## **CAMBRIDGE INTERNATIONAL EXAMINATIONS**

GCE Advanced Subsidiary Level and GCE Advanced Level

## MARK SCHEME for the October/November 2012 series

## 9702 PHYSICS

9702/33 Paper 3 (Advanced Practical Skills 1), maximum raw mark 40

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.



1	(b)	(i)	Value of $h$ in range $0.085 \mathrm{m} \le h \le 0.095 \mathrm{m}$ consistent with unit.	[1]
	(c)		lue of $T$ in range $0.6 s \le T \le 1.5 s$ consistent with unit. dence of repeats.	[1] [1]
	(d)		sets of readings of $h$ and $T$ or raw times scores 4 marks, five sets scores 3 marks etc. Ip from Supervisor $-1$ .	[4]
		Ra	nge: $h_{\text{max}} - h_{\text{min}} \ge 15.5 \text{cm}$	[1]
		Eac The	lumn headings: ch column heading must contain a quantity and a unit where appropriate. e unit must conform to accepted scientific convention e.g. $T^2h / s^2m$ (or $ms^2$ ) and $m^2$ .	[1]
			nsistency: raw values of <i>h</i> must be given to the nearest mm.	[1]
		ΑII	nificant figures: values of $h^2$ must have the same number of significant figures as, or one more than, the other of significant figures in $h$ .	e [1]
			lculation: lues of $\mathcal{T}^2h$ calculated correctly.	[1]
	(e)	(i)	Axes: Sensible scales must be used, no awkward scales (e.g. 3:10). Scales must be chosen so that the plotted points occupy at least half the graph grid in both <i>x</i> and <i>y</i> directions. Scales must be labelled with the quantity that is being plotted.	[1]
			Scale markings must be no more than three large squares apart.	
			Plotting of points: All observations in the table must be plotted on the graph grid. Diameter of plots must be $\leq$ half a small square (no "blobs"). Check that the points are plotted correctly. Work to an accuracy of half a small square both the $x$ and $y$ directions.	[1] e in
			Quality: All points in the table must be plotted (at least 5) for this mark to be scored. Judge by	[1] the

**Mark Scheme** 

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**Syllabus** 

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(ii) Line of best fit:

Judge by balance of all the points on the grid (at least 5) about the candidate's line.

There must be an even distribution of points either side of the line along the full length.

Allow one anomalous point only if clearly indicated (i.e. circled or labelled) by the candidate. Line must not be kinked or thicker than half a small square.

All points must be within  $\pm 0.0025 \,\mathrm{m}^2$  (25 cm²) in the  $h^2$  direction of a straight line.

scatter of all the points about a straight line.

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	<ul> <li>(iii) Gradient:         <ul> <li>The sign of the gradient must match the graph.</li> <li>The hypotenuse of the triangle should be greater than half the length of the drawn line.</li> <li>Both read-offs must be accurate to half a small square in both the x and y directions.</li> <li>The method of calculation must be correct.</li> </ul> </li> </ul>						
		y intercept: Either: Correct read-off from a point on the line and substitution into $y = mx + c$ . Read-off must be accurate to half a small square in both the x and y directions.			[1]		
			Or:	rect read-off of the intercept directly from the graph.	x and y direction	ons.	
	(f)	Value of $P$ = candidate's gradient. Value of $Q$ = candidate's intercept. Do not allow a value presented as a fraction.			[1]		
				$P(s^2 m^{-1} \text{ or } s^2 cm^{-1} \text{ or } s^2 mm^{-1})$ and $Q(s^2 m \text{ or } s^2 cm \text{ or } s^2 m)$ int with value.	mm) correct ar	nd [1]	
						[Total: 20]	
2	(a)	(ii)	Valu	tile of $L$ in range: $5.0  \text{cm} \le L \le 15.0  \text{cm}$ with unit to neares	st mm.	[1]	
	(b)	(ii)	Sup	tile of $s$ in range: $50.0  \text{cm} \le s \le 70.0  \text{cm}$ with unit. ervisor's help $-1$ .		[1]	
			Evid	lence of repeat measurements.		[1]	
		(iii)	If rep	olute uncertainty in s is between 2 cm – 10 cm. peated readings have been taken, then the absolute unc je. Correct method used to calculate the percentage unc	•	[1] half the	
		(iv)	Corr	rect calculation of x.		[1]	
	(c)	Rav	v valu	ue(s) of <i>t</i> greater than 1s to a precision of 0.1 or 0.01s w	rith unit.	[1]	
	(d)	(i)	Corr	rect calculation of $v$ using either value of $x$ with consisten	t unit.	[1]	
		(ii)		ification of significant figures in $\nu$ linked to significant figures "raw readings").	res in t and x c	r (s – <i>L</i> ) [1]	
	(e)	(iii)	Seco	ond value of <i>t.</i> ond value of <i>s.</i> lity: correct trend; If <i>s</i> increases, <i>t</i> increases.		[1] [1] [1]	
	(f)			comment relating to the calculated values of $\emph{v}$ , testing andidate.	igainst a criterio	on specified [1]	

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(g)

	(i) Limitations 4 max.	(ii) Improvements 4 max.	Do not credit
A	two readings not enough (to draw a conclusion)	take many readings (for different masses) and plot a graph /calculate more <i>v</i> values and compare	'repeat readings' /few readings /take more readings and calculate average v
В	the car does not travel in a straight line	method of determining the distance e.g. video + scale/method of marking a path /method of guiding trolley in straight line	
С	times are short /large uncertainty in t	use a longer slope /use a steeper slope	trolley too fast
D	difficult to judge when trolley stopped/ difficult to start the stopwatch when all wheels on bench/when trolley at B/when trolley horizontal	improved method of timing eg video with timer or frame by frame/motion sensor placed at end of path/ticker tape timer	light gate(s) /reaction time /human error
E	there is a drop when the trolley reaches the end of the board/at B there is a loss of velocity/kinetic energy	method to smooth transition e.g. thinner board/bevelled edge/thin card placed at transition	
F	difficult to release without applying a force/ velocity /difficult to position head at B after releasing trolley A	method of releasing trolley e.g. card/barrier or electromagnet	air resistance
G	calculation of x doesn't take back of trolley into account	detailed method of measuring from wheel to the back of the trolley	measuring <i>l</i>

[Total: 20]