

Cambridge International Examinations Cambridge International Advanced Subsidiary and Advanced Level

## PHYSICS

9702/33 October/November 2016

Paper 3 Advanced Practical Skills 1 MARK SCHEME Maximum Mark: 40

Published

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.

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Ρά	age 2		Mark Scheme	Syllabus	Paper
			Cambridge International AS/A Level – October/November 2016	9702	33
1	(a)	(v)	Value of <i>I</i> in range 20 mA $\leq I \leq$ 200 mA with unit.		[1]
	(c)		c sets of readings of $R$ and $y$ (with correct trend and without help from ores 5 marks, five sets scores 4 marks etc.	n Supervisor	) [5]
			nge: lues of <i>R</i> must include 33Ω.		[1]
		Ea Th	lumn headings: ch column heading must contain a quantity and a unit where appropr e presentation of the quantity and unit must conform to accepted scie nvention, e.g. $1/y/m^{-1}$ or $1/y$ (m <sup>-1</sup> ).		[1]
			nsistency: values of raw <i>y</i> must be given to the nearest mm.		[1]
		-	gnificant figures: ery value of 1 <i>/ R</i> must be given to 2 or 3 significant figures.		[1]
			lculation: y calculated correctly to the number of s.f. given by the candidate.		[1]
	(d)	(i)	Axes: Sensible scales must be used. Awkward scales (e.g. 3:10, fraction are not allowed. Scales must be chosen so that the plotted points occupy at least ha grid in both <i>x</i> and <i>y</i> directions. Scales must be labelled with the quantity that is being plotted. Scale markings should be no more than three large squares apart.		
			Plotting of points: All observations must be plotted on the grid. Diameter of plotted points must be $\leq$ half a small square (no "blobs Plotted points must be accurate to half a small square.	<i></i>	[1]
			Quality: All points in the table must be plotted on the grid for this mark to be All points must be within $0.001 \text{ cm}^{-1}$ ( $0.1 \text{ m}^{-1}$ ) (to scale) on the <i>y</i> -axis straight line.		[1]
		(ii)	Line of best fit: Judge by balance of all points on the grid about the candidate's line 5 points). There must be an even distribution of points either side of along the full length. Allow one anomalous point only if clearly indicated (i.e. circled or la the candidate. There must be at least five points left after the anon point is disregarded. Line must not be kinked or thicker than half a small square.	of the line belled) by	[1]

P	age 3		Mark Scheme	Syllabus	Paper
		(	Cambridge International AS/A Level – October/November 2016	9702	33
	(	(iii)	Gradient: The hypotenuse of the triangle must be greater than half the length drawn line. The method of calculation must be correct. Do not allow $\Delta x / \Delta y$ . Both read-offs must be accurate to half a small square in both the or directions.		[1]
			<ul> <li>y-intercept:</li> <li>Either:</li> <li>Check correct read-off from a point on the line and substituted into Read-off must be accurate to half a small square in both x and y did Or:</li> <li>Check read-off of the intercept directly from the graph (accurate to small square.</li> </ul>	rections.	[1]
	(e)		ue of $P = -$ candidate's gradient and value of $Q =$ candidate's interce not allow fractions.	pt.	[1]
		Uni	ts for <i>P</i> (e.g. $\Omega m^{-1}$ ) and <i>Q</i> (e.g. $m^{-1}$ ) correct.		[1]
	(f)	(ii)	Value of X in the range 5.0 $\Omega$ to 20.0 $\Omega$ from correct calculation.		[1]
2	(b) (	(iii)	All raw readings stated to at least 0.1 s. Value for $T$ with unit in the 0.50 s to 0.90 s.	range	[1]
			Evidence of repeats (at least two recordings of $nT$ where $n \ge 5$ ).		[1]
	(c)	(i)	Correct calculation of <i>l</i> .		[1]
		(ii)	Justification of s.f. in $l$ linked to s.f. in time readings (e.g. time, raw t	time, <i>nT</i> ).	[1]
	(d)	(ii)	Value of <i>d</i> ( $l \pm 0.050 \text{m}$ ).		[1]
	(	(iii)	Absolute uncertainty in <i>d</i> in range 2 mm–8 mm. If repeated readings have been taken, then the uncertainty can be range (but not zero) if the working is clearly shown. Correct method of calculation to obtain percentage uncertainty.	half the	[1]
	(e)	(ii)	Value for <i>t</i> in the range 2.0s–8.0s.		[1]
	(f)	Sec	cond value of <i>T</i> .		[1]
		Sec	cond value of <i>t</i> .		[1]
		Qu	ality: Second value of $t >$ first value of $t$ .		[1]

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2016	9702	33

[1]

[1]

(g) (i) Two values of k calculated correctly, and to at least 2 significant figures.

(ii) Valid comment consistent with calculated values of *k*, testing against a <u>stated</u> numerical criterion.

(h)	(i) Limitations [4]	(ii) Improvements [4]	Do not credit
A	Two readings not enough to draw a conclusion	Take many readings (for different masses) <u>and</u> plot a graph/ take more readings <u>and</u> compare <i>k</i> values	Two readings not enough for accurate results Repeat readings Few readings Take more readings and calculate average <i>k</i>
В	Difficult to set <u>d</u> with reason e.g. knot takes some string/knot or weight slips	Improved method to set <i>d</i> e.g. trial and error/glue knots to stop slipping	
С	Difficult to measure <u>d</u> with reason e.g. parallax error/cannot get ruler close/hands move holding ruler in place/difficult to judge centre of mass(es)/rule not vertical	Clamped metre rule/ measure to top and bottom of masses and find the average/ detailed method to check rule vertical/ detailed method to reduce parallax error	Eyes level Eyes perpendicular Reference to set square without detail
D	Difficult to measure ( <i>n</i> ) <i>T</i> with reason e.g. difficult to judge complete oscillation	Use fiducial marker at centre of oscillation/ use a motion sensor placed under masses	Reaction time error Force on release
E	Difficult to see when coil separation is constant <b>or</b> Separation of coils constant for a short time	Video with timer/ video and view frame by frame/ screen behind spring	Video timer
F	Movement of spring along rod	Method to fix spring to rod e.g. Blu-Tack or groove in rod	Air conditioning/draughts Unwanted modes of oscillation