Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

PHYSICS **9702/36**

Paper 3 Advanced Practical Skills 2 **October/November 2017**

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.

Cambridge International will not enter into discussions about these mark schemes.

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Question	Answer	Marks
1(c)(ii)	T with unit in range 0.1–1.0 s.	**1**
	Evidence of repeated readings of nT where n = 5 or more.	**1**
1(e)	Six sets of readings of x and T showing the correct trend and without help from the Supervisor scores 5 marks, five sets scores 4 marks etc.	**5**
	Range: $0 \leqslant (x - L/2)_{min} \leqslant 1.0$ 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. $1/T^2$ / s^{-2}.	**1**
	Consistency: All values of x must be given to the nearest mm.	**1**
	Significant figures: Significant figures for every value of $1/T^2$ same as, or one greater than, the s.f. of raw time as recorded in table. If raw times recorded to nearest 0.01 s, allow number of significant figures of $1/T^2$ to be one less than the number of significant figures of the raw times.	**1**
	Values of $(x - L/2)$ calculated correctly.	**1**

Question	Answer	Marks
1(f)(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 accurate to within half a small square in both *x* and *y* directions.	**1**
	Quality: All points in the table must be plotted (at least 5) for this mark to be awarded. Scatter of points must be no more than $\pm$ 0.25 cm from a straight line in the ($x - L/2$) direction.	**1**
1(f)(ii)	Line of best fit: Judged by balance of all 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. Lines must not be kinked or thicker than half a square.	**1**
1(f)(iii)	Gradient: The hypotenuse of the triangle used must be greater than half the length of the drawn line. The method of calculation must be correct. 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 into $y = mx + c$. Read-off must be accurate to half a small square in both *x* and *y* directions. **or** Intercept read directly from the graph, with read-off at $x = 0$, accurate to half a small square in the *y* direction.	**1**
1(g)	Value of *a* = candidate's gradient **and** value of *b* = candidate's intercept. The values must not be fractions.	**1**
	Unit for *a* correct (e.g. $cm^{-1}s^{-2}$) **and** unit for *b* correct (e.g. s^{-2}).	**1**

Question	Answer	Marks
2(a)(iv)	Value of D with unit to nearest mm and in range 10.0–150.0 cm.	**1**
2(b)(ii)	Value of h_1 with consistent unit and in range 6.0–10.0 cm.	**1**
2(c)	Absolute uncertainty in h_1 of 1 mm and correct method of calculation to obtain percentage uncertainty. If repeated readings have been taken, then the uncertainty can be half the range (but not zero) if the working is clearly shown.	**1**
2(d)(ii)	Correct calculation of d.	**1**
2(f)(ii)	Values of t and w to nearest mm, with unit.	**1**
2(f)(iii)	Correct calculation of E.	**1**
2(g)	Second values of h_1 and h_2.	**1**
	Quality: Second value of d < first value of d.	**1**
	Second values of h_3 and h_4.	**1**
2(h)(i)	Two values of k calculated correctly.	**1**
2(h)(ii)	Justification for s.f. in k linked to s.f. in d and p, or linked to s.f. in h_1, h_2, h_3 and h_4.	**1**
2(h)(iii)	Valid comment relating to the calculated values of k, testing against a criterion stated by the candidate.	**1**

Question	Answer	Marks
2(i)(i)	A Two readings/too few readings/only two readings not enough to draw a (valid) conclusion. B Difficult to pile masses in centre, with reason. C Blocks move/slip/tilt. D *d* (or *p* or *t*) small so large uncertainty/ large % uncertainty in *d* (or *p* or *t*). E Permanent deformation of strip. F Difficult to mark ends of *D* due to curvature of masses. *1 mark for each point up to a maximum of 4.*	**4**
2(i)(ii)	A Take more readings and plot a graph/calculate more *k* values and compare. B Improved method for point load, e.g. suspend masses below strip/named method for sticking masses together. C Named means of stabilising blocks, e.g. stick to bench/stick to strip/stops on bench/clamp blocks to bench. D Use calipers or travelling microscope **or** use micrometer for *t* value **or** measure stack of MDF pieces. E Use 8 masses before 10 **or** turn strip over. F Use set square with detail/measure length of 10 masses then mark strip. *1 mark for each point up to a maximum of 4.*	**4**