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* 7 0 2 3 1 4 9 6 2 8 *

0653/61

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 **15** printed pages and **1** blank page.

- 1 A student investigates plant transport systems using a celery stalk and coloured water.

He cuts a piece of celery stalk and places it into some coloured water for five minutes with the freshly cut end downwards as shown in Fig. 1.1.

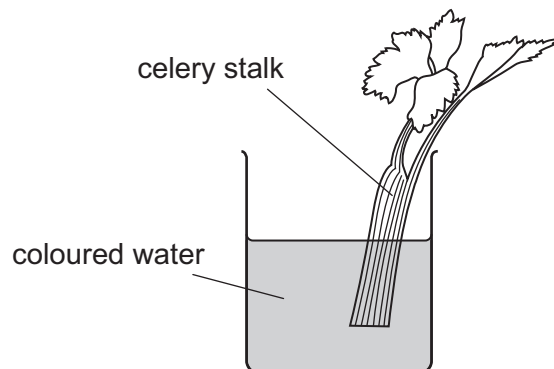


Fig. 1.1

After five minutes he removes the stalk from the coloured water and cuts a slice from the end. Fig. 1.2 shows what the cross section looks like.

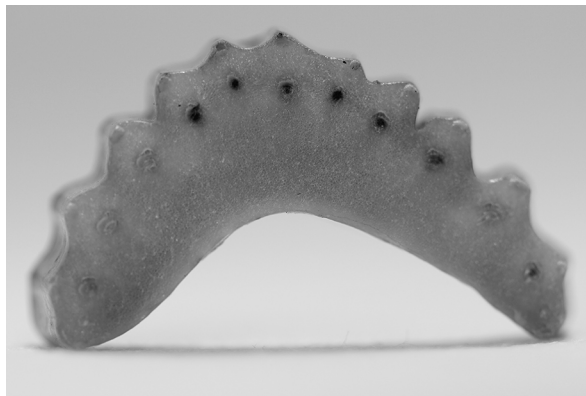
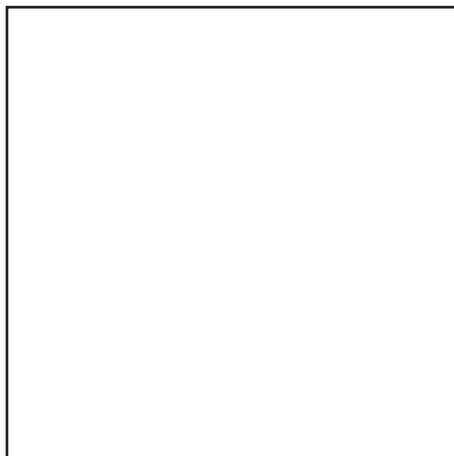


Fig. 1.2

- (a) (i) In the space below make a pencil drawing of the piece of celery stalk in Fig. 1.2 to show the shape of the outline. Label **two** of the stained areas.



[2]

- (ii) Name the tissue that has become coloured and state what can be concluded about its function.

name

function

[2]

- (b) The student crushes a piece of the celery with distilled water using a pestle and mortar.

- He divides the mixture between three test-tubes.
- To one test-tube he adds an equal amount of Benedict's solution and then places it in a hot water-bath for about five minutes.
- To a second test-tube he adds biuret solution.
- To the third test-tube he adds iodine solution.

His observations are shown in Table 1.1.

Table 1.1

test	observation	conclusion
Benedict's solution	orange	
biuret solution	blue	
iodine solution	orange	

Complete Table 1.1 by writing a conclusion for each of the three tests.

[3]

- (c) Plan an experiment based on the method described above, to investigate the effect of temperature on the speed of movement of the coloured water in pieces of celery stalk.

.....

.....

.....

.....

.....

.....

..... [3]

- 2 A student is finding the spring constant k of a spring. The spring constant of a spring is a measure of the spring's stiffness.

She sets up the apparatus as shown in Fig. 2.1.

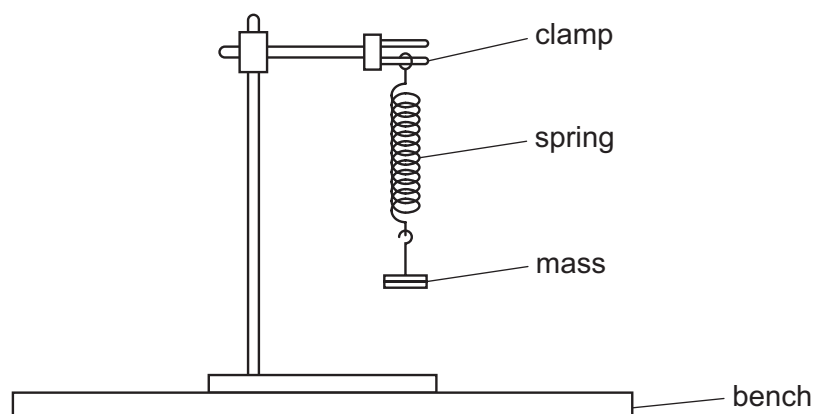


Fig. 2.1

- She hangs a mass m of 0.20 kg on the spring.
 - She pulls the 0.20 kg mass down a small distance and releases it.
 - The mass oscillates up and down.
 - The period T of the oscillations is the time taken for **one** oscillation. This is difficult to measure accurately so she measures the time taken t for 20 oscillations.
 - She enters this value in Table 2.1.
 - She calculates the values of T and T^2 and enters them in Table 2.1.
 - She repeats this with masses m of 0.30 kg, 0.40 kg and 0.50 kg.
- (a) Fig. 2.2 shows the stopwatches for the time taken for 20 oscillations when $m = 0.30$ kg and 0.40 kg.

Read the stopwatches and record the times, to the nearest second, in Table 2.1.

[1]

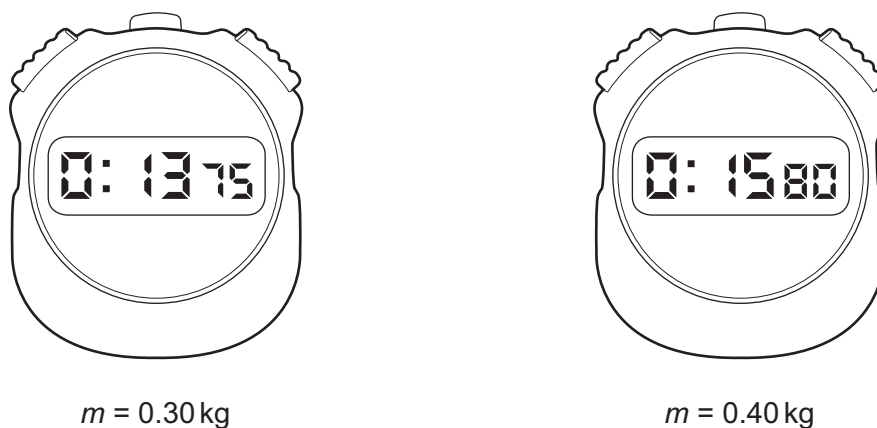


Fig. 2.2

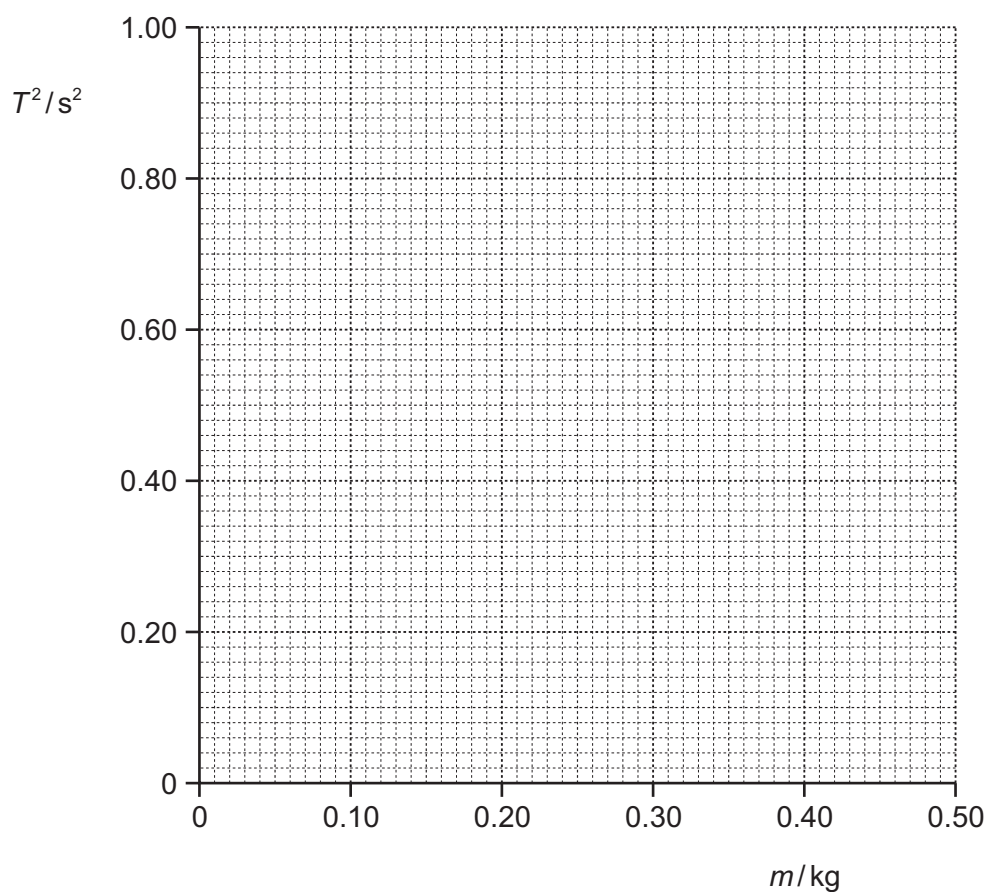
- (b) (i) Complete Table 2.1 by calculating T and T^2 , for $m = 0.30$ kg and 0.40 kg to two decimal places. [3]

Table 2.1

mass m /kg	time for 20 oscillations t /s	period T /s	T^2/s^2
0.20	11	0.55	0.30
0.30			
0.40			
0.50	18	0.90	0.81

- (ii) On the grid provided, plot a graph of T^2 against m .

Draw the best fit straight line through the origin.



[2]

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

gradient = ... [2]

- (iv) Use your value from (iii) to calculate the value of the spring constant k of the spring from the equation

$$k = \frac{39.5}{\text{gradient}}$$

Give your answer to two significant figures.

$k =$ N/m [2]

Please turn over for Question 3.

- 3 A student is given a solid, **X**, which is a mixture of three metal oxides **A**, **B** and **C**. She is told that one of the oxides is soluble in water.

- (a) She places some of the solid **X** into a beaker and adds some distilled water. She stirs the mixture for 30 seconds and then filters it. She keeps the residue for use in (b).

She pours the filtrate into two test-tubes.

- (i) To the first test-tube of filtrate she adds Universal Indicator (full range) solution. The student concludes that the filtrate is alkaline.

Suggest the colour observed by the student and hence give the pH.

colour

pH [1]

- (ii) She bubbles carbon dioxide through the other test-tube of filtrate.

A white precipitate forms in the filtrate.

State the name of the filtrate and so deduce the name of one of the oxides present in solid **X**. This is metal oxide **A**.

name of filtrate

name of metal oxide **A** [2]

- (b)** The student adds dilute nitric acid to the residue from part **(a)** and warms it gently until it dissolves. She pours the resulting solution into two test-tubes until they are each one third full.

To the first test-tube the student adds aqueous sodium hydroxide until no further changes are observed.

To the second test-tube she adds aqueous ammonia until no further changes are observed.

She concludes that the copper(II) ion is present in the solution and has come from metal oxide **B**.

- (i)** Describe the observations that confirm the presence of copper(II) ions.

observations with aqueous sodium hydroxide

.....

.....

observations with aqueous ammonia

.....

.....

[3]

- (ii)** State the formula for the metal oxide **B**.

formula of metal oxide **B** [1]

- (c)** Metal oxide **C** is zinc oxide.

Starting with a pure sample of zinc oxide, describe how the student can confirm the presence of zinc ions. Include any reagents she uses and the observations that she makes.

.....

.....

.....

..... [3]

- 4 (a) A student is looking at a sample of blood using a microscope. Blood has four main components. These are labelled **A** to **D** in Fig. 4.1.

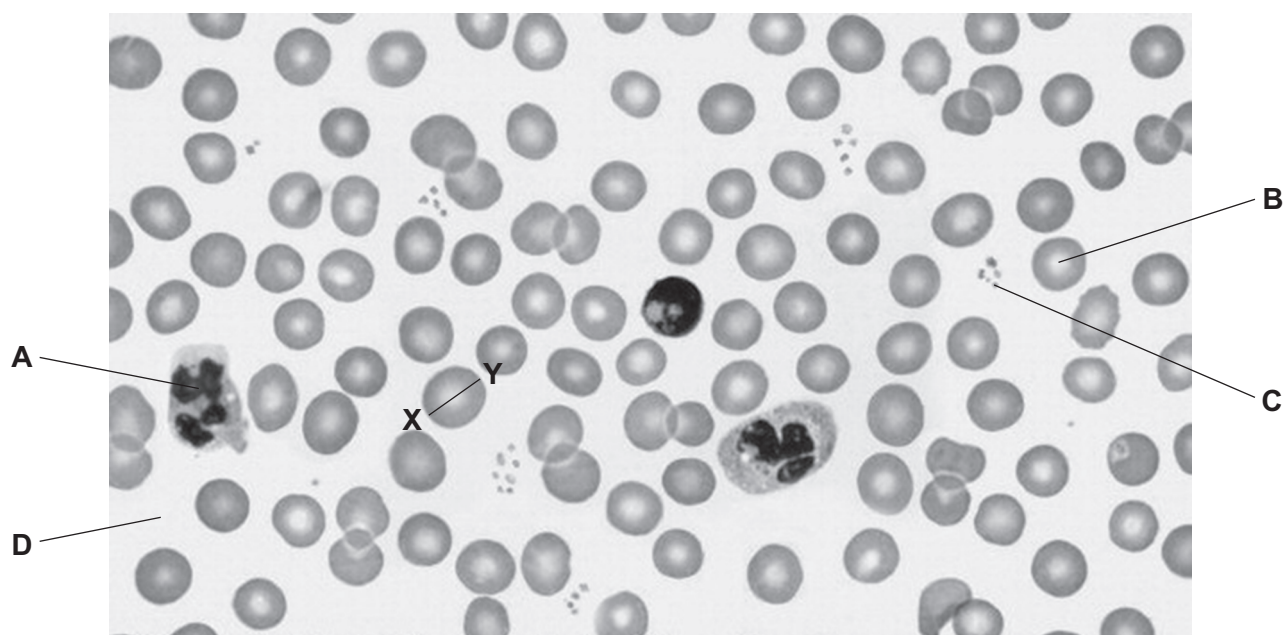


Fig. 4.1

- (i) Name the components **A** to **D** in Fig. 4.1.

A

B

C

D

[4]

- (ii) Measure the length of the line **X–Y** in Fig. 4.1 in millimetres.

..... mm [1]

- (iii) The magnification of the photograph in Fig. 4.1 is $\times 1000$. Use this information and your measurement in (a)(ii) to calculate the actual diameter in millimetres of the component with the line **X–Y** in Fig. 4.1.

Show your working.

actual diameter = ... mm [2]

(b) Some students investigate the effect of physical activity on pulse rate.

- They record their pulse as the number of beats in 15 seconds.
- They each jog on a treadmill for 5 minutes and immediately record their pulse again as the number of beats for 15 seconds.

The students' results are shown in Table 4.1.

Table 4.1

recording	average number of beats in 15 seconds	average heart rate in beats per minute
before jogging	17	
after jogging	35	

(i) Complete Table 4.1 by calculating the average pulse rates in beats per minute. [1]

(ii) Suggest why the pulse rate changes after jogging.

..... [1]

(iii) Explain why this method is more reliable than just one student using only their own pulse rate.

..... [1]

- 5 (a) The teacher gives a student some lamps. The teacher says that some of the lamps do not work.

Outline a procedure the student can use to identify which lamps are working and which are not. Include the names of the pieces of apparatus that the student must use. You should include a diagram in your answer.

.....

.....

.....

..... [3]

- (b) The student finds five lamps are working.

Draw a circuit diagram using **one** lamp only to show how the student can find the current passing through it and the potential difference across it.

- (c) The student repeats the procedure in (b) for the other four lamps in turn.

Construct a table, with headings, the student can use to record the current and potential difference for each lamp.

Remember to include units.

[3]

- (d) Explain how the student can calculate the resistance of each lamp from the readings in the table.

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

- 6 (a) A student is investigating the reaction between magnesium and hydrochloric acid.

He places a piece of magnesium ribbon 1 cm in length into a test-tube of hydrochloric acid. He sees bubbles of gas given off.

Name the gas.

Describe a test for this gas, including the result which confirms its identity.

name of gas

test

result

[3]

- (b) The student investigates how much gas is given off when all the magnesium reacts. He adds hydrochloric acid to a piece of magnesium ribbon in a conical flask and quickly attaches apparatus so he can measure the volume of gas given off.

Draw a labelled diagram of the complete apparatus he uses.

[2]

- (c) The student adds a 2 cm length of magnesium ribbon to a fresh supply of hydrochloric acid. He measures the total volume of gas collected every 30 seconds for 3 minutes.

He plots his results as shown in Fig. 6.1.

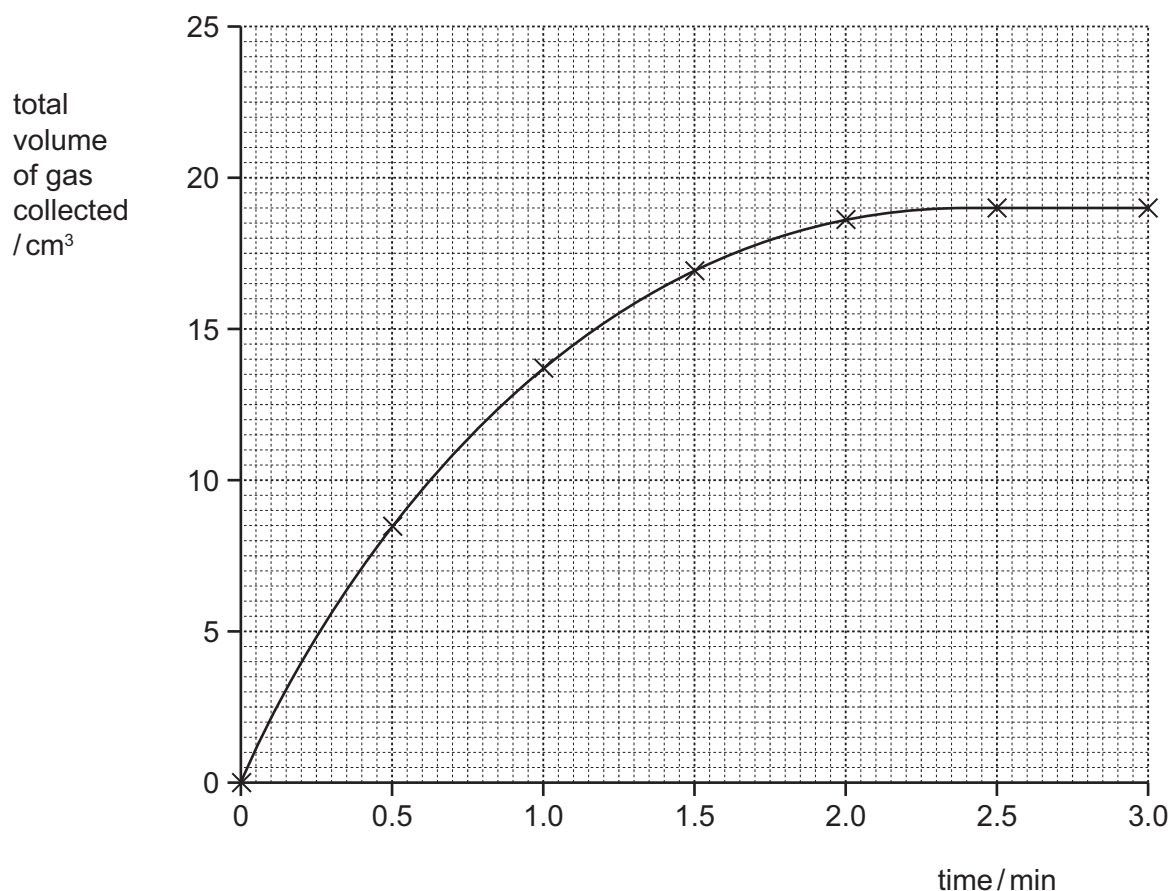


Fig. 6.1

- (i) Describe what happens to the rate of this reaction during the 3 minute period.

.....

 [2]

- (ii) Suggest a reason for the rate of reaction between 2.5 and 3 minutes.

.....

 [1]

- (d) He does a second experiment with a new 2 cm length of magnesium ribbon and the same volume and concentration of acid, but at a higher temperature.

Draw on Fig. 6.1 the curve that the student draws. **Label your curve T.**

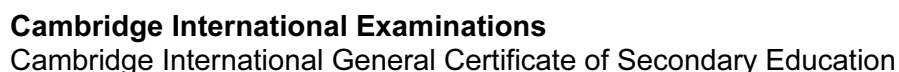
[2]

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0653/62

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1 hour

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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.

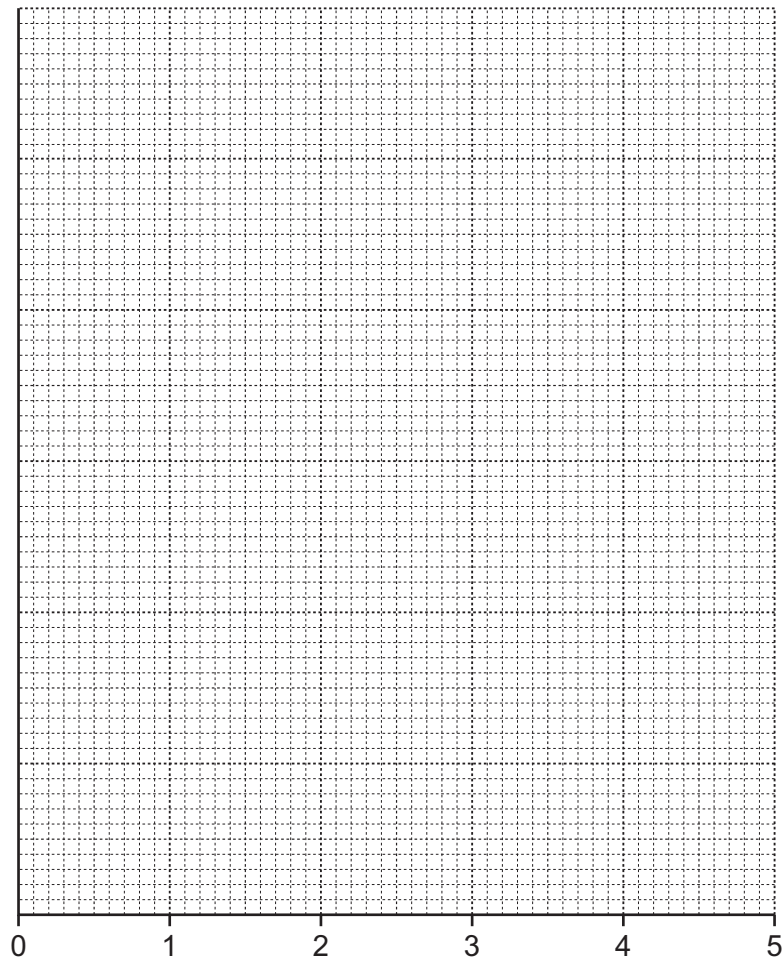
The student places a potato slice at the bottom of a beaker containing hydrogen peroxide solution. She records the time taken for the slice to rise to the surface due to the bubbles of oxygen forming on it.

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]

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

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

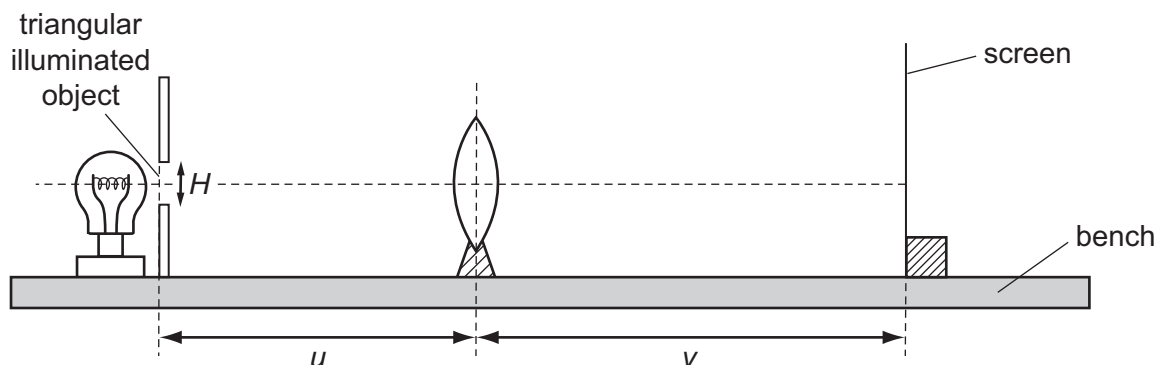


Fig. 3.1

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.

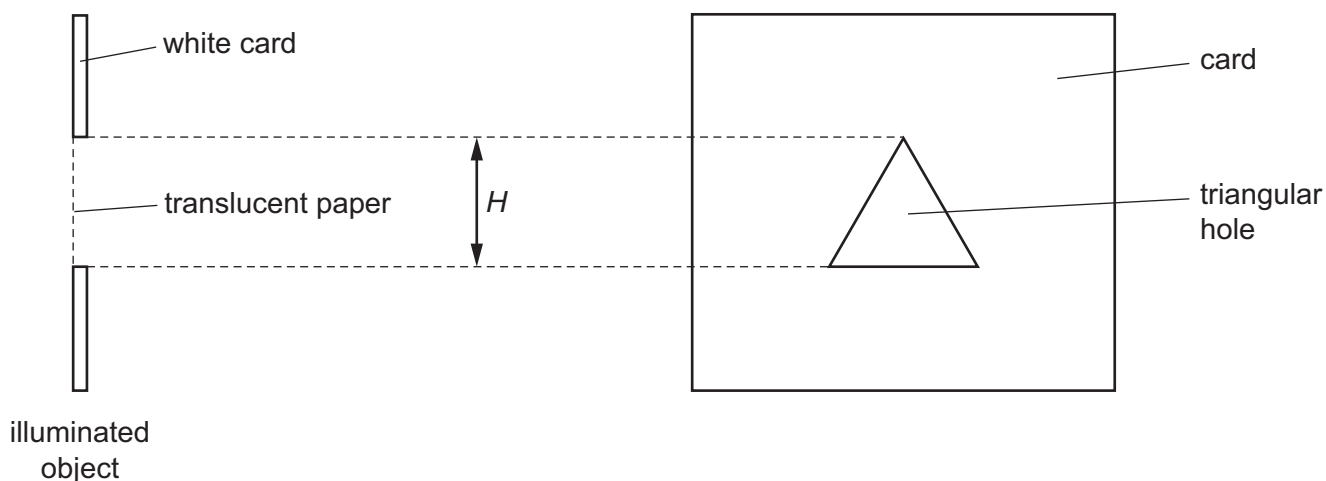


Fig. 3.2

- (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 $u = 25.0 \text{ cm}$ 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]

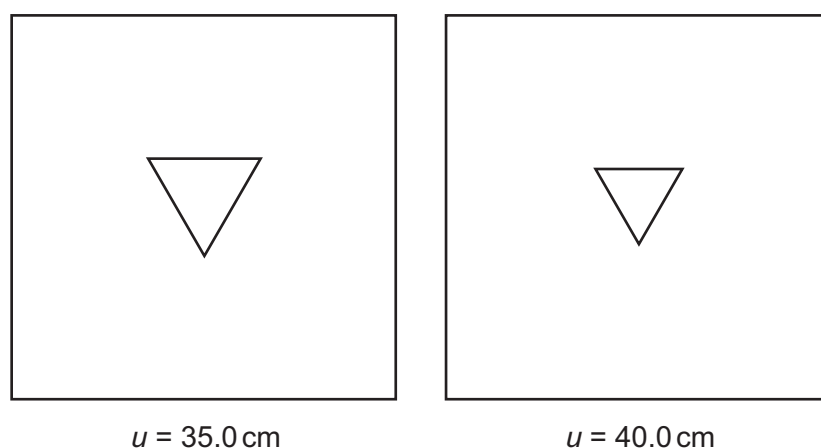


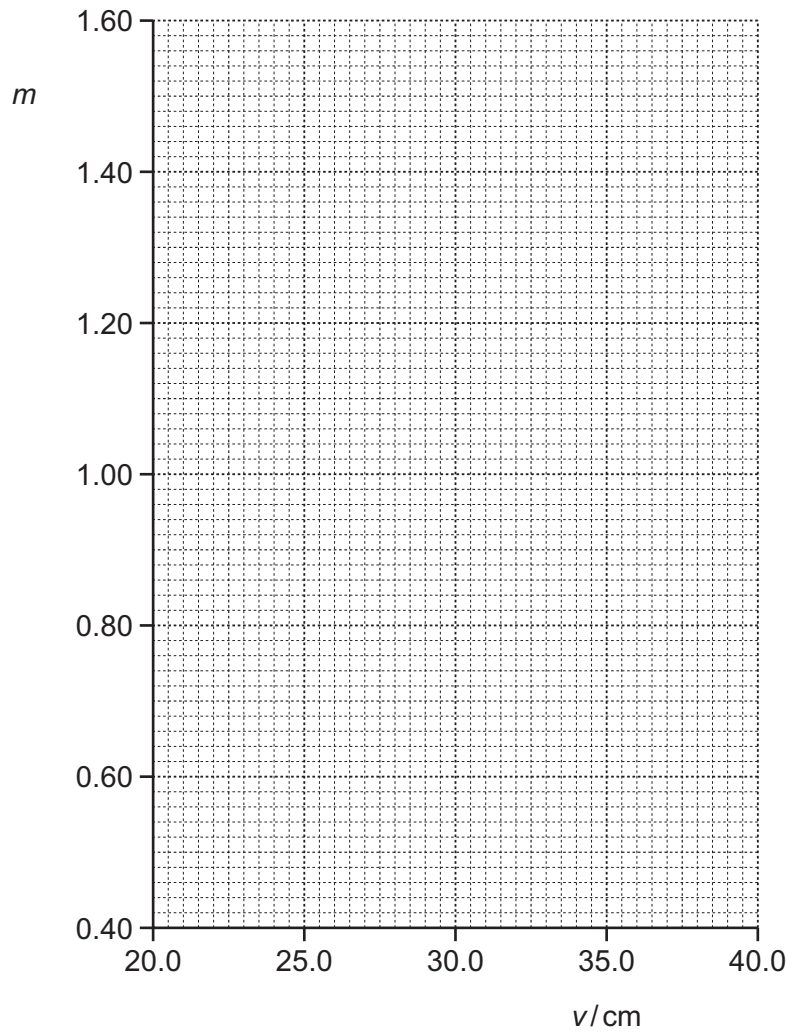
Fig. 3.3

(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

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

$f = \dots\dots\dots$ 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.

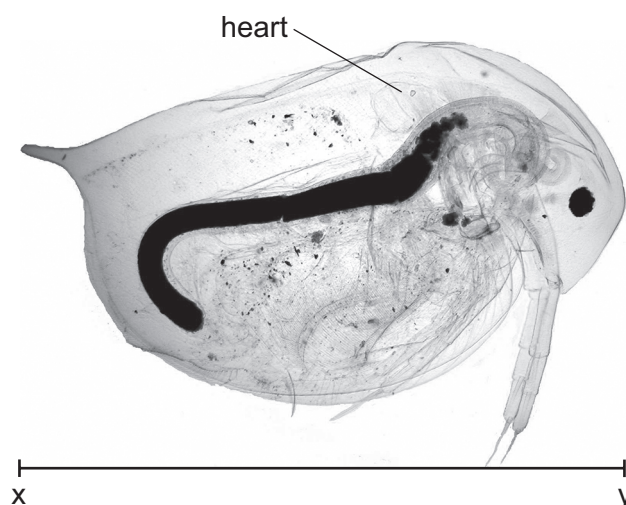


Fig. 4.1

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.

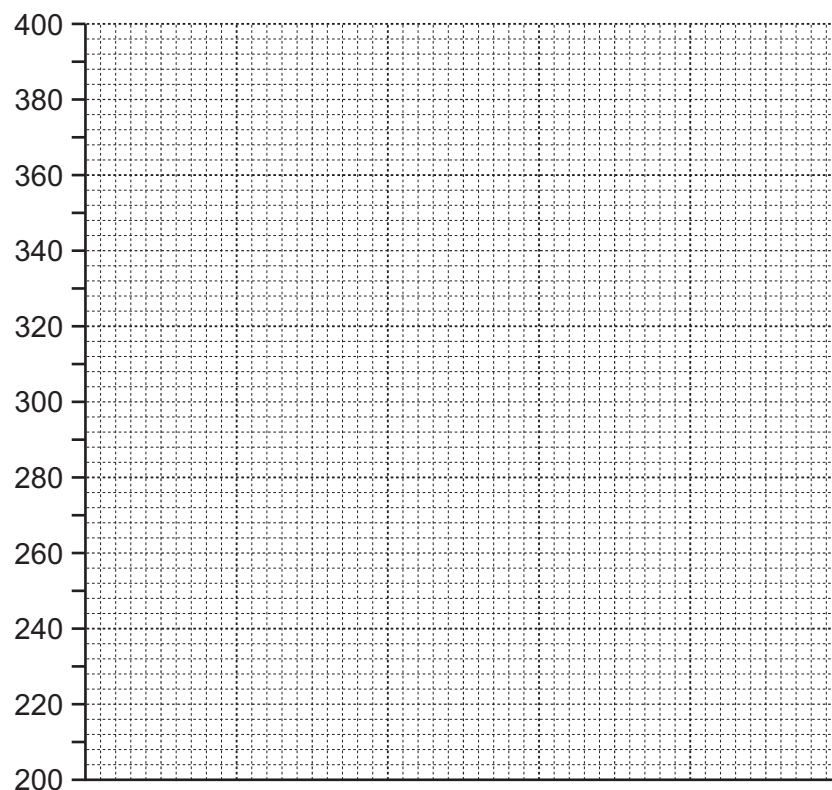
Use the results in Table 4.1 to comment on the accuracy of this claim.

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.

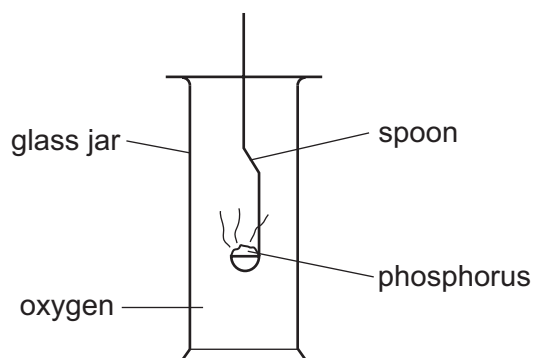


Fig. 5.3

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.

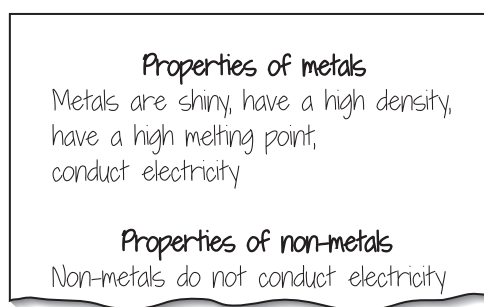


Fig. 5.4

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.

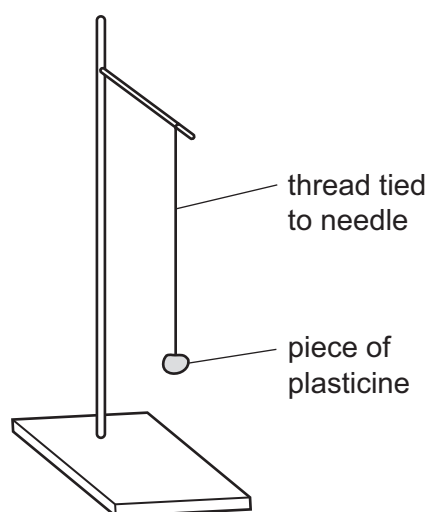


Fig. 6.1

- (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.

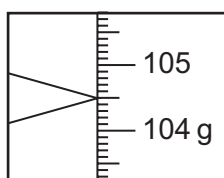


Fig. 6.2

- (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.

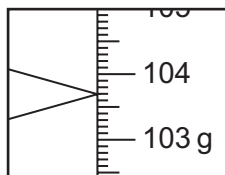


Fig. 6.3

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

$m = \dots\dots\dots$ 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	1.50
38	1.20
19	0.85
$h = \dots\dots\dots$	0.45

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

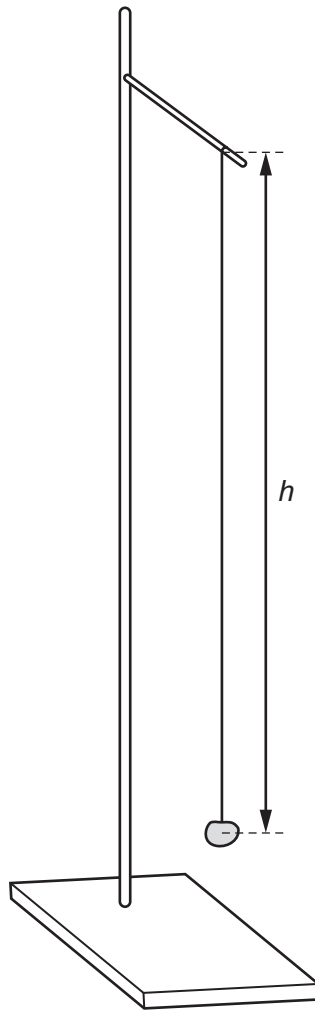


Fig. 6.4

- (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.

.....

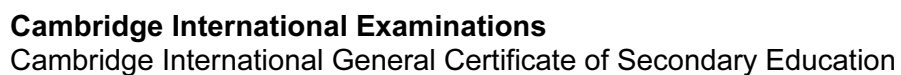
..... [1]

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0653/63

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 A student is investigating respiration in yeast cells.

She uses the indicator methylene blue to measure the rate of respiration. A solution of methylene blue is decolourised when oxygen is removed by respiration.

She sets up three test-tubes labelled **A**, **B** and **C** as shown in Fig. 1.1.

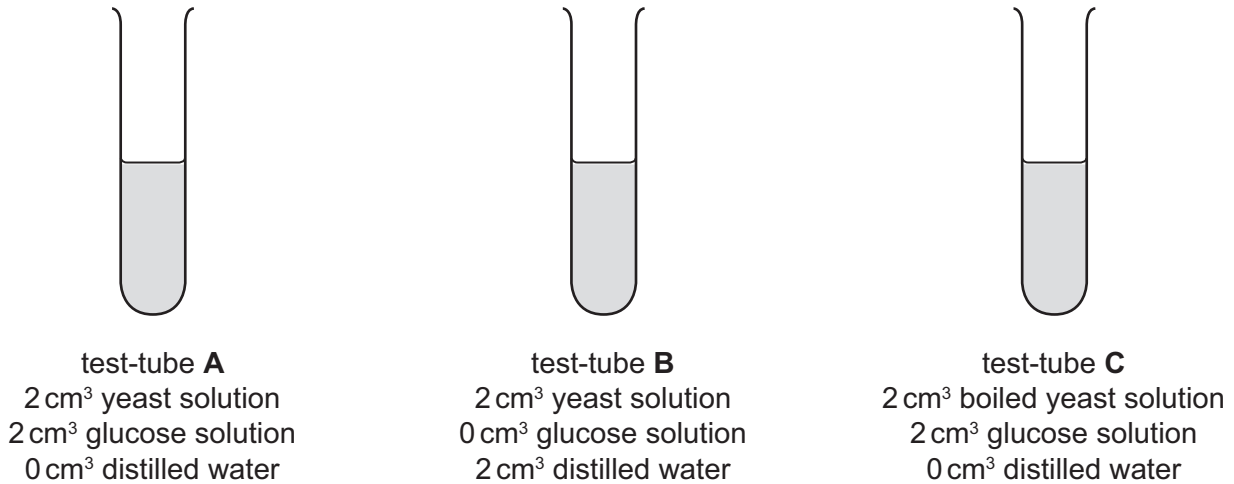


Fig. 1.1

- She places the three test-tubes in a water bath at 35 °C for 5 minutes.
- She adds 2 cm³ methylene blue indicator to each test-tube.
- She starts a stopclock.
- She observes the colour of each test-tube each minute for 6 minutes.

Results

The indicator in test-tube **A** decolourised at 2 minutes.
 The indicator in test-tube **B** decolourised at 5 minutes.
 There is no change in test-tube **C**.

(a) Explain why there is no change in test-tube **C**.

.....
 [1]

(b) Use all the information given above to complete the heading for column 1 and the observations in Table 1.1 on page 3.

Table 1.1

.....	colour in test-tube A	colour in test-tube B	colour in test-tube C
1	blue	blue	blue
2			
3			
4			
5			
6			

[4]

(c) (i) Explain why distilled water is added to test-tube **B**.

.....
 [1]

(ii) Describe and explain the difference in results for test-tubes **A** and **B**.

.....

 [2]

(d) She removes test-tube **A** from the water bath and shakes it vigorously until it froths.

Describe and explain what you would expect to observe.

.....

 [2]

2 A student is given a sample of a solid **D**.

She is told that it contains the three ions Fe^{2+} , NH_4^+ and SO_4^{2-} .

(a) Describe a procedure that she can carry out to show that solid **D** contains Fe^{2+} ions.

Name any chemicals used and state the observations expected.

.....

.....

.....

.....

..... [3]

(b) The student is given pieces of red and blue litmus paper.

Describe how she can use these pieces of litmus paper to show that solid **D** contains the NH_4^+ ion.

.....

.....

.....

.....

..... [3]

(c) Describe a procedure that the student can carry out to show that solid **D** contains the SO_4^{2-} ion.

Name any chemicals used and state the expected observations.

.....

.....

.....

.....

.....

..... [4]

Please turn over for Question 3.

- 3 A student is investigating the resistance of lamps arranged in different ways in electrical circuits. She sets up circuit 1 as shown in Fig. 3.1.

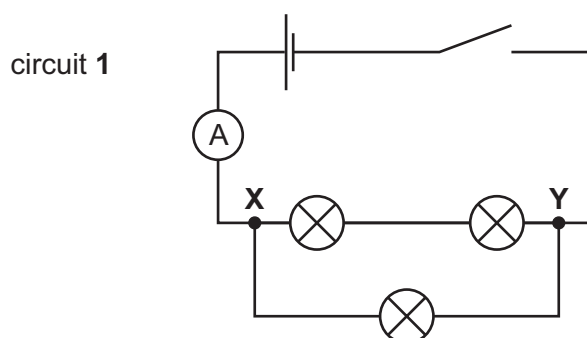


Fig. 3.1

- (a) On Fig. 3.1, draw the symbol for a voltmeter correctly connected to measure the potential difference between point **X** and point **Y**. [2]

- The student connects the voltmeter into the circuit to measure the potential difference between point **X** and point **Y**.
- She closes the switch.
- She measures, and records in Table 3.1, the potential difference V and the current I .
- She opens the switch.

She reconnects the lamps between point **X** and point **Y**, in circuit 2 as shown in Fig. 3.2. The voltmeter is connected in the same place.

She records the new V and I in the next row of Table 3.1.

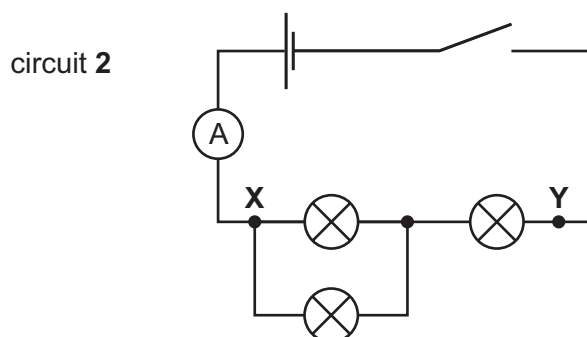


Fig. 3.2

She reconnects the lamps between **X** and **Y** to make circuit 3 as shown in Fig. 3.3.

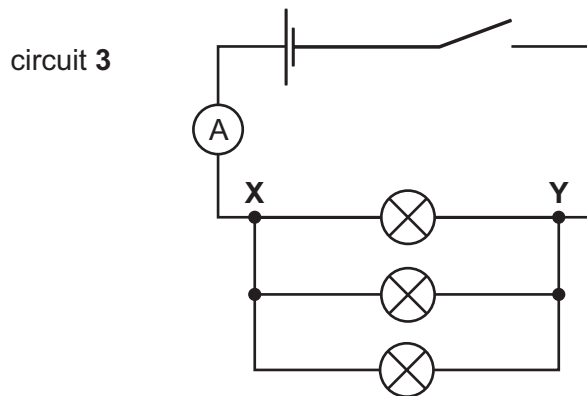


Fig. 3.3

- (b) (i)** Read and record in the last row of Table 3.1 the values of V and I shown in Fig. 3.4. [2]

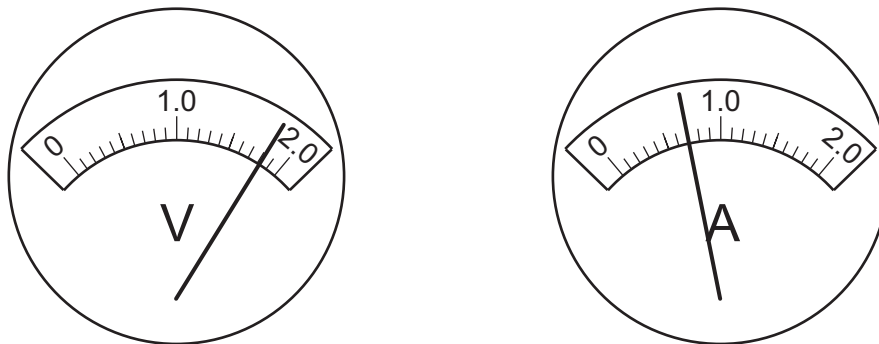


Fig. 3.4

- (ii)** Complete the column headings in Table 3.1 to show the units. [1]

Table 3.1

circuit	V /.....	I /.....	R /.....
1	1.72	0.44	
2	1.76	0.22	
3			

- (iii)** Calculate, and record in Table 3.1, the total resistance R of the lamps in each of the circuits. Use the equation

$$R = \frac{V}{I}$$

[2]

(c) The teacher makes the following suggestion.

“If each lamp has the same resistance, the total resistance of the lamps in circuit **1** should be twice the total resistance of the lamps in circuit **3**.”

State whether the results in Table 3.1 support the teacher’s suggestion.

Justify your statement by using the values of R you have calculated.

statement

justification

.....

[2]

(d) A student observes that the lamps in circuit **1** have different brightness.

Suggest how this might have affected the results of this experiment.

.....

.....

.....

[1]

- 4 A student carries out an experiment to investigate the effect of temperature on the activity of the enzyme pepsin.

Pepsin breaks down protein in the stomach.

The activity of pepsin can be measured by timing how long it takes to break down a cloudy protein solution into a clear solution.

- The student places 5.0 cm^3 of the protein solution into a test-tube and adds 1.0 cm^3 hydrochloric acid.
- He places 1.0 cm^3 of pepsin solution into another test-tube.
- He places both test-tubes into a water-bath at 35°C for five minutes.
- He then pours the pepsin solution into the protein solution and times how long it takes for the contents of the tube to go clear.
- He records this time in Table 4.1.
- He repeats this procedure for the different temperatures as shown in Table 4.1.

The thermometer reading for the last temperature used is shown in Fig. 4.1.

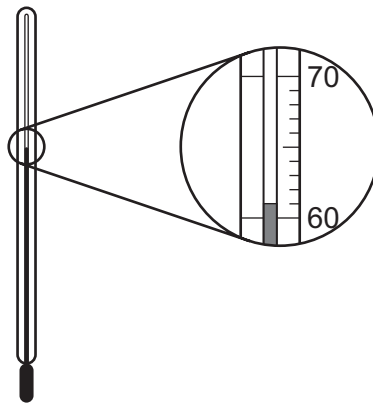


Fig. 4.1

- (a) (i) Read the thermometer in Fig. 4.1 and record the value in the last row of Table 4.1 on page 10. [1]

The stopwatch reading for the final temperature used is shown in Fig. 4.2.



Fig. 4.2

Table 4.1

temperature / °C	time taken for solution to go clear / s	rate of reaction in $\frac{1}{s}$
35	400	0.0025
41	175	0.0057
46	80	0.0125
52	30	0.0333
56	120	0.0083

(ii) Read the stopwatch and record in Table 4.1 the time shown **in seconds**.

[1]

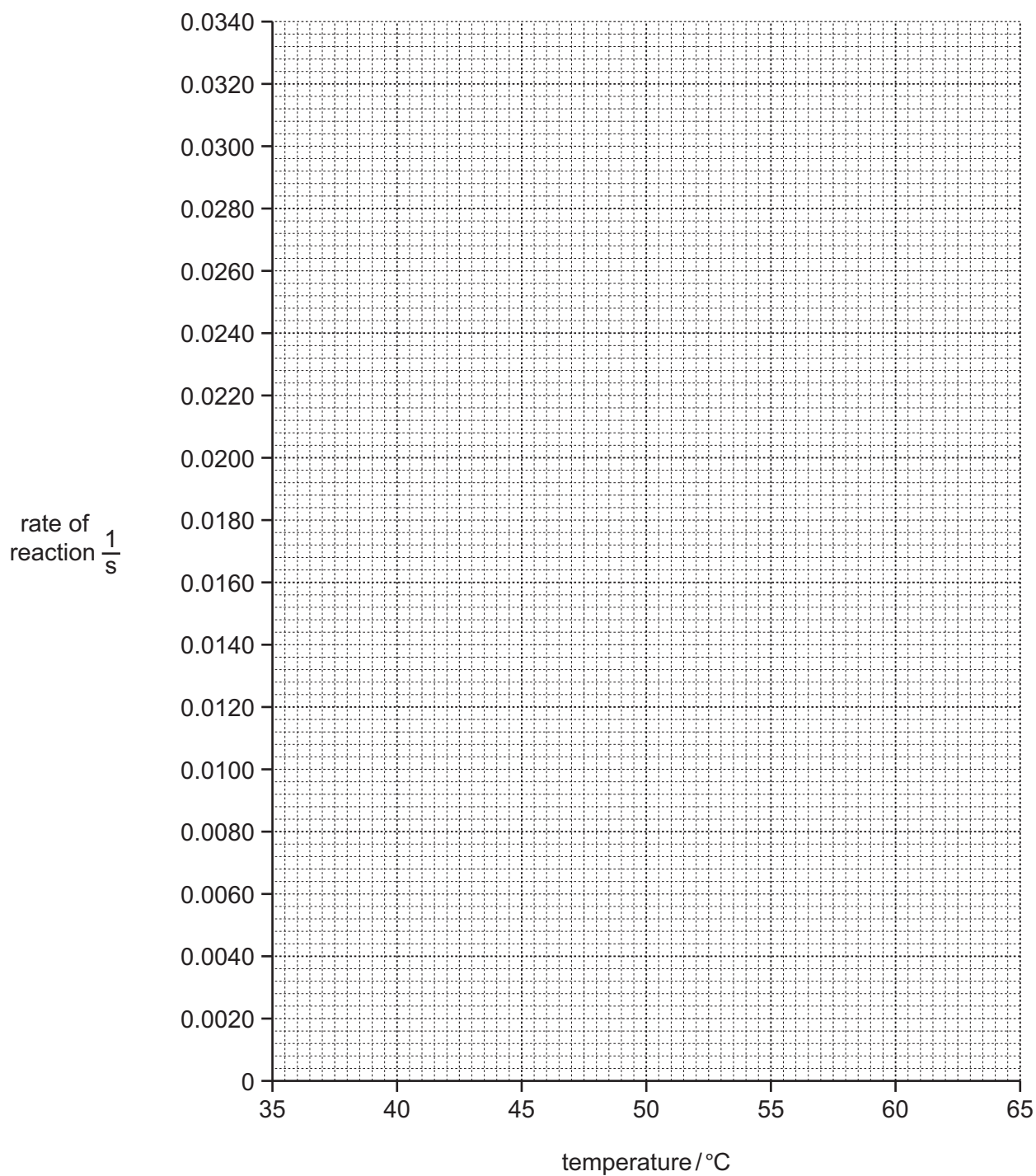
(iii) Complete Table 4.1 by calculating the rate of reaction, $\frac{1}{s}$, for the final temperature.

[1]

(b) (i) On the grid provided, plot a graph of rate of reaction against temperature.

[2]

Draw the best-fit **curve**.



(ii) Use the graph to estimate the optimum temperature for the activity of pepsin.

optimum temperature = ... °C [1]

(iii) Explain why you cannot be sure that this is an accurate optimum temperature.

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

(c) Describe an experiment to show that acid is required for pepsin to break down protein.

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

Please turn over for Question 5.

- 5 A student investigates the electrolysis of brine (salt water).

He sets up the apparatus as shown in Fig. 5.1.

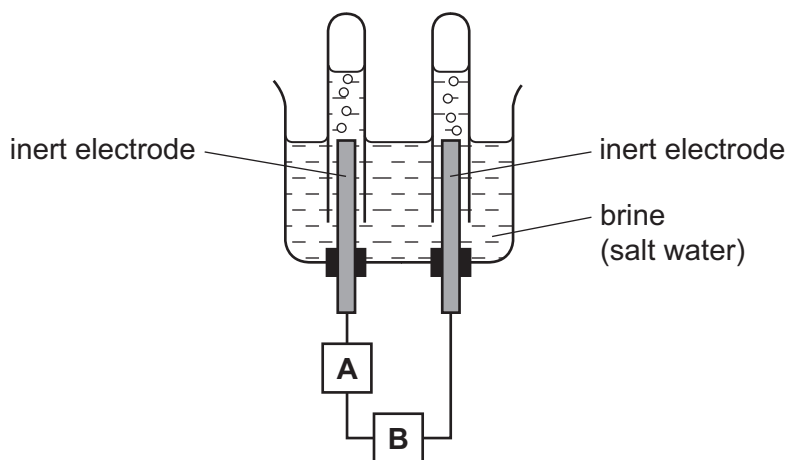


Fig. 5.1

- (a) (i) Box **A** on Fig. 5.1 represents a piece of apparatus that shows when a current is flowing.

Name this piece of apparatus.

..... [1]

- (ii) Box **B** on Fig. 5.1 represents a piece of apparatus that supplies the energy for the experiment.

Draw the **symbol** for this piece of apparatus in the **space below**.

[1]

- (iii) The electrodes are inert.

Explain what this means and name a material that can be used to make these electrodes.

explanation

.....

material [2]

The ions present in the brine are Na^+ , Cl^- , H^+ and OH^- .

Gases are produced at both electrodes.

The gas produced at the cathode is colourless.

The gas produced at the anode is a pale yellow/green colour.

The solution that remains is sodium hydroxide.

- (b) (i)** Suggest how the student can use iron(III) sulfate solution to show that the remaining solution is sodium hydroxide.

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

- (ii)** The gas produced at the anode is chlorine.

State the test and result to identify chlorine.

test

result [2]

- (iii)** Use the above information to name the colourless gas and state the test and result you would use to identify it.

name

test

result [3]

6 A student investigates the thermal conduction of five metal rods.

The rods are alloys of aluminium and magnesium. Each rod contains a different percentage of magnesium.

He sets up the apparatus as shown in Fig. 6.1. The student fills the container with hot water and starts the stopclock.

He measures the time taken for the drawing pins to fall off the rods due to the wax melting.

He records the times in Table 6.1.

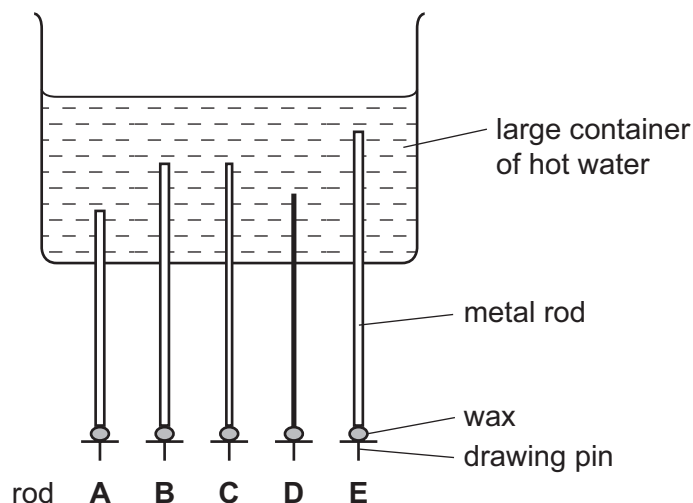
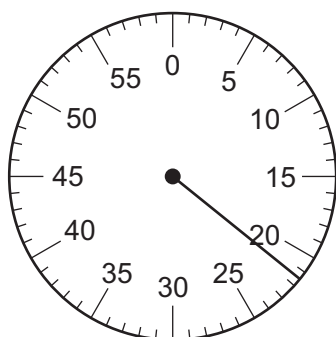


Fig. 6.1

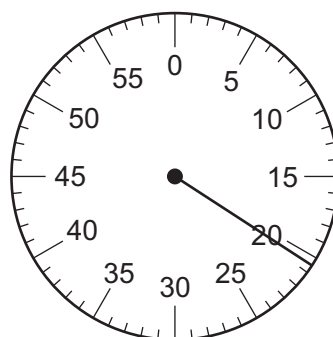
Table 6.1

rod	A	B	C	D	E
percentage magnesium / %	1	2	3	4	5
time for pin to drop / s	20.5	21.5	20.0		

Fig. 6.2 shows stopclocks with the times for the pins to drop from rods **D** and **E**.



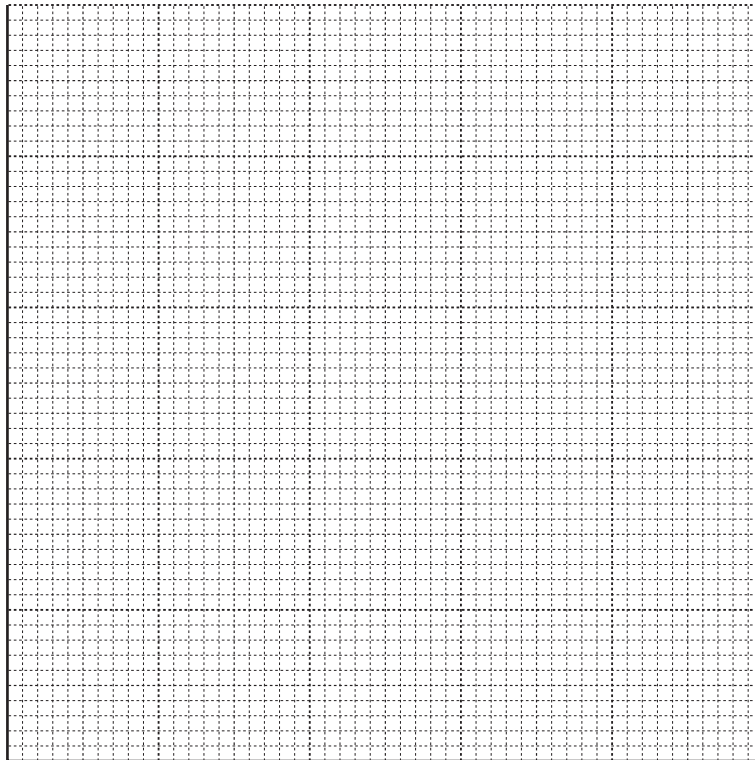
rod D



rod E

Fig. 6.2

- (a) (i) Read the stopclocks and record the times in Table 6.1. [2]
- (ii) On the grid provided plot a graph of time (vertical axis) against percentage magnesium in the alloy.



- [3]
- (iii) Use the graph to suggest and explain if there is a correlation between the percentage magnesium in the alloy and the time taken for the pins to fall off.

.....

..... [1]

(b) The teacher says that the results are not very reliable and not very accurate.

Suggest **three** changes the student can make to improve the method.

1

.....

2

.....

3

.....

[3]

(c) Explain how **one** of the changes you have given in **(b)** affects the reliability or accuracy.

.....

..... [1]

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