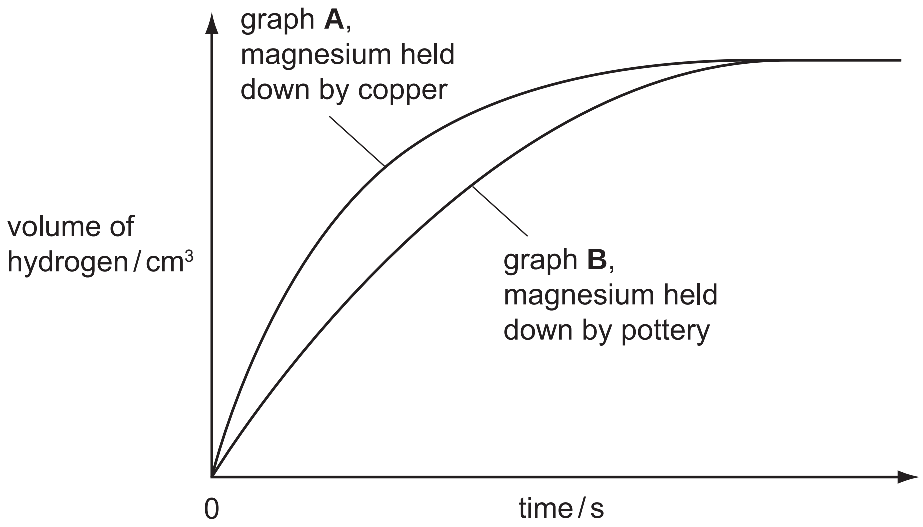

Fig. 6.2

(c) State the difference between the shape of graph **A** and graph **B** and suggest a reason for this difference.

difference ....

....

reason ....

.... [2]

(d) After the reaction finishes, the student looks into the beaker and decides that the magnesium was in excess.

What observation suggests that the magnesium was in excess?

.... [1]

(e) She repeats the experiment using a fresh piece of magnesium ribbon and a piece of pottery, but this time using ethanoic acid of the same concentration.

She measures the volume of hydrogen given off as before.

Sketch on **Fig. 6.2** the line you would expect. [2]

(f) The teacher shows the students a method of collecting and measuring the gas that does not involve displacement of water.

Complete Fig. 6.3 to show what the apparatus may look like.

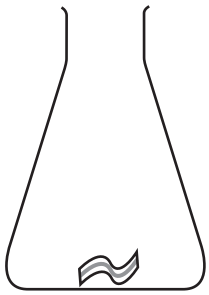

Fig. 6.3

[1]

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