Cambridge Secondary 2

Example Candidate Responses

Cambridge IGCSE®

Physics **0625**

Paper 6

CAMBRIDGE
International Examinations

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Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching IGCSE Physics (0625), and to show how different levels of candidates' performance (high, middle and low) relate to the subject's curriculum and assessment objectives.

In this booklet candidate responses have been chosen to exemplify a range of answers. Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answers.

For each question, response is annotated with clear explanation of where and why marks were awarded or omitted. This, in turn, followed by examiner comments on how the answer could have been improved. In this way it is possible for you to understand what candidates have done to gain their marks and what they will have to do to improve their marks. At the end there is a list of common mistakes candidates made in their answers for each question.

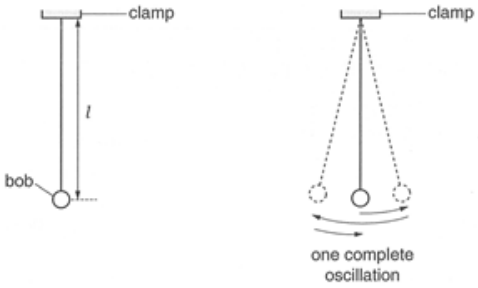
This document provides illustrative examples of candidate work. These help teachers to assess the standard required to achieve marks, beyond the guidance of the mark scheme. Some question types where the answer is clear from the mark scheme, such as short answers and multiple choice, have therefore been omitted.

The questions, mark schemes and pre-release material used here are available to download from Teacher Support. These files are:

Question Paper 3, June 2016	
Question paper	0625_s16_qp_31.pdf
Mark scheme	0620_s16_ms_31.pdf
Question Paper 4, June 2016	
Question paper	0620_s16_qp_41.pdf
Mark scheme	0620_s16_ms_41.pdf
Question Paper 5, November 2016	
Question paper	0620_w16_qp_52.pdf
Mark scheme	0620_w16_ms_52.pdf
Question Paper 6, June 2016	
Question paper	0620_s16_qp_62.pdf
Mark scheme	0620_s16_ms_62.pdf

Other past papers, Examiner Reports and other teacher support materials are available on Teacher Support at **https://teachers.cie.org.uk**

How to use this booklet

Example Candidate Response – high	Examiner comments
1 In this experiment, you will use a pendulum to determine a value for the acceleration of free fall *g*. Carry out the following instructions, referring to Figs. 1.1 and 1.2.  neasured to the centre of the hen measuring the length *l*. along the el eye	**Examiner annotations:** Each response is annotated with clear explanation of where and why marks were awarded or omitted. In this way it is possible for you to understand what candidates have done to gain their marks. 1 The candidate shows understanding of perpendicular viewing of the scale on the metre rule.

Answers by real candidates in exam conditions. These show you the types of answers for each level.

Discuss and analyse the answers with your learners in the classroom to improve their skills.

How the candidate could have improved the answer

(d) (ii) The candidate could have suggested
experiment using different lengths, repeating
repeating the timing of the 20 oscillations sev
that merely suggesting repeats, without spec

Examiner comments This explains how the candidate could have improved the answer. This helps you to interpret the standard of Cambridge exams and helps your learners to refine exam technique.

Common mistakes

The most common error for this question was the mistake
constitutes an Alphabet Agency. Many responses incorre
reforms, all legislation passed by the Roosevelt administr
Commonplace was the inclusion of the Emergency Bankin

Common mistakes a list of common mistakes candidates made in their answers for each question.

Assessment at a glance

All candidates take three papers.

Candidates who have studied the Core subject content, or who are expected to achieve a grade D or below, should be entered for Paper 1, Paper 3 and either Paper 5 or Paper 6. These candidates will be eligible for grades C to G.

Candidates who have studied the Extended subject content (Core and Supplement), and who are expected to achieve a grade C or above, should be entered for Paper 2, Paper 4 and either Paper 5 or Paper 6. These candidates will be eligible for grades A* to G.

Core candidates take:

Paper 1 45 minutes
Multiple Choice 30%
40 marks
40 four-choice multiple-choice questions
Questions will be based on the Core subject content
Assessing grades C–G
Externally assessed

Extended candidates take:

Paper 2 45 minutes
Multiple Choice 30%
40 marks
40 four-choice multiple-choice questions
Questions will be based on the Extended subject content (Core and Supplement)
Assessing grades A*–G
Externally assessed

and Core candidates take:

Paper 3 1 hour 15 minutes
Theory 50%
80 marks
Short-answer and structured questions
Questions will be based on the Core subject content
Assessing grades C–G
Externally assessed

and Extended candidates take:

Paper 4 1 hour 15 minutes
Theory 50%
80 marks
Short-answer and structured questions
Questions will be based on the Extended subject content (Core and Supplement)
Assessing grades A*–G
Externally assessed

All candidates take either:

Paper 5 1 hour 15 minutes
Practical Test 20%
40 marks
Questions will be based on the experimental skills in Section 4
Assessing grades A*–G
Externally assessed

or:

Paper 6 1 hour
Alternative to Practical 20%
40 marks
Questions will be based on the experimental skills in Section 4
Assessing grades A*–G
Externally assessed

Teachers are reminded that the latest syllabus is available on our public website at **www.cie.org.uk** and Teacher Support at **https://teachers.cie.org.uk**

Question 1

Example candidate response – high	Examiner comments

1 A student is investigating the stretching of a spring.

The apparatus is shown in Fig. 1.1.

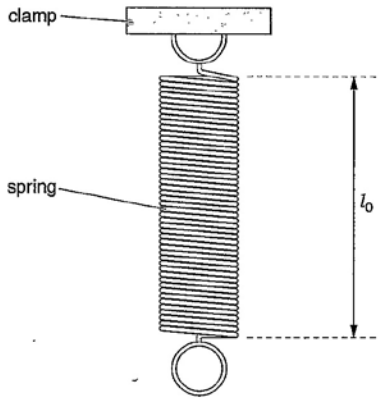


Fig. 1.1

(a) On Fig. 1.1, measure the unstretched length l_0 of the spring. Record l_0 in the first row of Table 1.1. [1]

(b) The student hangs a load L of 1.0 N on the spring and measures the new length l of the spring. She repeats the measurements using loads of 2.0 N, 3.0 N, 4.0 N and 5.0 N. The readings are shown in Table 1.1.

(i) For each set of readings, calculate the extension e of the spring using the equation $e = (l - l_0)$. Record the values of e in the table.

Table 1.1

L/N	l/mm	e/mm
0.0	55	0
1.0	59	4
2.0	64	9
3.0	69	14
4.0	74	19
5.0	78	23

[1]

(ii) Explain briefly one precaution that you would take in order to obtain reliable readings.

Wait for the spring to go back to it's original length before taking the next reading. [1]

1 The candidate measures and records the length correctly.

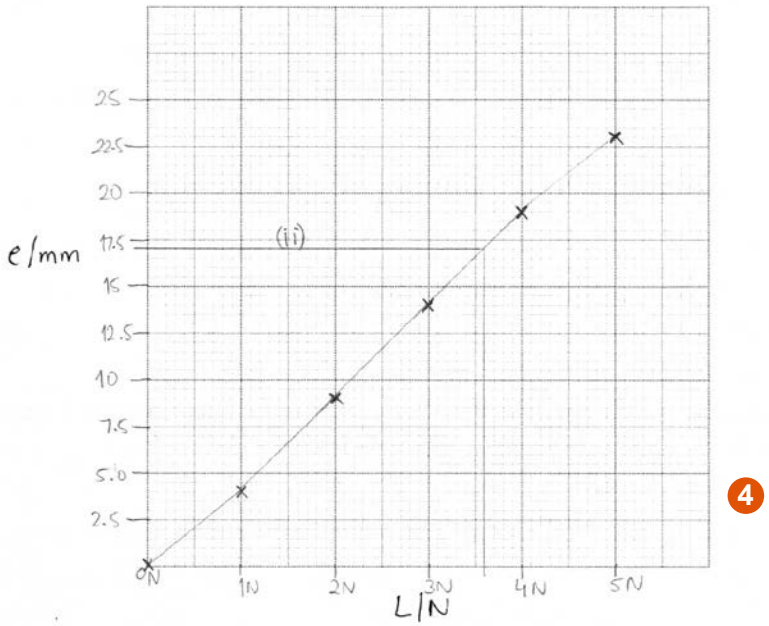
Mark awarded for (a) =
1 out of 1

2 The values of extension have been successfully calculated.

Mark awarded for (b) (i) =
1 out of 1

3 The suggested procedure contradicts the description of the experiment.

Mark awarded for (b) (ii) =
0 out of 1

Example candidate response – high, continued	Examiner comments
(c) Plot a graph of e/mm (y-axis) against L/N (x-axis).  4 [4] **(d)** The student removes the load from the spring and hangs an unknown load **X** on the spring. She measures the length l of the spring. l = 72 mm **(i)** Calculate the extension e of the spring. $e = l - l_0$ $e = 72 - 55 = 17$ e = 17 mm 5 [1] **(ii)** Use the graph to determine the weight W of the load **X**. Show clearly on the graph how you obtained the necessary information. W = 3.6N 6 [2] [Total: 10]	4 The candidate draws a graph with the axes the right way round and correctly labels with a suitable scale. The plotting is accurate but a best-fit straight line has not been drawn. A line joins each point to the next. Mark awarded for (c) = 3 out of 4 5 This is correct. Mark awarded for (d) (i) = 1 out of 1 6 The method is clearly shown on the graph and obtains a value for W that is within the tolerance allowed and gives the correct unit N. Mark awarded for (d) (ii) = 2 out of 2 **Total mark awarded = 8 out of 10**

How the candidate could have improved the answer

The candidate needed to write a relevant precaution describing how to read the rule to obtain a reliable reading.

The graph line should have been a best-fit straight line.

Example candidate response – middle

1 A student is investigating the stretching of a spring.

The apparatus is shown in Fig. 1.1.

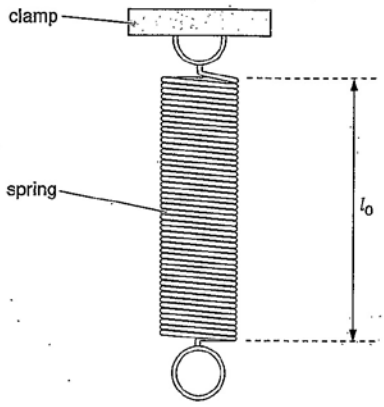


Fig. 1.1

(a) On Fig. 1.1, measure the unstretched length l_0 of the spring. Record l_0 in the first row of Table 1.1. [1]

(b) The student hangs a load L of 1.0 N on the spring and measures the new length l of the spring. She repeats the measurements using loads of 2.0 N, 3.0 N, 4.0 N and 5.0 N. The readings are shown in Table 1.1.

(i) For each set of readings, calculate the extension e of the spring using the equation $e = (l - l_0)$. Record the values of e in the table.

Table 1.1

L/N	l/mm	e/mm
0.0	55	0
1.0	59	4
2.0	64	9
3.0	69	14
4.0	74	19
5.0	78	23

[1]

(ii) Explain briefly one precaution that you would take in order to obtain reliable readings.

I won't put any external force on the load as the length of the spring will change. [1]

Examiner comments

1 The candidate measures and records the length correctly.

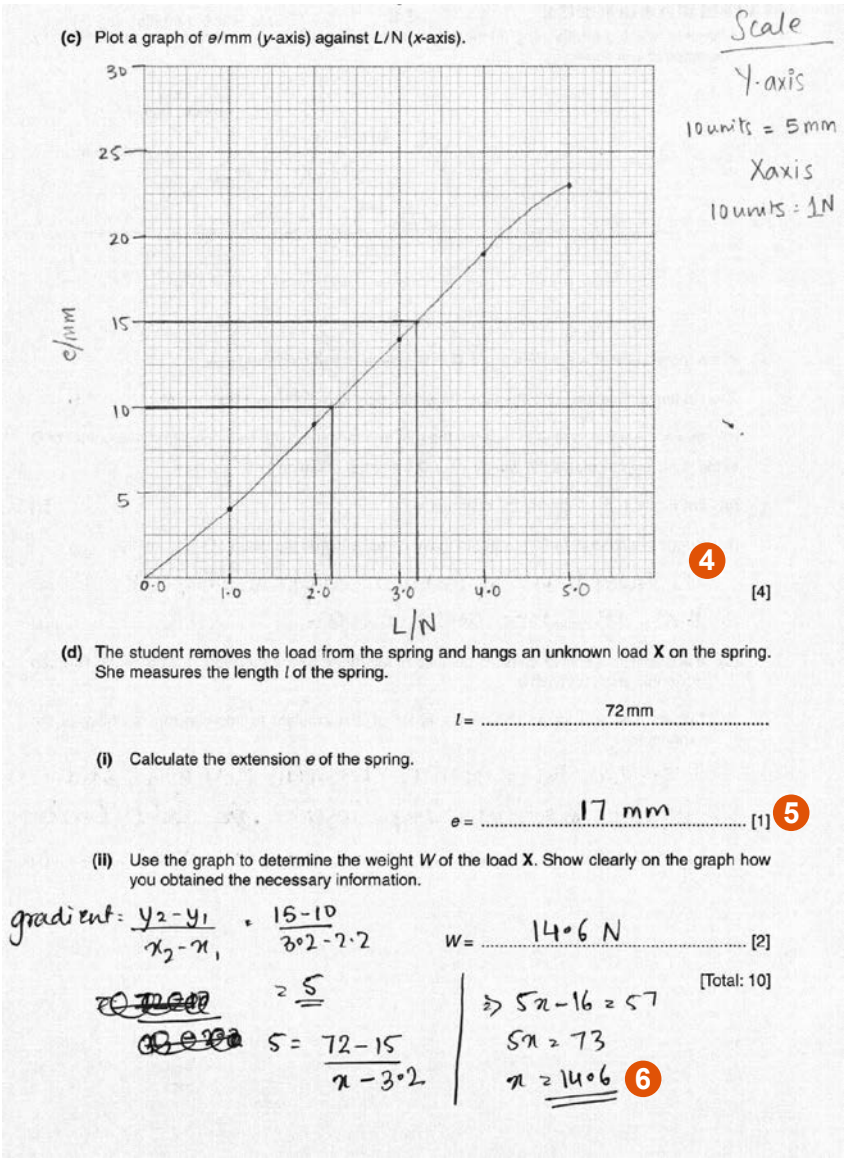
Mark awarded for (a) =
1 out of 1

2 The values of extension have been correctly calculated.

Mark awarded for (b) (i) =
1 out of 1

3 The candidate's suggestion is not a relevant precaution but a vague statement about avoiding carelessness.

Mark awarded for (b) (ii) =
0 out of 1

Example candidate response – middle, continued	Examiner comments
	4 The candidate draws a graph with the axes the right way round and correctly labels with a suitable scale. The plotting is accurate but the candidate does not draw a best-fit straight line. The candidate draws a line that joins each point to the next. Mark awarded for (c) = 3 out of 4 5 Extension has been calculated correctly. Mark awarded for (d) (i) = 1 out of 1 6 The candidate does not take a reading of *W* at the point on the graph where the extension *e* = 17mm, but calculates the gradient and then goes on to some further calculations. Mark awarded for (d) (ii) = 0 out of 2 **Total mark awarded = 6 out of 10**

How the candidate could have improved the answer

The candidate needed to write a relevant precaution describing how to read the rule to obtain a reliable reading.

The graph line should have been a best-fit straight line.

The candidate needed to read the load from the graph at the point where the extension is 17 mm.

Example candidate response – low

1 A student is investigating the stretching of a spring.

The apparatus is shown in Fig. 1.1.

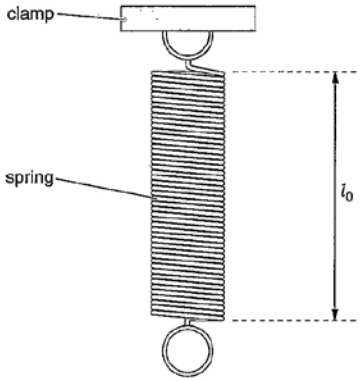


Fig. 1.1

(a) On Fig. 1.1, measure the unstretched length l_0 of the spring. Record l_0 in the first row of Table 1.1. [1]

(b) The student hangs a load L of 1.0 N on the spring and measures the new length l of the spring. She repeats the measurements using loads of 2.0 N, 3.0 N, 4.0 N and 5.0 N. The readings are shown in Table 1.1.

(i) For each set of readings, calculate the extension e of the spring using the equation $e = (l - l_0)$. Record the values of e in the table.

Table 1.1

L/N	l/mm	e/mm
0.0	55	0
1.0	59	4
2.0	64	5
3.0	69	5
4.0	74	5
5.0	78	4

1 2

[1]

(ii) Explain briefly one precaution that you would take in order to obtain reliable readings.

~~it was a spring law~~ the spring law could happen in this progress, when the weight was increase [1]

maybe the spring just decreasing it range from original length when put on weight

3

Examiner comments

1 This is correct.

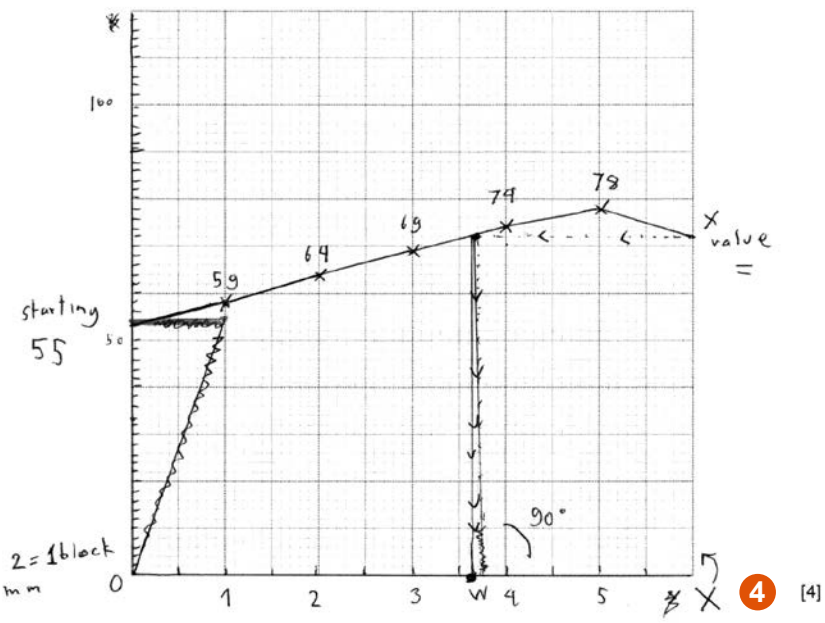
Mark awarded for (a) (i) =
1 out of 1

2 The candidate does not calculate the extension for each value of the load but calculates the change in extension for each value of load.

Mark awarded for (b) (i) =
0 out of 1

3 The candidate makes a comment about 'the spring law' instead of writing a precaution.

Mark awarded for (b) (ii) =
0 out of 1

Example candidate response – low, continued	Examiner comments
(c) Plot a graph of *e*/mm (*y*-axis) against *L*/N (*x*-axis).  4 [4] (d) The student removes the load from the spring and hangs an unknown load **X** on the spring. She measures the length *l* of the spring. *l* = 72 mm (i) Calculate the extension *e* of the spring. *e* = 17 mm 5 [1] (ii) Use the graph to determine the weight *W* of the load **X**. Show clearly on the graph how you obtained the necessary information. *W* = 6 3.7 N [2] [Total: 10]	4 The candidate plots *l*/mm against *L*/N instead of *e*/mm against *L*/N as instructed in the question. The axes are not labelled. The first plot is missing and the line is not a best-fit straight line. Mark awarded for (c) = 0 out of 4 5 The extension is calculated correctly. Mark awarded for (d) (i) = 1 out of 1 6 In spite of plotting the wrong graph, the candidate is able to use the graph correctly to obtain a value for *W* that is within the tolerance allowed and gives the correct unit, *N*. Mark awarded for (d) (ii) = 2 out of 2 **Total mark awarded =** **4 out of 10**

How the candidate could have improved the answer

The candidate should have understood what was meant by the extension of a spring to calculate the values correctly.

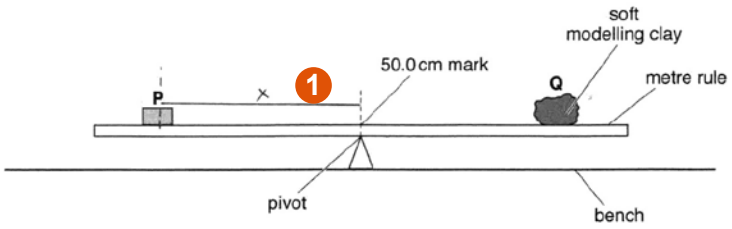
A relevant precaution describing how to read the rule should have been used to obtain a reliable reading.

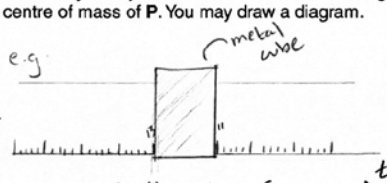
The candidate should have plotted extension on the *y*-axis of the graph and then plot all the points accurately and draw a best-fit straight line.

Common mistakes candidates made in this question

- Writing a vague statement rather than a relevant precaution describing how to read the rule to obtain a reliable reading.
- Making a poor judgement of the best-fit straight line on the graph.

Question 2

Example candidate response – high	Examiner comments
2 A student is using a balancing method to determine the weight of a piece of soft modelling clay. The apparatus is shown in Fig. 2.1.  **Fig. 2.1** **P** is a metal cube of weight $P = 1.0$ N. **Q** is the piece of soft modelling clay. The student places the cube **P** so that its weight acts at a distance x from the pivot. He adjusts the position of **Q** to balance the rule and measures the distance y from the centre of **Q** to the pivot. He calculates the weight W of **Q** using the equation $W = \frac{Px}{y}$. **(a)** **On Fig. 2.1**, mark clearly the distance x. [1] **(b)** Suggest a change to **Q** that would make it easier to find the value of y accurately. +Make the shape be more defined, e.g: Square. So you can find the center of the object. 2 [1] **(c)** It is difficult to achieve an exact balance of the metre rule in this type of experiment. This can make the result unreliable. Explain how you would reduce the effect of this problem to improve the reliability of the experiment. + Use a solid object instead of a modelling clay. + Make sure object P and Q don't cover the lines and numbers of the ruler. 3 [1]	1 The candidate correctly marks the distance x on Fig. 2.1. Mark awarded for (a) = 1 out of 1 2 This is a good suggestion for the change to **Q**. Mark awarded for (b) = 1 out of 1 3 Exact balance has not been addressed but the candidate writes about precautions that are taken to obtain accurate distance readings. Mark awarded for (c) = 0 out of 1

Example candidate response – high, continued	Examiner comments
(d) The metal cube **P** is larger than the width of the metre rule. Explain briefly how you would determine the reading of the metre rule scale at the position of the centre of mass of **P**. You may draw a diagram.  step 1) you will determin the two points. Beginning of the cube and the back. step2) And because we need the center ~~into~~ we are going to add both values (e.g: 11+13) and then divide by 2. (eg: 24÷2 = 12) Step3) hence you will find the center of the cube in the most accurate way possible. 4 [2] **(e)** Before starting the experiment, the student determines the position of the centre of mass of the metre rule. Explain briefly how you would do this. + By balancing the ruler on the Pivot. + Or by hanging it from two sides and then drawing a line, where the plumb falls. Where the two lines intersect is the centre of mass, 5 [1] 1 for each side [Total: 6]	4 Clear diagram has been drawn which explains the procedure well. Mark awarded for (d) = 2 out of 2 5 Balancing the rule on the pivot has been written correctly. The alternative method, added unnecessarily, is too complex and not very practical but has not been penalised. Mark awarded for (e) = 1 out of 1 **Total mark awarded =** **5 out of 6**

How the candidate could have improved the answer

(c) The candidate should have used the experience gained during the course to describe what was done in this type of experiment. For example moving **Q** slowly one way until the rule just tips, then moving **Q** the other way until the rule tips back and taking the reading between these two positions of **Q**.

(e) Although the candidate was awarded the mark, it would have been better to have written only about balancing the rule on the pivot and not to add a second, rather impractical method.

Example candidate response – middle	Examiner comments

2 A student is using a balancing method to determine the weight of a piece of soft modelling clay. The apparatus is shown in Fig. 2.1.

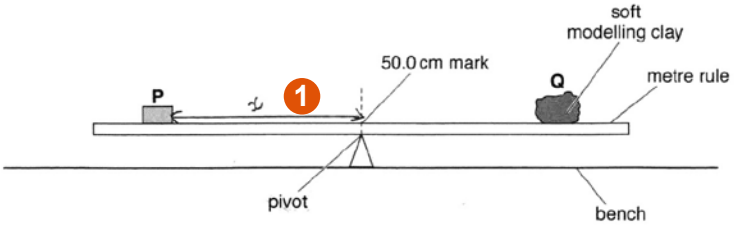


Fig. 2.1

P is a metal cube of weight $P = 1.0$ N. **Q** is the piece of soft modelling clay.

The student places the cube **P** so that its weight acts at a distance x from the pivot.

He adjusts the position of **Q** to balance the rule and measures the distance y from the centre of **Q** to the pivot. He calculates the weight W of **Q** using the equation $W = \frac{Px}{y}$.

(a) **On Fig. 2.1**, mark clearly the distance x. [1]

(b) Suggest a change to **Q** that would make it easier to find the value of y accurately.

Give an ~~effect~~ appropriate measured shape to the modelling clay. 2 [1]

(c) It is difficult to achieve an exact balance of the metre rule in this type of experiment. This can make the result unreliable.

Explain how you would reduce the effect of this problem to improve the reliability of the experiment.

~~Repeating~~ By repeating the experiment several times and taking average. 3 [1]

1 The candidate shows the distance to one edge of the cube, not the centre.

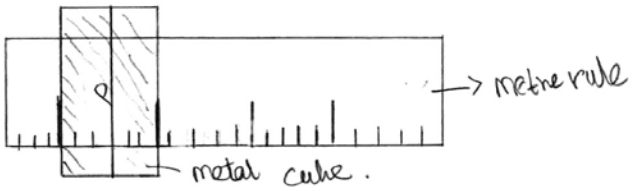
Mark awarded for (a) = 0 out of 1

2 This is a vague answer.

Mark awarded for (b) = 0 out of 1

3 The answer suggests repeating the experiment several times and taking the average.

Mark awarded for (c) = 1 out of 1

Example candidate response – middle, continued	Examiner comments
(d) The metal cube **P** is larger than the width of the metre rule. Explain briefly how you would determine the reading of the metre rule scale at the position of the centre of mass of **P**. You may draw a diagram.  By dividing the mass equally on both sides of the required position 4 [2] **(e)** Before starting the experiment, the student determines the position of the centre of mass of the metre rule. Explain briefly how you would do this. By placing the metre rule on the pivot and seeing the point where it balances equally [1] 5 [Total: 6]	4 The candidate indicates a correct method but the response is too vague to gain both marks. Mark awarded for (d) = 1 out of 2 5 This is correct. Mark awarded for (e) = 1 out of 1 **Total mark awarded = 3 out of 11**

How the candidate could have improved the answer

(a) The distance *x* to the centre of the block should have been shown.

(b) The candidate should have suggested an appropriate shape (e.g. a cube).

(d) Writing should have been clearer that the block width must be measured.

Example Candidate Response – low	Examiner comments
2 A student is using a balancing method to determine the weight of a piece of soft modelling clay. The apparatus is shown in Fig. 2.1.	

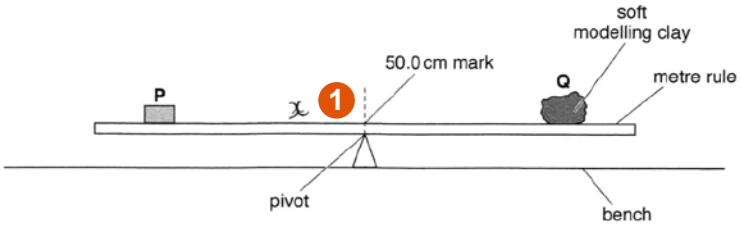


Fig. 2.1

P is a metal cube of weight $P = 1.0$ N. **Q** is the piece of soft modelling clay.

The student places the cube **P** so that its weight acts at a distance x from the pivot.

He adjusts the position of **Q** to balance the rule and measures the distance y from the centre of **Q** to the pivot. He calculates the weight W of **Q** using the equation $W = \frac{Px}{y}$.

(a) **On Fig. 2.1**, mark clearly the distance x. [1]

(b) Suggest a change to **Q** that would make it easier to find the value of y accurately.

Weigh rib. Place it on it's centre of mass. 2

.....[1]

(c) It is difficult to achieve an exact balance of the metre rule in this type of experiment. This can make the result unreliable.

Explain how you would reduce the effect of this problem to improve the reliability of the experiment.

Repeat the experiment and find the average. 3

.....[1]

1 The candidate does not mark the distance x clearly.

Mark awarded for (a) = 0 out of 1

2 This does not answer the question.

Mark awarded for (b) = 0 out of 1

3 The candidate correctly suggests repeating the experiment several times and taking the average.

Mark awarded for (c) = 1 out of 1

Example candidate response – low, continued	Examiner comments
(d) The metal cube **P** is larger than the width of the metre rule. Explain briefly how you would determine the reading of the metre rule scale at the position of the centre of mass of **P**. You may draw a diagram. you would measure the reading and subtract it from 50.0 cm 4 .....[2] **(e)** Before starting the experiment, the student determines the position of the centre of mass of the metre rule. Explain briefly how you would do this. by placing on the pivot so it doesn't tilt 5 .....[1] [Total: 6]	4 This does not answer the question. Mark awarded for (d) = 0 out of 2 5 This is correct. Mark awarded for (e) = 1 out of 1 **Total mark awarded =** **2 out of 6**

How the candidate could have improved the answer

(a) The candidate should have shown the distance *x* from the pivot to the centre of the block.

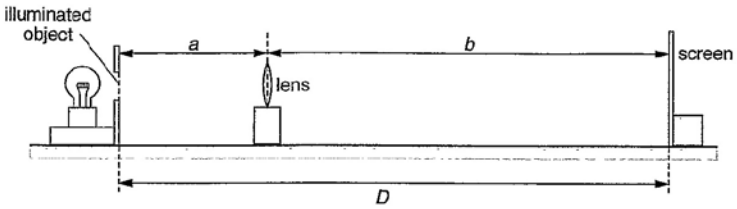
(b) An appropriate shape should have been suggested (e.g. a cube).

(c) The candidate needed to explain that the width of the cube must be measured and then the block positioned so that half the width lays either side of the required position. A diagram makes it much easier for the candidate to describe this.

Common mistakes candidates made in this question

Writing vague responses to parts **(c)** and **(d)**. Candidates should realise that they are being asked to write from their own experience of carrying out similar experiments during their course.

Question 3

Example Candidate Response – high	Examiner comments
3 A student is investigating the magnification of images produced by a lens. The apparatus is shown in Fig. 3.1.  Fig. 3.1 The student places a screen at a distance $D = 80.0\,cm$ from an illuminated object. The screen and the illuminated object remain in the same positions throughout the experiment. **(a)** She places the lens close to the illuminated object. She moves the lens until she sees a sharply focused, **enlarged** image of the object on the screen. She measures the distance a from the illuminated object to the centre of the lens. $a =$ 20.3cm She measures the distance b from the centre of the lens to the screen. $b =$ 59.7cm Calculate the magnification m_1 of the image, using the equation $m_1 = \frac{b}{a}$. $m_1 =$ 2.94 **1** [1]	**1** The calculation is correct. Mark awarded for (a) = 1 out of 1

Example Candidate Response – high, continued	Examiner comments
(b) The student then moves the lens towards the screen until a **smaller**, sharply focused image of the object is seen on the screen. She measures the distance x from the illuminated object to the centre of the lens. $x =$ 60.2cm She measures the distance y from the centre of the lens to the screen. $y =$ 19.8cm Calculate the magnification m_2 of the image, using the equation $m_2 = \frac{y}{x}$. $m_2 =$ 0.329 **2** [1] **(c)** A student suggests that $m_1 \times m_2$ should equal 1. State whether the results support this suggestion. Justify your answer by reference to the results. statement Yes justification $m_1 \times m_2 = 0.967 < 1$, but the result is within the limit of experimental accuracy. **3** [2] **(d)** State two precautions that you would take in this experiment to obtain reliable results. 1. Keep the object, lens and screen at the same height. 2. Do the experiment in a dark room. **4** [2] **(e)** Suggest one reason why it is difficult, in this type of experiment, to decide on the best position of the lens to obtain a sharply focused image on the screen. It is hard to find the best sharply focused image because of the small difference between images.[1] **5** [Total: 7]	**2** The calculation is correct. Mark awarded for (b) = 1 out of 1 **3** The statement is correct and the justification is clearly explained. Mark awarded for (c) = 2 out of 2 **4** The candidate suggests two sensible precautions. Mark awarded for (d) = 2 out of 2 **5** The candidate does not give a convincing reason, showing a lack of familiarity with this type of experiment. Mark awarded for (e) = 0 out of 1 **Total mark awarded = 6 out of 7**

How the candidate could have improved the answer

(e) The candidate should have explained that the image could appear equally well focused over a range of lens positions.

Example candidate response – middle	Examiner comments

3 A student is investigating the magnification of images produced by a lens.

The apparatus is shown in Fig. 3.1.

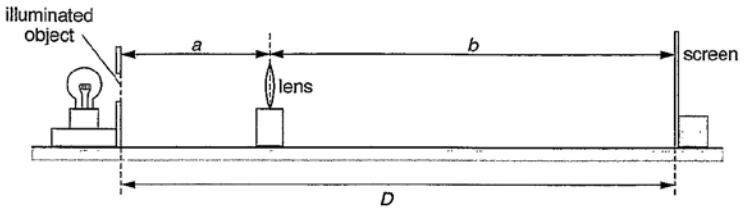


Fig. 3.1

The student places a screen at a distance $D = 80.0\,cm$ from an illuminated object. The screen and the illuminated object remain in the same positions throughout the experiment.

(a) She places the lens close to the illuminated object. She moves the lens until she sees a sharply focused, **enlarged** image of the object on the screen.

She measures the distance a from the illuminated object to the centre of the lens.

$a =$ 20.3 cm

She measures the distance b from the centre of the lens to the screen.

$b =$ 59.7 cm

Calculate the magnification m_1 of the image, using the equation $m_1 = \frac{b}{a}$.

$m_1 =$ 2.94 1 [1]

1 The calculation is correct.

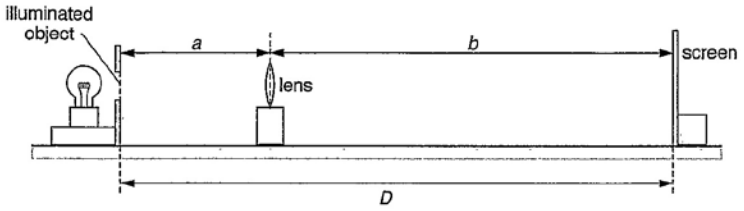
Mark awarded for (a) = 1 out of 1

Example candidate response – middle, continued	Examiner comments
(b) The student then moves the lens towards the screen until a **smaller**, sharply focused image of the object is seen on the screen. She measures the distance x from the illuminated object to the centre of the lens. $x =$ 60.2 cm She measures the distance y from the centre of the lens to the screen. $y =$ 19.8 cm Calculate the magnification m_2 of the image, using the equation $m_2 = \frac{y}{x}$. $m_2 =$ 0.33 **2** [1]	**2** The calculation is correct. Mark awarded for (b) = 1 out of 1
(c) A student suggests that $m_1 \times m_2$ should equal 1. State whether the results support this suggestion. Justify your answer by reference to the results. statement the magnification of the image is ~~the same~~ not the same justification The magnification wouldn't be the same no matter where the len is placed because it can change according to where the lens is placed 2.94 × 0.33 = 0.97 **3** [2]	**3** The candidate calculates $m_1 \times m_2$ correctly but does not state that 0.97 is very close to 1 and therefore the results support the suggestion within the limits of experimental accuracy. Mark awarded for (c) = 0 out of 2
(d) State two precautions that you would take in this experiment to obtain reliable results. 1. adjust the lens back and forth until it show clear and sharp ima 2. make the experiment in a dark room **4** [2]	**4** Two sensible precautions are suggested. Mark awarded for (d) = 2 out of 2
(e) Suggest one reason why it is difficult, in this type of experiment, to decide on the best position of the lens to obtain a sharply focused image on the screen. Because the size of the object also make the experiment difficult **5** [1] [Total: 7]	**5** The candidate does not give a convincing reason, showing a lack of familiarity with this type of experiment. Mark awarded for (e) = 0 out 1 **Total mark awarded = 4 out of 7**

How the candidate could have improved the answer

(c) The candidate should have realised that the results support the suggestion within the limits of experimental accuracy.

(e) The candidate needed to show familiarity with this type of experiment by explaining that the image can appear equally well focused over a range of lens positions.

Example Candidate Response – low	Examiner comments
3 A student is investigating the magnification of images produced by a lens. The apparatus is shown in Fig. 3.1.  **Fig. 3.1** The student places a screen at a distance $D = 80.0\,cm$ from an illuminated object. The screen and the illuminated object remain in the same positions throughout the experiment. **(a)** She places the lens close to the illuminated object. She moves the lens until she sees a sharply focused, **enlarged** image of the object on the screen. She measures the distance a from the illuminated object to the centre of the lens. $a =$ 20.3 cm She measures the distance b from the centre of the lens to the screen. $b =$ 59.7 cm Calculate the magnification m_1 of the image, using the equation $m_1 = \frac{b}{a}$. $m_1 =$ x 1.94 **1** [1]	**1** The calculation is correct. Mark awarded for (a) = 1 out of 1

Example candidate response – low, continued	Examiner comments
(b) The student then moves the lens towards the screen until a **smaller**, sharply focused image of the object is seen on the screen. She measures the distance x from the illuminated object to the centre of the lens. $x =$ 60.2 cm She measures the distance y from the centre of the lens to the screen. $y =$ 19.8 cm Calculate the magnification m_2 of the image, using the equation $m_2 = \frac{y}{x}$. $m_2 =$ X 0·3 (2) [1]	(2) The calculation is correct but not given to 2 or 3 significant figures. Mark awarded for (b) = 0 out of 1
(c) A student suggests that $m_1 \times m_2$ should equal 1. State whether the results support this suggestion. Justify your answer by reference to the results. statement NO justification It is because the distances from the centre of lens and from illuminated object is vice versa in the two experiments therefore magnifications are also different. (3) [2]	(3) The candidate does not state or explain that the results support the suggestion, within the limits of experimental accuracy. Mark awarded for (c) = 0 out of 2
(d) State two precautions that you would take in this experiment to obtain reliable results. 1. use a bright light bulb so that image formed can be clearer 2. carry out this experiment in a dark room with no other light (4) [2]	(4) These are alternative answers for one correct response. Mark awarded for (d) = 1 out of 2
(e) Suggest one reason why it is difficult, in this type of experiment, to decide on the best position of the lens to obtain a sharply focused image on the screen. It is because the lens is adjusted by hand. (5) [1] [Total: 7]	(5) The candidate does not give a convincing reason, showing a lack of familiarity with this type of experiment. Mark awarded for (e) = 0 out of 1 **Total mark awarded = 2 out of 7**

How the candidate could have improved the answer

(b) The answer should have been given to 2 or 3 significant figures.

(c) The candidate should have realised that the results support the suggestion within the limits of experimental accuracy.

(d) A second valid suggestion should have been made.

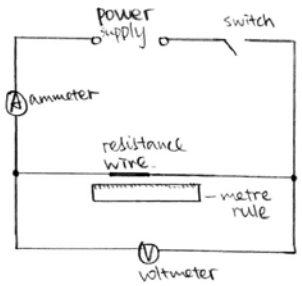
(e) Familiarity with this type of experiment should have been shown by explaining that the image can appear equally well focused over a range of lens positions.

Common mistakes candidates made in this question

Failure to realise the significance of results being within the limits of experimental accuracy.

Writing vague responses to part **(e)**. Candidates should realise that they are being asked to write from their own experience of carrying out similar experiments during their course.

Question 4

Example candidate response – high	Examiner comments
4 A student is investigating how the resistance of a wire depends on the length of the wire. The student aims to plot a graph. The following apparatus is available to the student: ammeter voltmeter power supply variable resistor switch connecting leads resistance wires of different lengths metre rule. Plan an experiment to investigate how the resistance of a wire depends on the length of the wire. You should • draw a diagram of the circuit you could use to determine the resistance of each wire • explain briefly how you would carry out the investigation • suggest suitable lengths of wire • state the key variables that you would control • draw a table, or tables, with column headings to show how you would display your readings. You are not required to enter any readings in the table.  1	1 The candidate draws a good circuit diagram including the correct circuit symbols.

Example candidate response – high, continued	Examiner comments

Steps: ① According to the diagram, connect the circuit with the apparatus, and connect a 10 cm resistance wire. (length measured by metre rule)
② close the switch, read the current on the ammeter, I and the potential difference on the voltmeter, V and record them into the table.
③ Use the formula, resistance = p.d / current, calculate the resistance of this wire (as R) and record the data.
④ repeat the experiment, only change the wires with different lengths, (measured by meter rule), they are 15cm, 20cm, 25cm, 30cm, 35cm, 40cm seperately, calculate their resistance and record the data. (keep the power supply constant.) 2

length of resistance wire/cm	I / A	V / V	R / Ω

3

[7]

[Total: 7]

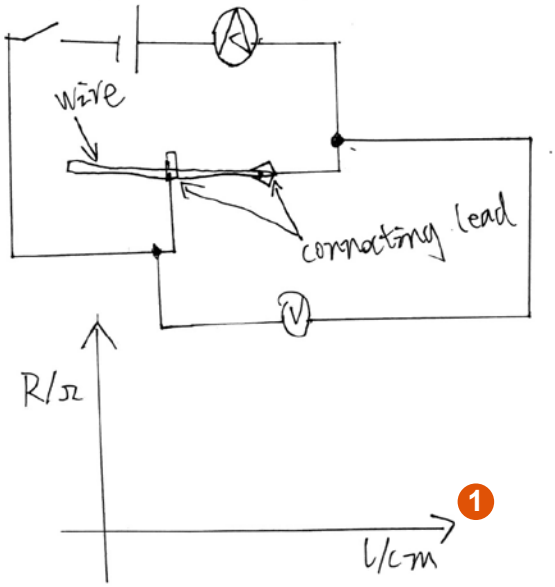
2 The method includes taking readings of current and potential difference using at least five different lengths.
The range of different lengths is appropriate.

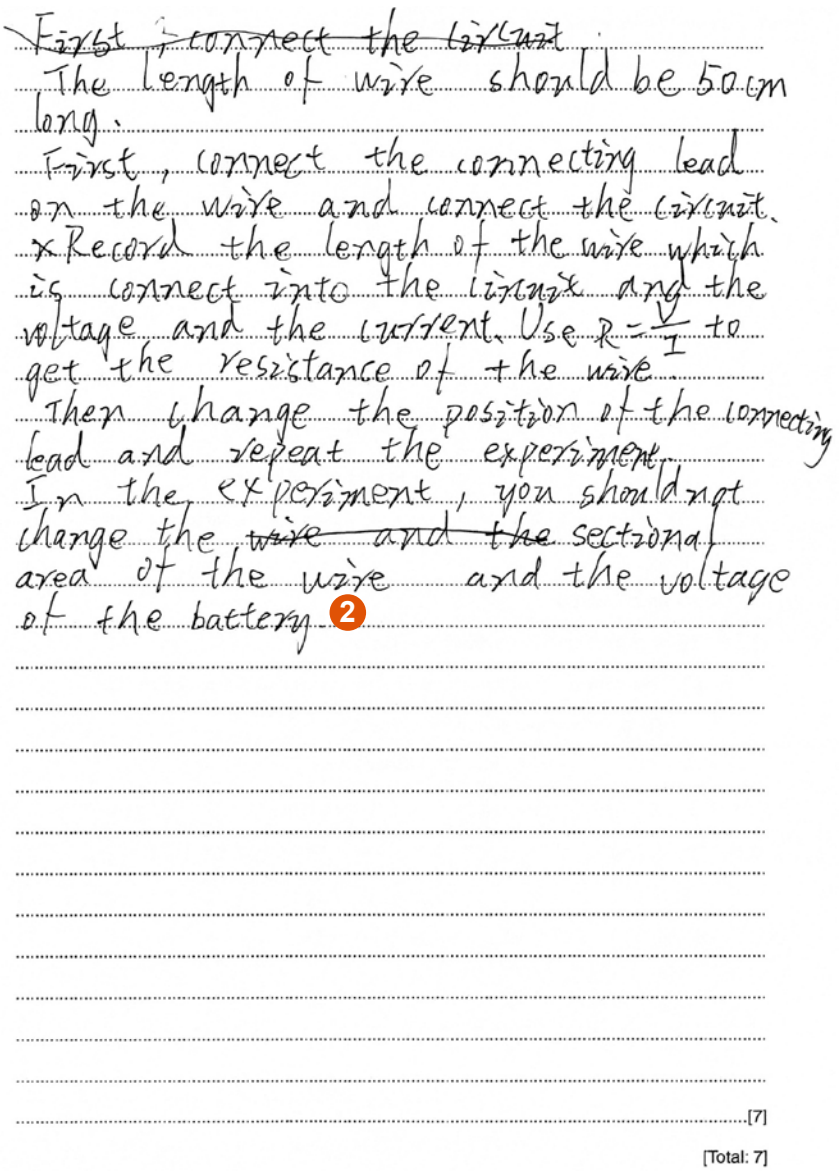
3 The candidate draws a suitable table with headings for length, current, potential difference and resistance, each with the correct unit.

Total mark awarded =
6 out of 7

How the candidate could have improved the answer

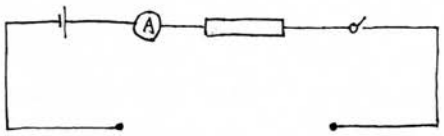
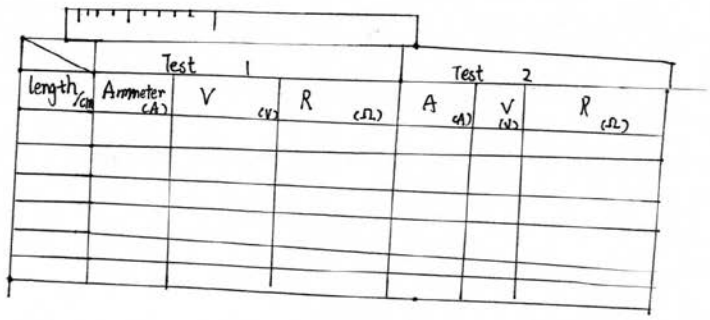
The candidate needed to state any key variables to control.

Example candidate response – middle	Examiner comments
4 A student is investigating how the resistance of a wire depends on the length of the wire. The student aims to plot a graph. The following apparatus is available to the student: ammeter voltmeter power supply variable resistor switch connecting leads resistance wires of different lengths metre rule. Plan an experiment to investigate how the resistance of a wire depends on the length of the wire. You should • draw a diagram of the circuit you could use to determine the resistance of each wire • explain briefly how you would carry out the investigation • suggest suitable lengths of wire • state the key variables that you would control • draw a table, or tables, with column headings to show how you would display your readings. You are not required to enter any readings in the table.  1	1 The candidate draws a workable circuit diagram including the correct circuit symbols.

Example candidate response – middle, continued	Examiner comments
	2 The method does not include taking readings of current and potential difference using at least five different lengths. The candidate correctly suggests that the cross-sectional area of the wire is a variable that should be kept constant. **Total mark awarded = 4 out of 7**

How the candidate could have improved the answer

The candidate should have written a clear, brief method to include taking readings of current and voltage, using five or more lengths of wire and suggesting a suitable range of different lengths. Also the candidate should have drawn a table as specified in the question.

Example candidate response – low	Examiner comments
4 A student is investigating how the resistance of a wire depends on the length of the wire. The student aims to plot a graph. The following apparatus is available to the student: ammeter voltmeter power supply variable resistor switch connecting leads resistance wires of different lengths metre rule. Plan an experiment to investigate how the resistance of a wire depends on the length of the wire. You should • draw a diagram of the circuit you could use to determine the resistance of each wire • explain briefly how you would carry out the investigation • suggest suitable lengths of wire • state the key variables that you would control • draw a table, or tables, with column headings to show how you would display your readings. You are not required to enter any readings in the table.  1  	1 The candidate draws an incomplete circuit, but the circuit symbols are correct.

Example Candidate Response – low, continued	Examiner comments
Build a circuit like the diagram as shown., place different length of wire at the connecting leads., each one test for twice by change the resistance (variable resistor)., record the ammeter and voltmeter reading., measure its length after testing in the circuit. During the experiment, make sure each wire only need to test for twice, but different considerable resistance., the other one still need to test at these two resistance. Then caculate. 2 [7] [Total: 7]	2 The candidate mentions taking readings of current and voltage but there are no other important aspects of the method given. The candidate does not state any key variables to control. **Total mark awarded = 2 out of 7**

How the candidate could have improved the answer

The candidate should have drawn a complete circuit then written a clear brief method including taking readings of current and voltage, using five or more lengths of wire and suggesting a suitable range of different lengths. Also the candidate should have drawn a table as specified in the question.

Any key variables to control should have been mentioned.

Common mistakes candidates made in this question

Writing a vague method that did not address the task set in the question, drawing an incomplete table (e.g. with units missing) and missing out the description of key variables to control.

Question 5

Example candidate response – high	Examiner comments

5 A student is investigating the cooling of water.

Some of the apparatus is shown in Fig. 5.1.

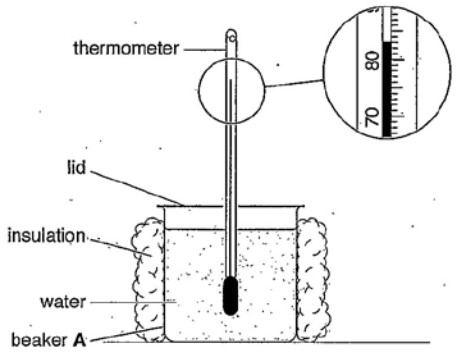


Fig. 5.1

(a) The student pours 200 cm^3 of hot water into a 250 cm^3 insulated beaker labelled **A**. He covers the top of the beaker with a lid.

The student takes a temperature reading every 30 s as the water cools. The readings are shown in Table 5.1.

(i) Complete the column headings in the table. [1]

(ii) The starting temperature θ of the hot water in beaker **A** is shown on Fig. 5.1.

Record this temperature in the table at time $t = 0$ s. [1]

Table 5.1

	beaker **A** insulation and lid	beaker **B** insulation, no lid	beaker **C** lid, no insulation
t/s	θ/°C	θ/°C	θ/°C 1
0	83 2	85	78
30	80	79	74
60	77	74	71
90	75	70	68
120	73	67	66
150	71	64	64

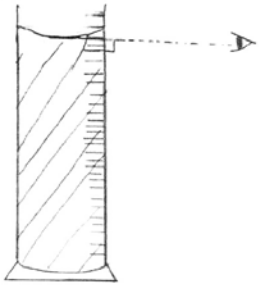
1 The column headings are correct.

2 The temperature reading is correct.

Mark awarded for (a) (i) = 1 out of 1

Mark awarded for (a) (ii) = 1 out of 1

Example candidate response – high, continued	Examiner comments
(b) The student repeats the procedure using a 250 cm^3 beaker labelled **B**. This beaker is insulated but has no lid. He repeats the procedure again using a 250 cm^3 beaker labelled **C**. This beaker has a lid but no insulation. All the readings are shown in Table 5.1. **(i)** Tick the statement that best describes the results of the investigation. ☐ Removing the lid speeds up the rate of cooling significantly more than removing the insulation. ☐ Removing the insulation speeds up the rate of cooling significantly more than removing the lid. ☑ There is no significant difference between removing the lid and removing the insulation. 3 [1] **(ii)** Justify your answer by reference to the readings. Low difference of changing in temperature 85°C − 79°C = 6°C 78°C − 72°C = 6°C 6°C − 6°C = 0°C 4 74°C − 70°C = 4°C 71°C − 68°C = 3°C (So the low difference should be [1] **(c)** State two of the conditions that should be kept the same in this experiment in order for the comparison to be fair. 1. Initial temperature of hot water 2. Keep the experiment humidity 5 [2] **(d)** Suggest a suitable material for the lid. Give a reason for your choice of material. material wood reason ~~Because~~ It is a insulator and can keep heat inside the beaker efficiently 6 [2]	3 The candidate has not ticked the first box. Mark awarded for (b) (i) = 0 out of 1 4 The answer given in part (i) is incorrect so the justification is also incorrect. Mark awarded for (b) (ii) = 0 out of 1 5 Two appropriate conditions that should be kept constant have been suggested. Mark awarded for (c) = 2 out of 2 6 The candidate makes a sensible suggestion for the material of the lid and gives a good reason for the choice. Mark awarded for (d) = 2 out of 2

Example candidate response – high, continued	Examiner comments
(e) Describe briefly how a measuring cylinder is read in order to obtain a reliable value for the volume of water. You may draw a diagram.  Eyes should perpendicular to the measuring cylinder's scale of level of water 7 [2] [Total: 10]	7 The candidate draws a clear and correct diagram giving all the necessary information – measuring to the bottom of the meniscus and viewing the scale at right angles. Mark awarded for (e) = 2 out of 2 **Total mark awarded = 8 out of 10**

How the candidate could have improved the answer

(b) The candidate needed to draw the correct conclusion from the results and then justify that conclusion.

Example candidate response – middle

5 A student is investigating the cooling of water.

Some of the apparatus is shown in Fig. 5.1.

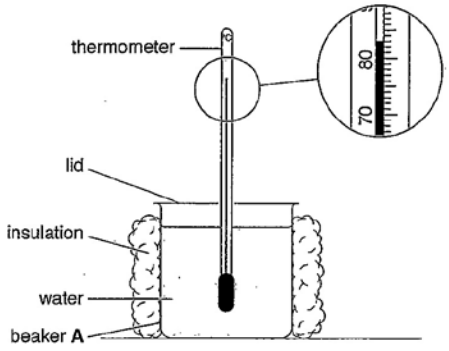


Fig. 5.1

(a) The student pours 200 cm^3 of hot water into a 250 cm^3 insulated beaker labelled **A**. He covers the top of the beaker with a lid.

The student takes a temperature reading every 30 s as the water cools. The readings are shown in Table 5.1.

(i) Complete the column headings in the table. [1]

(ii) The starting temperature θ of the hot water in beaker **A** is shown on Fig. 5.1.

Record this temperature in the table at time $t = 0$ s. [1]

Table 5.1

	beaker **A** insulation and lid	beaker **B** insulation, no lid	beaker **C** lid, no insulation
t/s	θ/°C	θ/°C	θ/°C 1
0	83 2	85	78
30	80	79	74
60	77	74	71
90	75	70	68
120	73	67	66
150	71	64	64

Examiner comments

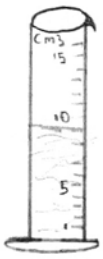
1 The column headings are correct.

2 The temperature reading is correct.

Mark awarded for (a) (i) =
1 out of 1

Mark awarded for (a) (ii) =
1 out of 1

Example candidate response – middle, continued	Examiner comments
(b) The student repeats the procedure using a 250 cm^3 beaker labelled **B**. This beaker is insulated but has no lid. He repeats the procedure again using a 250 cm^3 beaker labelled **C**. This beaker has a lid but no insulation. All the readings are shown in Table 5.1. (i) Tick the statement that best describes the results of the investigation. ☐ Removing the lid speeds up the rate of cooling significantly more than removing the insulation. ☐ Removing the insulation speeds up the rate of cooling significantly more than removing the lid. ☑ There is no significant difference between removing the lid and removing the insulation. 3 [1] (ii) Justify your answer by reference to the readings. Beaker B and C ~~are~~ have different rates of cooling at the start but then Beaker B's rate gets faster and the become almost same 4 [1] (c) State two of the conditions that should be kept the same in this experiment in order for the comparison to be fair. 1. Volume of water 2. Initial temperature of water 5 [2] (d) Suggest a suitable material for the lid. Give a reason for your choice of material. material Rubber reason Good insulator 6 [2]	3 The first box should have been ticked. Mark awarded for (b) (i) = 0 out of 1 4 The answer given in part **(i)** is incorrect so the justification is also incorrect. Mark awarded for (b)(ii) = 0 out of 1 5 The candidate suggests one appropriate condition (the initial temperature of the water) that should be kept constant. Mark awarded for (c) = 1 out of 2 6 The candidate makes a sensible suggestion for the material of the lid and gives a good reason for the choice. Mark awarded for (d) = 2 out of 2

Example candidate response – middle, continued	Examiner comments
(e) Describe briefly how a measuring cylinder is read in order to obtain a reliable value for the volume of water. You may draw a diagram.  The point at which the top of the water is is read in the scale provided so in this case the volume of the water is 9cm³ 7 .....[2] [Total: 10]	7 The candidate does not show in the diagram or description how to obtain a reliable reading for the volume. Mark awarded for (e) = 0 out of 2 **Total mark awarded = 5 out of 10**

How the candidate could have improved the answer

(b) The correct conclusion should have been drawn from the results and then justified that conclusion.

(c) Second valid conclusion should have been stated.

(e) The candidate should have shown in the diagram or description how to obtain a reliable reading for the volume.

Example candidate response – low	Examiner comments

5 A student is investigating the cooling of water.

Some of the apparatus is shown in Fig. 5.1.

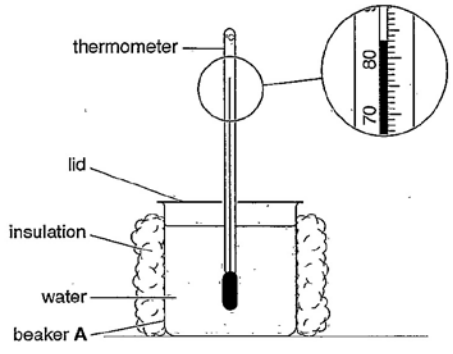


Fig. 5.1

(a) The student pours 200 cm^3 of hot water into a 250 cm^3 insulated beaker labelled **A**. He covers the top of the beaker with a lid.

The student takes a temperature reading every 30 s as the water cools. The readings are shown in Table 5.1.

(i) Complete the column headings in the table. [1]

(ii) The starting temperature θ of the hot water in beaker **A** is shown on Fig. 5.1.

Record this temperature in the table at time $t = 0$ s. [1]

Table 5.1

	beaker **A** insulation and lid	beaker **B** insulation, no lid	beaker **C** lid, no insulation
t/ S	θ/ cm	θ/ cm	θ/ cm 1
0	83 2	85	78
30	80	79	74
60	77	74	71
90	75	70	68
120	73	67	66
150	71	64	64

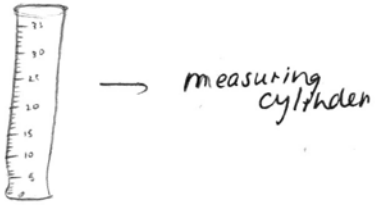
1 The time unit is correct but the candidate writes cm as the unit for temperature.

2 The temperature reading is correct.

Mark awarded for (a) (i) = 0 out of 1

Mark awarded for (a) (ii) = 1 out of 1

Example candidate response – low, continued	Examiner comments
(b) The student repeats the procedure using a 250 cm^3 beaker labelled **B**. This beaker is insulated but has no lid. He repeats the procedure again using a 250 cm^3 beaker labelled **C**. This beaker has a lid but no insulation. All the readings are shown in Table 5.1. **(i)** Tick the statement that best describes the results of the investigation. ☑ Removing the lid speeds up the rate of cooling significantly more than removing the insulation. ☑ Removing the insulation speeds up the rate of cooling significantly more than removing the lid. ☐ There is no significant difference between removing the lid and removing the insulation. 3 [1] **(ii)** Justify your answer by reference to the readings. Because in beaker C, as you can see the results and temperature going down much faster than beaker B. 4 [1] **(c)** State two of the conditions that should be kept the same in this experiment in order for the comparison to be fair. 1. Surrounding temperature should be kept same /normal at all times. 2. Size of the beaker ~~used~~. that is used. 5 [2] **(d)** Suggest a suitable material for the lid. Give a reason for your choice of material. material Glass. reason An expensive and it also catches water droplets. 6 [2]	3 The candidate has not ticked the correct box. Mark awarded for (b) (i) = 0 out of 1 4 The answer given in part (i) is incorrect so the justification is also incorrect. Mark awarded for (b) (ii) = 0 out of 1 5 The candidate suggests one appropriate condition (room temperature) that should be kept constant. Mark awarded for (c) = 1 out of 2 6 The candidate does not suggest a suitable material in the context of the experiment in a school laboratory. Mark awarded for (d) = 1 out of 2

Example candidate response – low, continued	Examiner comments
(e) Describe briefly how a measuring cylinder is read in order to obtain a reliable value for the volume of water. You may draw a diagram.  water is filled inside measuring cylinder. The readings will be given and there are proper divisions in the cylinder you you to obtain a much more acculate reading 7 ..[2] [Total: 10]	7 The candidate does not show in the diagram or description how to obtain a reliable reading for the volume. Mark awarded for (e) = 0 out of 2 **Total mark awarded = 3 out of 10**

How the candidate could have improved the answer

(a) The unit of temperature ºC was required.

(b) The candidate should have arrived at the correct conclusion from the results and then justify that conclusion.

(c) Second valid condition was not stated.

(d) The candidate should have suggested a suitable material and reason, in the context of a school laboratory.

(e) The candidate needed to show in the diagram or description how to obtain a reliable reading for the volume.

Common mistakes candidates made in this question

- Drawing the wrong conclusion in part **(b)**.
- Writing a vague answer for one of the conditions that should be kept the same.

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Version 1.0