## **CAMBRIDGE INTERNATIONAL EXAMINATIONS**

GCE Advanced Subsidiary Level and GCE Advanced Level

## MARK SCHEME for the October/November 2012 series

## 9702 PHYSICS

9702/31

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.



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(b)	<b>(b) (ii)</b> Values of raw $L$ in range $2.0  \text{cm} \le L \le 8.0  \text{cm}$ consistent with unit.			[1]	
	(iii)	Valu	e of $\theta$ < 90 ° with unit. No raw value greater than 0.5 ° p	recision.	[1]
(c)	Inco	rrect	of readings of $L$ , $m$ and $\theta$ scores 5 marks, four sets scottrend then $-1$ . Ip from Supervisor $-2$ . Minor help from Supervisor $-1$ .	ores 4 marks e	tc. [5]
	Rar	ige: <i>r</i>	$n_{\min} \le 0.100 \mathrm{kg},  m_{\max} \ge 0.350 \mathrm{kg}.$		[1]
	Eac	h col	neadings: umn heading must contain a quantity and a unit where a must conform to accepted scientific convention e.g. <i>m</i> /k		[1] g, θ/°.
		siste /alue	ncy: s of $L$ must be given to the nearest mm.		[1]
	All ۱	/alue	nt figures: s of $m$ sin $\theta$ must have the same number of significant file least number of significant figures in $m$ and $\theta$ .	gures as, or o	[1] ne more
		culati ues o	on: f $m$ sin $ heta$ calculated correctly.		[1]
(d)	(i)	Scal both Scal	s: sible scales must be used. Awkward scales (e.g. 3:10) a es must be chosen so that the plotted points occupy at l x and y directions. es must be labelled with the quantity that is being plotte e markings must be no more than three large squares a	east half the g d.	
		All o Dian Che	ing of points: bservations in the table must be plotted on the graph grater of plots must be $\leq$ half a small square (no blobs). ck that the points are plotted correctly. Work to an accurate $x$ and $y$ directions.		[1] mall square in
		Judg	lity: oints in the table must be plotted (at least 4) for this mange by the scatter of all the points about a straight line. oints must be within $\pm$ 0.01 kg in the $m$ sin $\theta$ direction of		
	(ii)		of best fit: ge by balance of all the points on the grid (at least 4) above must be an even distribution of points either side of the		

**Mark Scheme** 

**Syllabus** 

**Paper** 

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candidate. Line must not be kinked or thicker than half a small square.

There must be an even distribution of points either side of the line along the full length. Allow <u>one</u> anomalous point only if clearly indicated (i.e. circled or labelled) by the

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	<ul> <li>(iii) Gradient:         <ul> <li>The sign of the gradient must match the graph. The hypotenuse of the triangle used must be at least 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: Check correct read-off from a point on the line and substitu Read-off must be accurate to half a small square in both th Or: Check the read-off of the intercept directly from the graph.	•	
	(e)		ue of $P = \text{candidate's gradient}$ . Value of $Q = \text{candidate's interested}$ not allow a value presented as a fraction.	ercept.	[1]
			t for $P$ (m kg <sup>-1</sup> or cm kg <sup>-1</sup> or mm kg <sup>-1</sup> or m g <sup>-1</sup> or cm g <sup>-1</sup> or mm rect and consistent with value.	g <sup>-1</sup> ) and Q (m c	[1]
					[Total: 20]
2	(a)	(ii)	Value of circumference in range 30.0 – 50.0 cm to the near	est mm with uni	t. [1]
		(iii)	Absolute uncertainty in circumference is between $2\text{mm}-6$ If repeated readings have been taken, then the absolute urrange. Correct method used to calculate the percentage ur	certainty can be	[1] e half the
		(iv)	Value of circumference within 2cm of first value.		[1]
	(b)	(ii)	Raw time values to at least 0.1s or 0.01s, value of 0.5s < 7 Evidence of repeats.	√<2.0s.	[1] [1]
	(c)	(i)	Second value of $T$ . Second value of $T >$ first value of $T$ .		[1] [1]
		(ii)	Third value of <i>T</i> .		[1]
	(d)	(ii)	Correct calculation of two values of <i>k</i> . Correct calculation of third value of <i>k</i> .		[1] [1]
		(iii)	Justification of significant figures in $\emph{k}$ linked to significant figures readings")	gures in time <u>an</u>	<u>d</u> <i>m</i> (not just [1]
		(iv)	Sensible comment relating to the calculated values of $k$ , tesspecified by the candidate.	sting against a c	riterion [1]

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(e)

	(i) Limitations 4 max.	(ii) Improvements 4 max.	Do not credit
A	three results not enough /not enough results	take more readings <u>and plot a</u> <u>graph</u>	two results not enough /repeat readings /few readings
В	string too wide for markings on rule	use thinner string	
С	rules have different thicknesses so effective length of loop changes/ /different lengths so not a fair test	use rulers of similar thicknesses/ readings/method to take thickness into account /use rulers of the same length	
D	times are small /large uncertainty in time	use longer strings/improved method of timing	
E	difficult to judge start/ end of/complete oscillation	Position/motion sensor facing the rule /video with timer	position sensor at end or in middle
F	swings of 30 cm ruler highly damped		
G	difficult to make two loops of the same circumference	method by which this can be achieved	
Н	large uncertainty in mass	method of measuring mass more precisely	accurate balance

[Total: 20]