Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 2017**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)(iii)	Value of x with unit to the nearest mm in the range 10.0–15.0 cm.	**1**
1(b)(ii)	Evidence of repeated timings. Must see nT repeated where $n \geqslant 5$.	**1**
1(c)	Six sets of readings of x (different values) and time with correct trend and without help from Supervisor scores 5 marks, five sets scores 4 marks etc.	**5**
	Range: $x_{min} \leqslant 5.0\,cm$ **and** $x_{max} \geqslant 20.0\,cm$.	**1**
	Column headings: Each column heading must contain a quantity and a unit where appropriate. The presentation of quantity and unit must conform to accepted scientific convention e.g. x^2 / m^2.	**1**
	Consistency: All values of raw x must be given to the nearest mm.	**1**
	Significant figures: All values of x^2 must be given to the same number of s.f. as (or one more than) the s.f. in raw x.	**1**
1(d)(i)	Axes: Sensible scales must be used, no awkward scales (e.g. 3:10 or fractions). Scales must be chosen so that the plotted points occupy at least half the graph grid in both x and y directions. Scales must be labelled with the quantity that is being plotted. Scale markings should be no more than three large squares apart.	**1**
	Plotting of points: All observations must be plotted on the grid. Diameter of plotted points must be $\leqslant$ half a small square (no “blobs”). Points must be plotted to an accuracy of half a small square.	**1**
	Quality: All points in the table must be plotted for this mark to be awarded. It must be possible to draw a straight line that is within ± 0.025 s on the T axis of all plotted points.	**1**

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Question	Answer	Marks
1(d)(ii)	Line of best fit: Judge by balance of all points on the grid about the candidate's line (at least 5). 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. There must be at least five points left after the anomalous point is disregarded. Lines must not be kinked or thicker than half a small square.	**1**
1(d)(iii)	Gradient: The hypotenuse of the triangle used must be greater than half the length of the drawn line. Gradient sign must match graph. 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 x and y directions.	**1**
	y-intercept: Correct read-off from a point on the line substituted correctly into $y = mx + c$ or an equivalent expression. Read-off accurate to half a small square in both x and y directions. **or** Intercept read directly from the graph, with read-off at $x^2 = 0$, accurate to half a small square in the y direction.	**1**
1(e)	Value of P = candidate's gradient **and** value of Q = candidate's intercept. The values must not be fractions.	**1**
	Unit for P dimensionally correct (e.g. $\mathrm{s\,m^{-2}}$ or $\mathrm{s\,cm^{-2}}$ or $\mathrm{s\,mm^{-2}}$). Unit for Q correct (s).	**1**
1(f)(iii)	Correct calculation of x.	**1**

Question	Answer	Marks
2(a)	Value of raw L with unit in range 1.5–2.5 cm.	**1**
2(c)(ii)	Value of $y \geqslant L$ and to the nearest mm.	**1**
2(c)(iii)	Value of raw θ to the nearest degree.	**1**
2(d)	Percentage uncertainty in θ based on absolute uncertainty of 2–10°. If repeated readings have been taken, then the uncertainty can be half the range (but not zero) if the working is clearly shown. Correct method of calculation to obtain percentage uncertainty.	**1**
2(e)(i)	Correct calculation of $(y - L)$.	**1**
2(e)(ii)	Correct calculation of $\cos(\theta / 2)$.	**1**
2(e)(iii)	Justification for s.f. in $\cos(\theta / 2)$ linked to s.f. in θ.	**1**
2(f)	Second value of y.	**1**
	Second value of θ.	**1**
	Quality: second value of θ > first value of θ.	**1**
2(g)(i)	Two values of k calculated correctly.	**1**
2(g)(ii)	Valid comment consistent with calculated values of k, testing against a criterion specified by the candidate.	**1**

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Question	Answer	Marks
2(h)(i)	A Two readings are not enough to draw a (valid) conclusion (**not** "not enough for accurate results", "few readings"). B Moving hands affecting keeping 15 cm the same or measuring y or θ. C Parallax error affecting the measurement of y or θ. D Reason for d not remaining constant e.g. loops slip on stand. E Difficult to know where to measure from for the angle or y. *1 mark for each point up to a maximum of 4.*	**4**
2(h)(ii)	A Take more readings <u>and</u> plot a graph/take more readings <u>and</u> compare k values (**not** "repeat readings" on its own). B Use another stand for valid purpose (e.g. instead of hand to hold spring). C Photo or still from video to measure θ **or** including scale in frame to measure y. D Improved method of fixing springs onto stand e.g. use Blu-Tack/tape/vertically clamped hacksaw blade/bulldog clips or use sandpaper to make stand rough. E Use a grid behind the springs/markers on spring. *1 mark for each point up to a maximum of 4.*	**4**

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