



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

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CO-ORDINATED SCIENCES

0654/62

Paper 6 Alternative to Practical

May/June 2015

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 an HB pencil for any diagrams or graphs.

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.

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 **18** printed pages and **2** blank pages.

- 1 Catalase is an enzyme found in potato cells that is involved in the breakdown of hydrogen peroxide into water and oxygen. The oxygen is released as bubbles.

A student investigates how the rate of this reaction is affected by the thickness of potato slices.

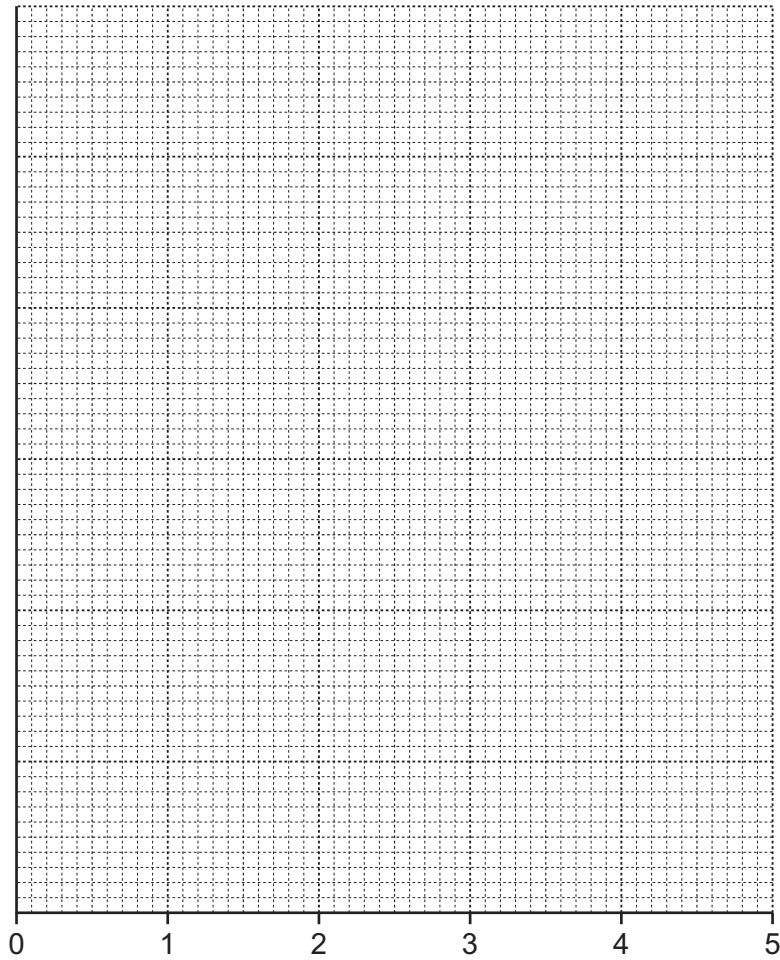
The student places a potato slice at the bottom of a beaker containing hydrogen peroxide solution. She records the time taken for the slice to rise to the surface due to the bubbles of oxygen forming on it.

Her results are shown in Table 1.1.

Table 1.1

thickness of potato slice / mm	time taken to rise to surface / s		
	experiment 1	experiment 2	average
5	26	29	27.5
4	19	22	
3	15	16	
2	11	10	
1	7	3	5.0

- (a) Calculate the average time for each thickness of potato slice to complete Table 1.1. Two have been done for you. [1]
- (b) On the grid provided label the axes and plot a graph of average time taken on the vertical axis against slice thickness on the horizontal axis. Draw a best-fit straight line going through the origin.



[4]

(c) Use your graph to estimate the average time that a 2.5 mm slice would take to rise to the surface. Draw lines on your graph to show how you worked this out.

..... s [2]

(d) Using your knowledge of enzymes, predict what will happen if the experiment is carried out at 5 °C,

.....
boiled potato is used for this experiment.

..... [1]

(e) Describe a simple test to prove that oxygen gas is produced in this experiment.

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

- 2 A student is provided with four solid compounds, **A**, **B**, **C** and **D**. She is told that **A** and **B** are sodium salts.

She carries out a number of tests to identify the four compounds. She is provided with the following reagents

- ammonia solution,
- barium chloride solution,
- dilute hydrochloric acid,
- limewater,
- silver nitrate solution.

- (a) (i) The student is told that one of the compounds is sodium carbonate.

She knows that one of the reagents will produce a gas with sodium carbonate. She tests all four compounds separately with this reagent.

Name this reagent and the gas produced.

name of reagent

name of gas

[2]

- (ii) Describe a test that will identify the gas produced in (a)(i) and give the expected positive result.

test

result

[2]

She decides that solid **B** is sodium carbonate.

- (b) She makes solutions of the remaining solids to make solutions **A**, **C** and **D**.

To a portion of each solution she adds silver nitrate solution. A white precipitate appears in solution **A**. There is no change in solutions **C** and **D**.

Name compound **A**.

..... [1]

(c) The student tests separate portions of solutions **C** and **D** with

- barium chloride solution,
- ammonia solution until there is no further change.

From her observations she concludes that compound **C** is zinc sulfate and compound **D** is copper sulfate.

Complete Table 2.1 with the observations the student makes to allow her to identify compounds **C** and **D**.

Table 2.1

reagent added	observation with C	observation with D
barium chloride solution		
ammonia solution		

[5]

- 3 A student is measuring the focal length of a converging lens.

He sets up the apparatus as shown in Fig. 3.1.

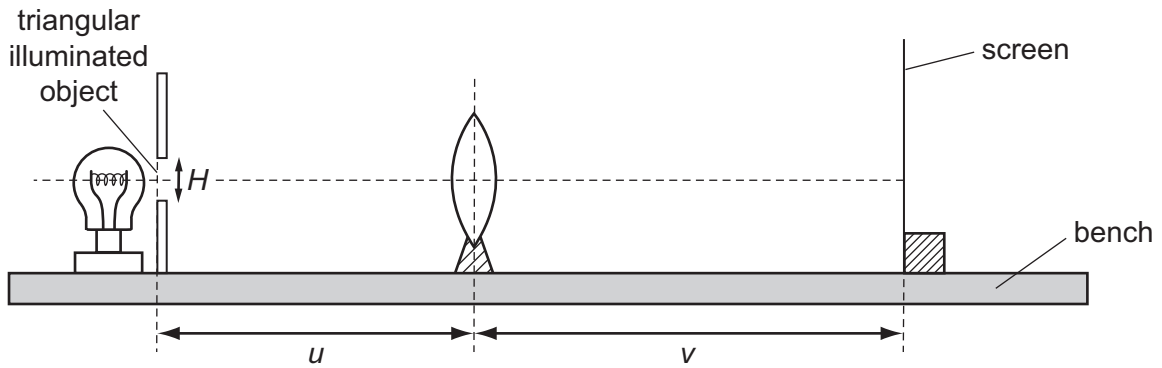


Fig. 3.1

The illuminated object is made by cutting a triangle out of a piece of card. The hole is covered with translucent paper as shown in Fig. 3.2.

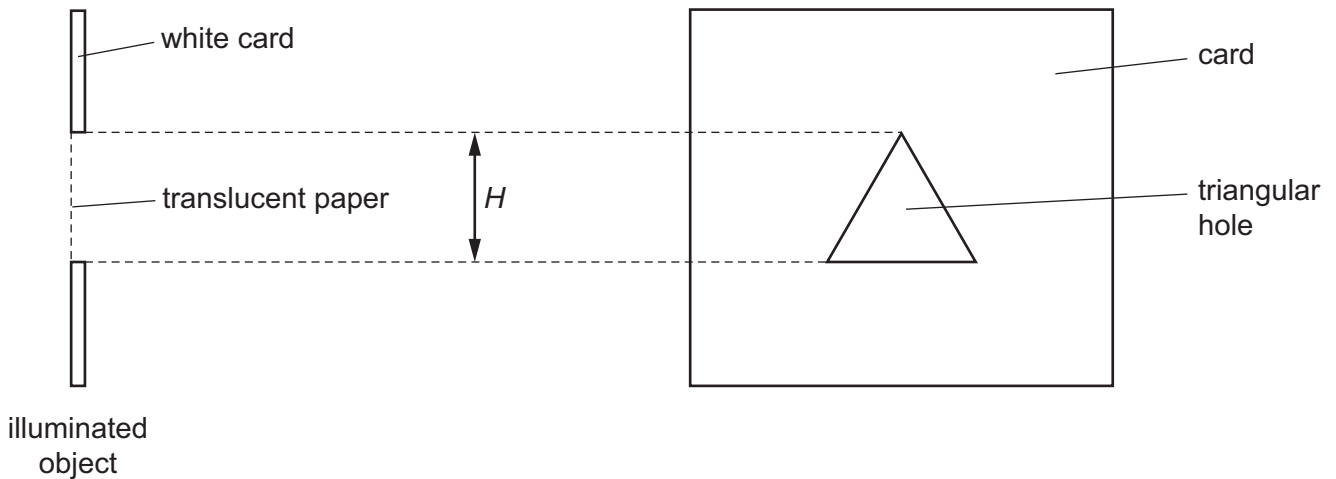


Fig. 3.2

- (a) Use a ruler to measure and record to the nearest millimetre the height H of the triangular hole in Fig. 3.2.

$$H = \dots\dots\dots \text{mm} \quad [1]$$

The student switches on the lamp and places the lens at a distance $u = 25.0$ cm from the illuminated object.

He adjusts the position of the screen by moving it backwards and forwards along the bench until a sharp triangular inverted image of the illuminated object is formed on the screen.

He measures and records in Table 3.1 the image distance v from the screen to the lens.

He also measures and records in Table 3.1, the new height h of the image in millimetres.

Table 3.1

u/cm	v/cm	h/mm	$m = \frac{h}{H}$
25.0	37.4	25	
30.0	30.2	17	
35.0	26.3		
40.0	24.2		
45.0	22.3	8	

He repeats the procedure for values of u of 30.0 cm, 35.0 cm, 40.0 cm and 45.0 cm.

(b) Fig. 3.3 shows the actual sizes of the triangular images when $u = 35.0$ and 40.0 cm.

Use a ruler to measure and record, in Table 3.1, the heights h in millimetres of the triangular images. [1]

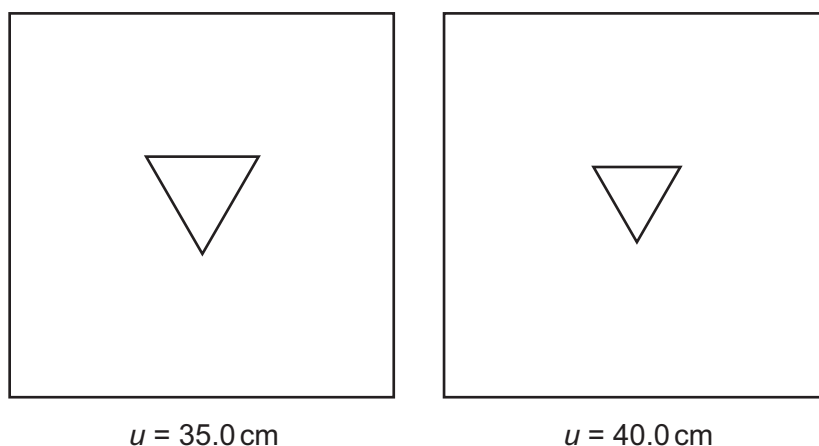


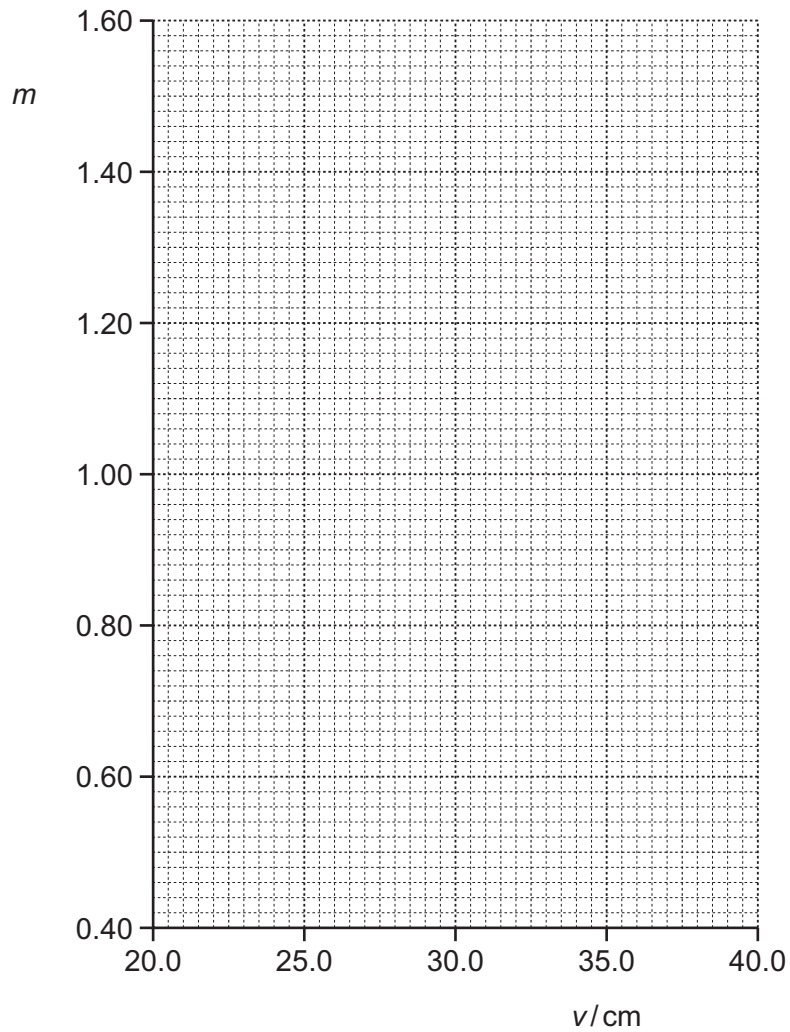
Fig. 3.3

(c) Use your result from (a) and the values of h in Table 3.1 to complete the final column in Table 3.1 by calculating the ratio $\frac{h}{H}$.

Record your answers to **two** decimal places. [2]

This ratio is called the magnification m of the image.

(d) (i) On the grid provided, plot a graph of m against v . Draw the best-fit straight line. [2]



(ii) Calculate the gradient of the line. Show clearly, **on the graph**, how you did this.

gradient = [2]

(iii) Calculate the focal length f of the lens using the equation

$$f = \frac{1}{\text{gradient}}$$

$f =$ cm [1]

(e) State **one** precaution that the student should take to obtain accurate results in this experiment.

.....
 [1]

- 4 *Daphnia* are transparent aquatic animals that can be viewed using a microscope allowing their heart rate to be measured and recorded. Fig. 4.1 shows a *Daphnia* viewed with a microscope.

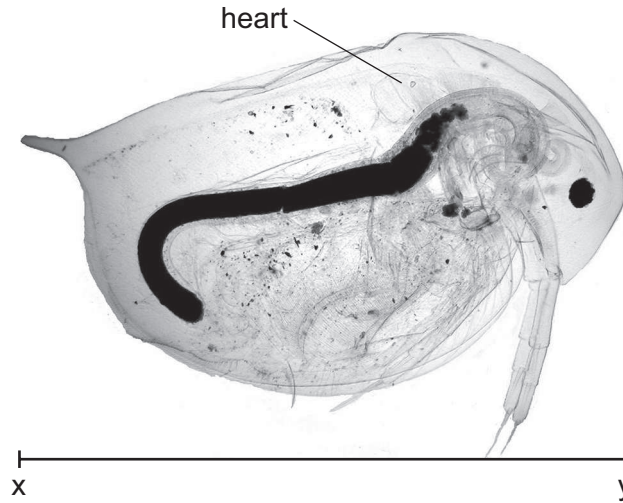


Fig. 4.1

A student investigates the effect of some solutions on the heart rate of *Daphnia*. His results are shown in Table 4.1.

Table 4.1

solution	heart rate in beats per minute			
	experiment 1	experiment 2	experiment 3	average
pond water	213	312	300	275
cola	374	389	365	376
coffee	386	409	402	399
decaffeinated coffee	290	324	298	304

- (a) (i) Explain how the student has made the investigation reliable.

..... [1]

- (ii) The teacher suggests to the student that the average result for pond water is not reliable.

Explain the reason for this.

..... [1]

- (iii) Suggest what the student can do to make the average result for pond water more reliable.

..... [1]

(b) Explain why pond water was used for the first set of experiments.

..... [1]

(c) (i) Cola and coffee contain a chemical called caffeine. Use the results in Table 4.1 to describe the effect that caffeine has on the heart rate of *Daphnia*.

..... [1]

(ii) The makers of decaffeinated coffee claim that all of the caffeine has been removed.

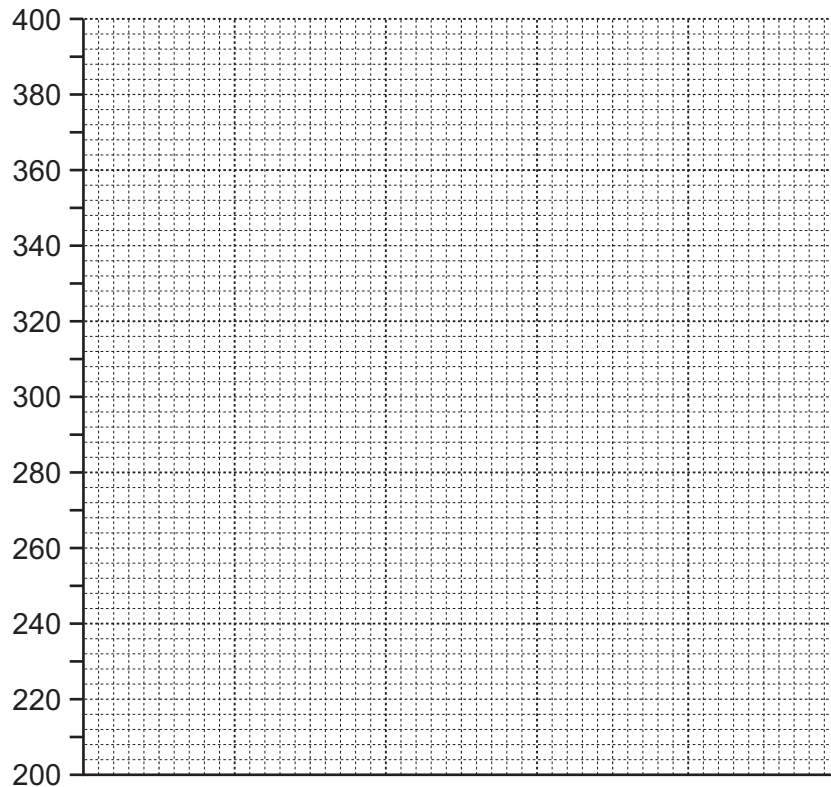
Use the results in Table 4.1 to comment on the accuracy of this claim.

agree/disagree with claim (delete as appropriate)

comment

..... [1]

(d) Using the grid below, draw a bar chart of heart rate on the vertical axis against solution.



[2]

(e) (i) Measure the line $x - y$ on Fig. 4.1 in millimetres.

..... mm [1]

(ii) The *Daphnia* is viewed using a magnification of $\times 40$.

Use your measurement in (e)(i) to calculate the actual size of the *Daphnia*.

Show your working.

..... mm [1]

- 5 A student is looking at some of the elements in Group V of the Periodic Table as shown in Fig. 5.1.

14 N Nitrogen 7
31 P Phosphorus 15
75 As Arsenic 33
122 Sb Antimony 51
209 Bi Bismuth 83

Fig. 5.1

The student examines a sample of nitrogen. Fig. 5.2 is an extract from his notebook with his observations.

Nitrogen

Nitrogen is a colourless,
odourless gas. When tested
with a lighted splint, the splint
goes out immediately.

Fig. 5.2

- (a) The student reads that ammonia, a compound of nitrogen, also extinguishes a lighted splint.

State a test, and give the positive result, the student could use to show that a sample of gas is ammonia.

test

positive result

[2]

- (b) The student heats a sample of phosphorus on a spoon. He then puts the spoon and phosphorus into a gas jar of oxygen as shown in Fig. 5.3.

The phosphorus burns and acidic phosphorus oxide is produced.

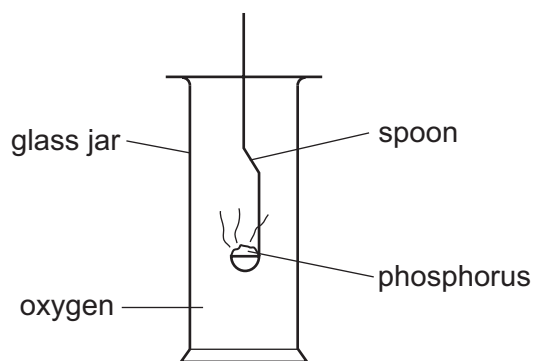


Fig. 5.3

Describe a test and give the result to show that the phosphorus oxide produced in Fig. 5.3 is acidic.

test

result [2]

Arsenic and antimony are metalloids.

Metalloids have some properties characteristic of metals and some other properties characteristic of non-metals.

- (c) The student writes some properties of metals and non-metals in his notebook as shown in Fig. 5.4.

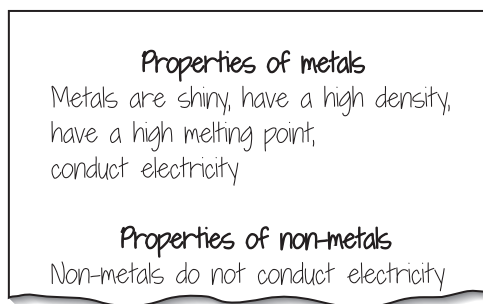


Fig. 5.4

The page has been torn and some of the properties of non-metals missing.

State **two** other properties of non-metals.

property 1

property 2

[1]

(d) (i) Bismuth is a soft silver coloured solid. The student thinks that bismuth is a metal.

Draw a circuit that the student can use to prove that bismuth conducts electricity.

[2]

(ii) Describe an experiment that the student can do to place bismuth into the reactivity series of metals.

.....

.....

.....

.....

..... [3]

6 A student is investigating a pendulum.

He sets up the apparatus as shown in Fig. 6.1.

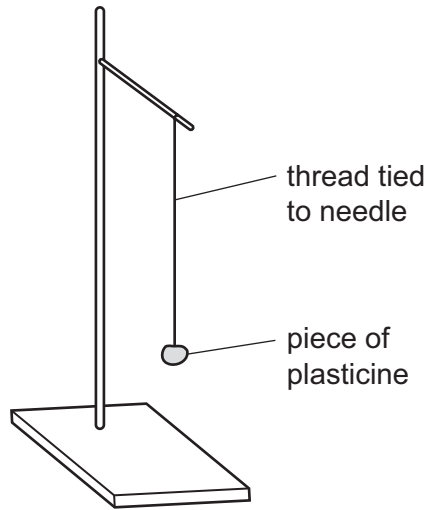


Fig. 6.1

(a) He wants to find out as **accurately** as possible the time taken for one complete swing of the pendulum. This is known as the period of the pendulum.

Describe the best way to find the value of the period of the pendulum.

.....

..... [1]

He finds the mass m of the plasticine using a balance. Fig. 6.2 shows the balance window.

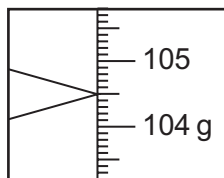


Fig. 6.2

(b) Read and record the mass m of the plasticine.

$m =$ g [1]

- The student finds the period of the pendulum and records it in Table 6.1.
- He removes some of the plasticine so that the mass of the pendulum is reduced by 10g and finds the new period.
- He reduces the mass by a further 10g and finds the new period.
- He repeats this twice more and his results are shown in Table 6.1.

Table 6.1

mass of plasticine /g	period /s
m	2.03
$m-10$	2.05
$m-20$	1.98
$m-30$	2.02
$m-40$	2.06

- (c) Comment on the results and decide if the mass of the plasticine has any effect on the period of the pendulum.

Explain your answer.

.....

.....

..... [2]

The student does another experiment. This time he keeps the mass of the pendulum constant and varies the length of the thread.

He uses a different piece of plasticine with a new mass.

He finds the new mass of the plasticine using a balance. Fig. 6.3 shows the balance window.

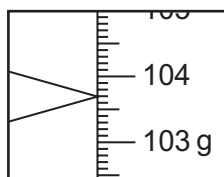


Fig. 6.3

(d) Read and record the mass m of the plasticine.

$m =$ g [1]

- The student makes the length of the thread between the needle and the plasticine 100 cm and measures the period.
- He records the time in Table 6.2.
- He reduces the length of thread and finds the new period.
- He does this several times.
- His results are in Table 6.2.

Table 6.2

length of string / cm	period / s
100	2.00
78	1.80
61	5.50
38	1.20
19	0.85
$h =$	0.45

(e) Measure the length of the thread h in Fig. 6.4 and complete the last row in Table 6.2. [1]

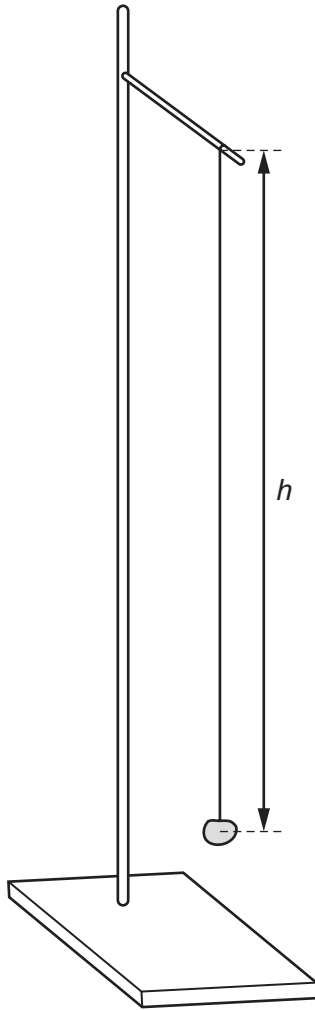


Fig. 6.4

(f) Comment on the results and decide if the length of the thread has any effect on the period of the pendulum.

Explain your answer.

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

(g) Suggest **one** improvement to this second experiment that would increase the reliability of the results.

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

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