Contents

Chapter 1

General physics

1.1 Length and time

1. 0625_s20_qp_62 Q: 1

A student investigates the period of a pendulum. Fig. 1.1 and Fig. 1.2 show the apparatus she uses.

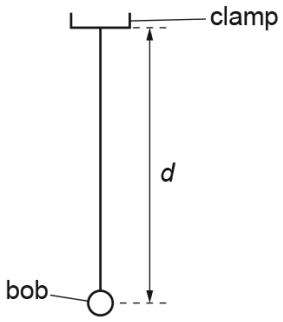


Fig. 1.1

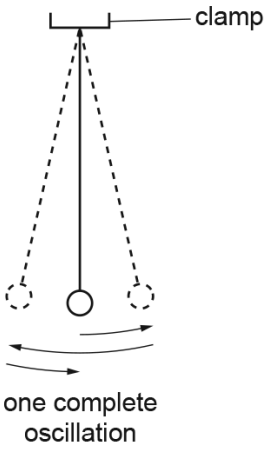


Fig. 1.2

(a) Explain briefly, with the help of a diagram, how you would use a metre rule and set square to measure the length d of a pendulum as accurately as possible.

Diagram:

.....

.....

..... [3]

(b) The student adjusts the pendulum so that d = 50.0 cm. She displaces the bob slightly and releases it so that it swings. Fig. 1.2 shows one complete oscillation of the pendulum.
She measures the time t_1 for 20 complete oscillations.

(i) Record the time t_1 shown in Fig. 1.3.

Fig. 1.3

t_1 = ... [1]

(ii) Calculate the period T_1 of the pendulum. The period is the time for one complete oscillation.

T_1 = ... [1]

(c) The student adjusts the pendulum until the distance d is 100.0 cm.

She repeats the procedure and records the time t_2 for 20 oscillations and the period T_2.

t_2 = 39.80 s

T_2 = 1.99 s

She measures the mass m_A of the pendulum bob. The reading on the balance is shown in Fig. 1.4.

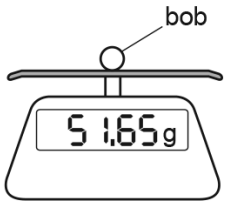


Fig. 1.4

Record mass m_A of the pendulum bob to the nearest gram.

m_A = ... g [1]

The student repeats the procedure using a pendulum bob of mass m_B.

m_B = 109 g

She obtains these results:

distance d = 50.0 cm

period T_3 = 1.39 s

distance d = 100.0 cm

period T_4 = 2.02 s

(d) **(i)** Using the results T_1, T_2, T_3 and T_4, for the period of each of the pendulums, tick (✓) the response that matches your results within the limits of experimental accuracy.

☐ the period T is affected by d only

☐ the period T is affected by both d and m

☐ the period T is affected by m only

☐ the period T is not affected by d or m

[1]

(ii) Justify your answer to **(d)(i)** by reference to the results.

.....

..... [1]

(e) The student now investigates the effect of the size of the oscillations on the period of the pendulum.

(i) Suggest briefly how you would measure the size of an oscillation. You may draw a diagram.

.....

..... [2]

(ii) State **one** variable that you would keep constant during this part of the investigation.

..... [1]

[Total: 11]

2. 0625_w19_qp_62 Q: 1

A student investigates a pendulum. Fig. 1.1 and Fig. 1.2 show some of the apparatus used.

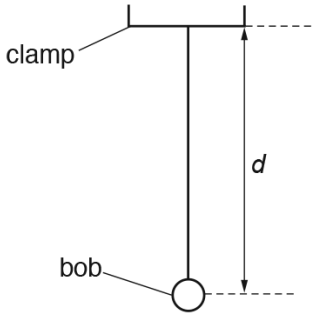


Fig. 1.1

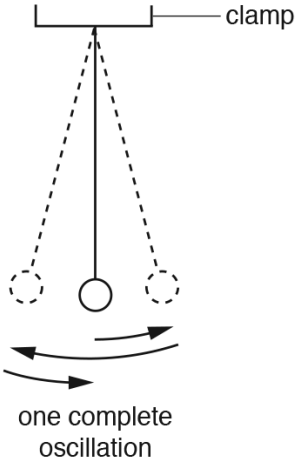


Fig. 1.2

(a) The student adjusts the length of the pendulum until the distance *d*, measured to the centre of the bob, is 50.0 cm. State one precaution that you would take to obtain the length of 50.0 cm as accurately as possible.

.....

..... [1]

(b) The student displaces the bob slightly and releases it so that it swings. Fig. 1.2 shows one complete oscillation of the pendulum.

(i) He measures the time *t* for 20 complete oscillations. The time *t* is shown on the stopwatch in Fig. 1.3.

Fig. 1.3

In the first row of Table 1.1, record the time *t* shown in Fig. 1.3. [1]

(ii) Calculate, and record in Table 1.1, the period *T* of the pendulum. The period is the time for one complete oscillation. [1]

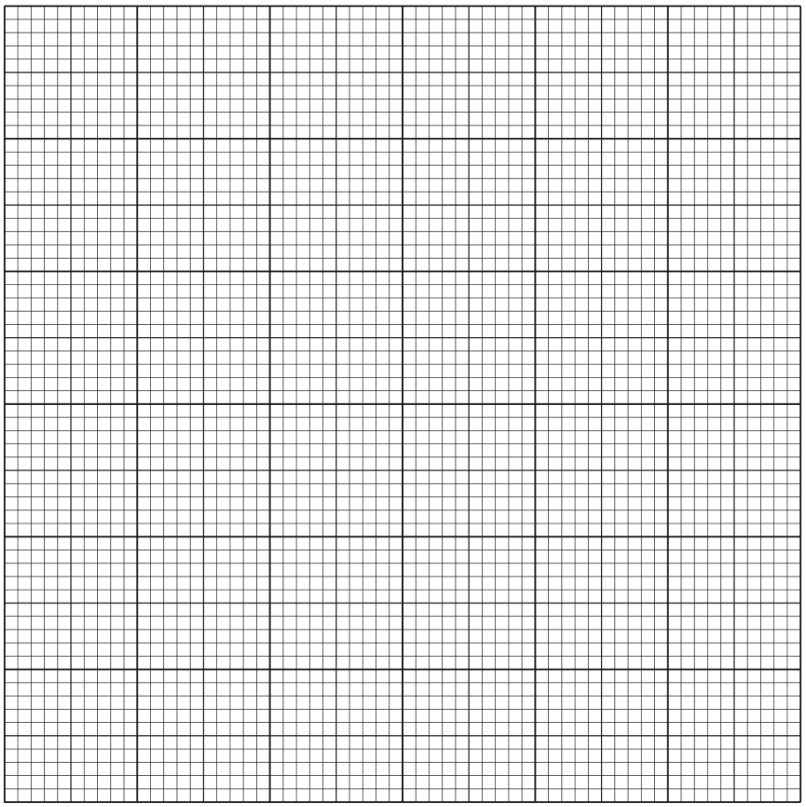
(iii) Calculate T^2. Record its value in Table 1.1. [1]

(c) The student repeats the procedure in **(b)** using d = 60.0 cm, 70.0 cm, 80.0 cm and 100.0 cm. The readings are shown in Table 1.1.

Table 1.1

d/cm	t/s	T/s	T^2/s^2
50.0			
60.0	30.00	1.50	2.25
70.0	33.20	1.66	2.76
80.0	35.80	1.79	3.20
100.0	39.80	1.99	3.96

Plot a graph of T^2/s^2 (y-axis) against d/cm (x-axis). You do **not** need to start your axes at the origin (0,0).



[4]

(d) Determine the gradient G of the line. Show clearly on the graph how you obtained the necessary information.

G = ... [2]

(e) Calculate the acceleration of free fall g in $\mathrm{m/s^2}$ using the equation $g = \frac{0.395}{G}$, where G is your gradient from **(d)**.

Write down the value of g to a suitable number of significant figures for this experiment.

$g =$ .....$\mathrm{m/s^2}$ [2]

[Total: 12]

3. 0625_s17_qp_61 Q: 4

The class is investigating the motion of a pendulum.

Fig. 4.1 shows the apparatus.

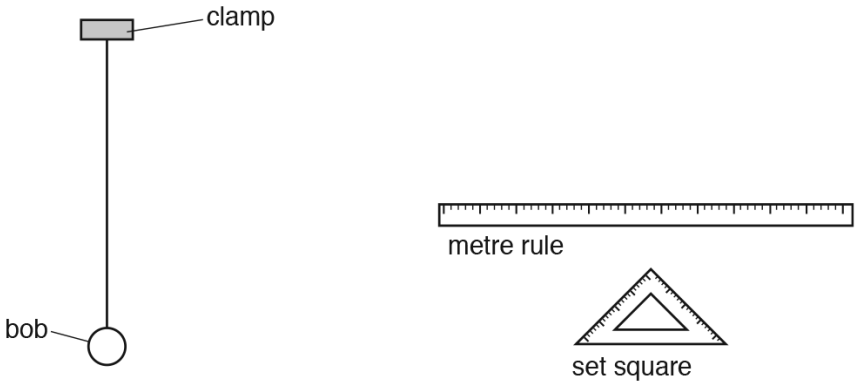


Fig. 4.1

(a) (i) On Fig. 4.1, show clearly the length l of the pendulum. [1]

(ii) Use Fig. 4.2 to explain how you would measure the length l accurately. You may draw on the diagram.

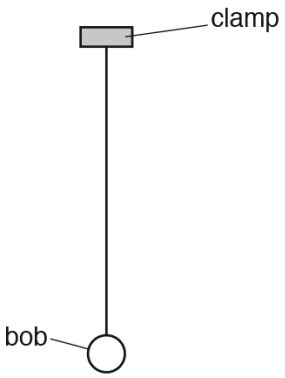


Fig. 4.2

.....

.....

.....

.....

.....[2]

1.2 Motion

21. 0625_s18_qp_61 Q: 1

A student is determining the acceleration of free fall *g* using a pendulum. Fig. 1.1 shows the pendulum. Fig. 1.2 shows one complete oscillation of the pendulum.

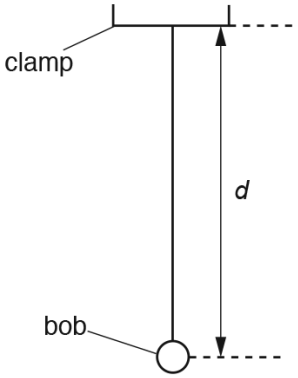


Fig. 1.1

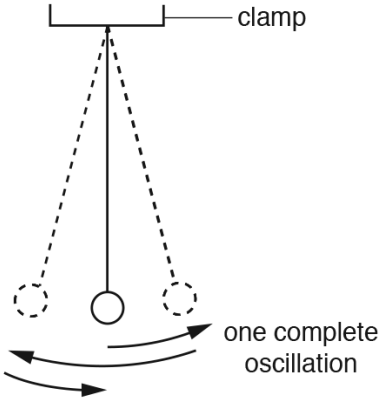


Fig. 1.2

(a) On Fig. 1.1, measure the distance *d*.

d = ... cm [1]

(b) Fig. 1.1 is drawn 1/10th actual size.

(i) Calculate the actual distance *D* from the bottom of the clamp to the centre of the bob.

D = ... cm [1]

The student displaces the bob slightly and releases it so that it swings. He measures the time *t* for 10 complete oscillations. The time *t* is shown on the stopwatch in Fig. 1.3.

Fig. 1.3

(ii) Write down the time *t* shown in Fig. 1.3.

t = ... [1]

(iii) Calculate the period *T* of the pendulum. The period is the time for one complete oscillation.

T = ... [1]

(iv) Calculate T^2.

T^2 = ... [1]

(v) Calculate the acceleration of free fall g using the equation $g = \frac{20}{T^2}$.

g = ... [1]

(c) The student adjusts the pendulum until the distance D measured to the centre of the bob is 100.0 cm.

He repeats the procedure and obtains another value of T^2.

T^2 = 3.94

(i) On the dotted line above, write the unit for T^2. [1]

(ii) Calculate the acceleration of free fall g using the equation $g = \frac{40}{T^2}$ and the value of T^2 from **(c)**. Give your answer to a suitable number of significant figures for this experiment.

g = ... [1]

(d) Another student states that repeating the experiment improves the reliability of the value obtained for g.

Suggest **two** changes that you would make to improve the reliability. The stopwatch cannot be changed.

1. .....

.....

2. .....

.....

[2]

(e) State **one** precaution that you would take in this experiment in order to obtain accurate readings.

.....

..... [1]

[Total: 11]

22. 0625_w16_qp_61 Q: 1

A student uses a pendulum to determine a value for the acceleration of free fall *g*.

Figs. 1.1 and 1.2 show the apparatus.

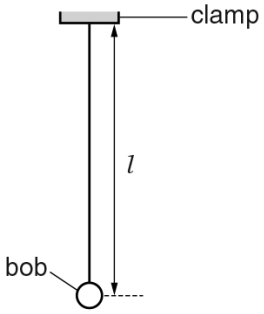


Fig. 1.1

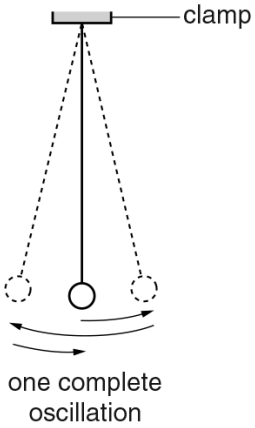


Fig. 1.2

(a) On Fig. 1.1, measure the length l of the pendulum.

l = ... cm [1]

(b) The student adjusts the pendulum until its length l = 50.0 cm. The length l is measured to the centre of the bob.

Explain briefly how the student avoids a parallax (line of sight) error when measuring length l.

.....

.....

.....[1]

(c) The student displaces the pendulum bob slightly and releases it so that it swings.

He measures the time t for 20 complete oscillations of the pendulum.

$t =$ 27.8 s

(i) Calculate the period T of the pendulum. The period is the time for one complete oscillation.

$T =$ .....[1]

(ii) Measuring the time for a large number of oscillations, rather than for one oscillation, gives a more accurate value for T.

Suggest one practical reason why measuring the time for 200 oscillations, rather than 20 oscillations, may **not** be suitable.

.....

.....[1]

(iii) Calculate T^2.

$T^2 =$ .....[1]

(iv) Calculate the acceleration of free fall g using the equation $g = \frac{4\pi^2 l}{T^2}$. Give your answer to a suitable number of significant figures for this experiment.

$g =$ ..... m/s^2 [2]

(d) The student checks the value of the acceleration of free fall g in a text book. The value in the book is $9.8\,\mathrm{m/s^2}$.

(i) Suggest a practical reason why the result obtained from the experiment may be different.

.....

.....

.....[1]

(ii) Suggest **two** improvements to the experiment.

1. .....

.....

2. .....

.....
[2]

[Total: 10]

23. 0625_s14_qp_62 Q: 5

An IGCSE student is investigating the average speed of a toy car travelling down a slope.

She releases the toy car on the slope. She uses a stopwatch to measure the time taken for the car to travel down part of the slope. Fig. 5.1 shows the slope.

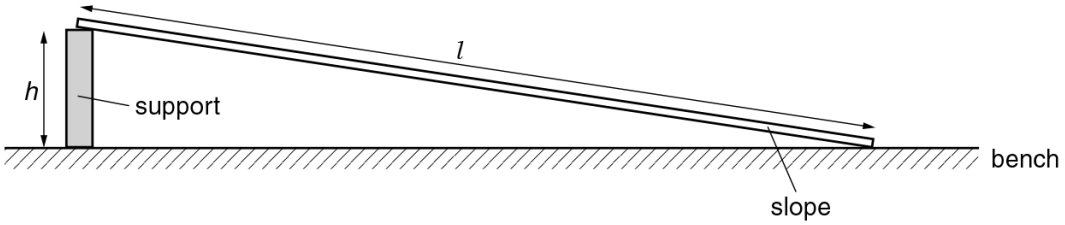


Fig. 5.1

(a) (i) Suggest a suitable length l for the slope used in this school laboratory experiment.

l = ...

(ii) Suggest a suitable height h, above the laboratory bench, for one end of the slope.

h = ...
[2]

(b) The student tries to determine the time that the toy car takes to travel a distance down the slope.

Make three suggestions about what she could do to ensure that the distance travelled and the time taken by the toy car are measured as reliably as possible.

1. .....

.....

2. .....

.....

3. .....

.....
[3]

[Total: 5]

24. 0625_w14_qp_63 Q: 4

An IGCSE student is investigating the motion of a ball down a slope.

She is using the apparatus shown in Fig. 4.1.

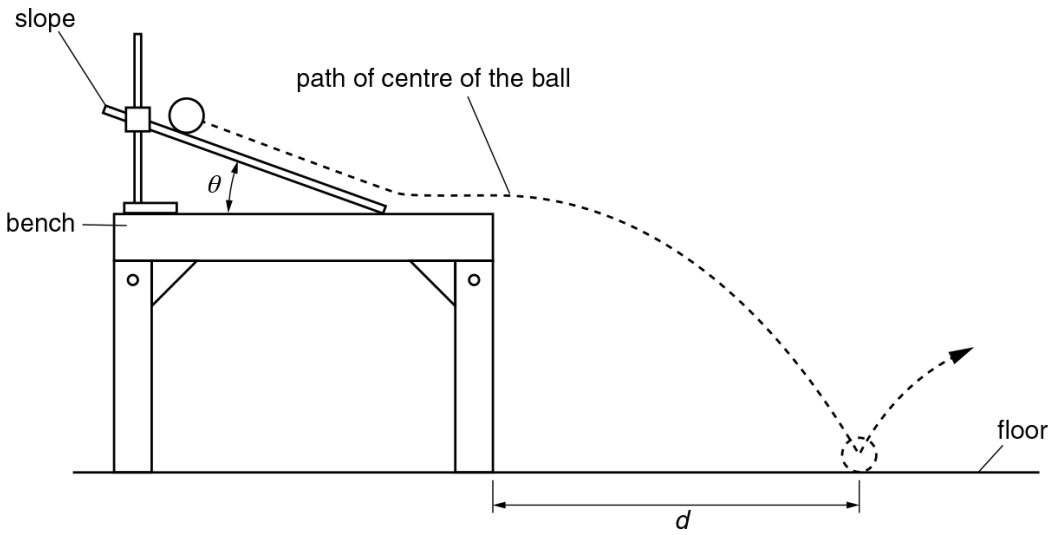


Fig. 4.1

She measures the angle θ of the slope, releases the ball from a marked p int on the slope and watches where it hits the floor.

She then measures the distance d from the table to where the ball lands.

This is repeated for a number of angles, releasing the ball from the same point on the slope. Her results are shown in Table 4.1.

Table 4.1

θ/°	d/cm
20	42
30	55
40	64
50	51
60	40

(a) **(i)** Describe the pattern in the values of d as θ is increased.

.....

.....

..... [1]

(ii) From the pattern of results, predict what the d values may be for slope angles of 10° and 70°.

10° .....

70° .....
[1]

(b) The student is being assessed and must carry out the experiment on her own. She says that it is difficult to release the ball carefully and then be able to see exactly where it lands.

Suggest an improvement she might make to the experiment, so that she could obtain a more accurate measurement of d.

.....

.....

..... [1]

(c) Suggest how she might make sure that the results of the experiment are reliable.

.....

.....

..... [2]

[Total: 5]

1.3 Mass and weight

This topic is not assessed in paper 6.

1.4 Density

26. 0625_m20_qp_62 Q: 1

A student is determining the density of wood by two methods.

He is using the wooden rod shown in Fig. 1.1.

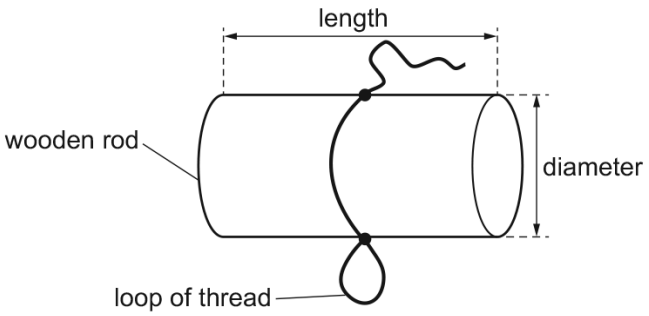


Fig. 1.1

Method 1

The dimensions of the wooden rod are shown full size in Fig. 1.2.

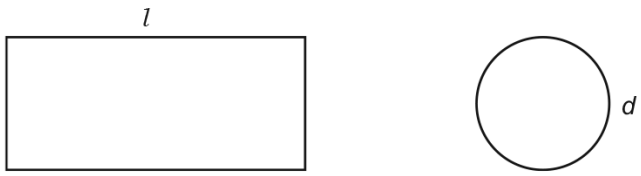


Fig. 1.2

(a) (i) Measure the length l and the diameter d of the wooden rod in Fig. 1.2.

l = ... cm

d = ... cm
[2]

(ii) Suggest an accurate method for measuring the diameter of the wooden rod in this experiment.
List any additional apparatus that might be required and briefly describe how you would determine the diameter.
You may draw a diagram if it helps to explain your answer.

.....

.....

..... [2]

Appendix A

Answers

1. 0625_s20_MS_62 Q: 1

(a)	clear diagram showing use of set square and rule with horizontal line of set square across to vertical rule from approximate centre of bob	1
	rule positioned to enable measurement of *d* from bottom of clamp	1
	wording to include perpendicular viewing of the rule	1
(b)(i)	t_1 = 28.12 (s)	1
(b)(ii)	T_1 = 1.406 (s)	1
(c)	m_A = 52	1
(d)(i)	first box only ticked (error carried forward possible)	1
(d)(ii)	justified by correct reference to results	1
(e)(i)	rule or protractor used	1
	method explained / diagram drawn	1
(e)(ii)	length	1

---

2. 0625_w19_MS_62 Q: 1

(a)	perpendicular viewing of scale / use of horizontal aid, e.g. set-square / clamp rule / rule close to pendulum	1
(b)(i)	27.6(0)	1
(b)(ii)	1.38	1
(b)(iii)	1.90	1
(c)	graph: axes correctly labelled and right way round	1
	suitable scales	1
	all plots correct to ½ small square	1
	good line judgement, thin, continuous line	1
(d)	triangle method indicated on graph	1
	with triangle at least half of candidate's line between the extreme plotted points	1
(e)	correct calculation of *g*	1
	to 2 or 3 significant figures	1

---

3. 0625_s17_MS_61 Q: 4

(a)(i)	*l* shown clearly from bottom of clamp to centre of bob	**1**
(a)(ii)	Any 2 from: Metre rule close to pendulum Measurement from bottom of clamp Set-square used as a horizontal reference	**2**
(b)(i)	1.01(1)	**1**
(b)(ii)	Any 2 from: Idea of averaging Reaction time / judgement of when to stop / start (owtte) Reduces effect of error / spreads error over 20 swings (owtte)	**2**
(c)	1.02(212) with 2, 3 or 4 significant figures	**1**
	unit s^2	**1**
	Total:	**8**

4. 0625_w17_MS_61 Q: 3

	MP1	Stopwatch (or equivalent) AND (metre) rule / ruler	**1**
	MP2	Measure time for 5 (□) oscillations	**1**
	MP3	Divide by number of oscillations to find period (*T*)	**1**
	MP4	Repeat for each bob	**1**
	MP5	Variable; one from: Initial amplitude / starting position Length of pendulum / thread Number of oscillations	**1**
	MP6	Table with column headings for *t*, or period (*T*), or both AND *d*, with correct units	**1**
	MP7	Conclusion: Plot graph(s) of *d* against period (*T*) or *t* (or vice versa) OR compare period (*T*) or *t* values for different diameters	**1**

5. 0625_w17_MS_62 Q: 1

(a)(i)	*d* = 5.0 (cm)	**1**
(a)(ii)	*D* = 50 cm	**1**
(a)(iii)	clear correct use of set-square AND vertical ruler	**1**
(b)(i)	28.12	**1**
(b)(ii)	1.406 / 1.41 / 1.4	**1**
	unit s / secs / seconds seen in **1(b)(i)** or **1(b)(ii)** at least once	**1**
(c)	statement to match readings justification to include the idea of within (or beyond e.c.f.)	**1**
	the limits of experimental accuracy e.g. (very) close / almost equal	**1**
(d)	final box ticked	**1**
(e)	V, V, V, V, P, P all correct = 2 marks 4 or 5 correct = 1 mark Fewer than 4 correct = 0 marks	**2**

6. 0625_w16_MS_62 Q: 3

(a)	any two from: length of spring / number of coils diameter / thickness of spring material / type / stiffness / elasticity / spring constant of spring how far spring is displaced / amplitude (of oscillations)	**2**
(b)(i)	increases has no effect on has no effect on	**1** **1** **1**
(b)(ii)	one from: repeats large number of oscillations and divide timing sensor / light gate use a fiducial mark (however expressed) counting down to zero (before starting the timer)	**1**
	Total:	**6**

---

7. 0625_s15_MS_61 Q: 5

(a) use of $T^2 = 4\,s^2$ [1]

correct method shown clearly on graph [1]

l = 0.99 (m) cao OR ecf 0.49 if $T^2 = 2\,s^2$ used [1]

(b) reduce (percentage) uncertainty OR reduce (the effect of) error due to starting/stopping [1]

(c) **(i)** 5 – 10 [1]

(ii) minimum not less than 10 g; maximum not more than 1000 g; maximum must be at least double the minimum [1]

[Total: 6]
