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PHYSICS **9702/34**

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

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(b)(ii)	Value of T with unit in range 1.00–2.00 s.	**1**
	Evidence of repeated readings of nT.	**1**
1(c)	Six sets of readings of m (different values) and T with correct trend and without help from the Supervisor scores 5 marks, five sets scores 4 marks etc.	**5**
	Range: m_{min} = 50 g **and** $m_{max} \geqslant$ 350 g.	**1**
	Column headings: Each column heading must contain a quantity and a unit. The presentation of quantity and unit must conform to accepted scientific convention e.g. T^2 / s^2.	**1**
	Consistency: All values of time must be given to the nearest 0.1 s or all values to the nearest 0.01 s.	**1**
	Significant figures: Significant figures of every value of T^2 must be the same as, or one greater than, the s.f. of the raw times as recorded in table. If raw times recorded to nearest 0.01 s, allow number of significant figures of T^2 to be one less than the number of significant figures of the raw times.	**1**
	Values of T^2 calculated correctly.	**1**

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Question	Answer	Marks
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 ⩽ 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 ±25 g from a straight line in the *m* direction (*x*-axis).	**1**
1(d)(ii)	Line of best fit: Judge 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 small square.	**1**
1(d)(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 $y = mx + c$ or an equivalent expression. 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 accurate to half a small square in the *y* direction.	**1**
1(e)	Value of *a* = candidate's gradient **and** value of *b* = candidate's intercept. The values must not be fractions.	**1**
	Correct units for *a* (e.g. $s^2\ g^{-1}$) **and** *b* (s^2).	**1**

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Question	Answer	Marks
2(b)(iii)	Value of u with unit in range 30.0–34.0 cm.	**1**
2(b)(v)	(Raw) value(s) of v to nearest 0.1 cm.	**1**
2(c)	Absolute uncertainty in v in range 0.2–0.8 cm 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)	Correct calculation of f.	**1**
2(e)(iii)	Value of v_w.	**1**
	Quality: $v_w > v$.	**1**
2(f)	Justification for s.f. in f_w linked to s.f. in u and v_w.	**1**
2(g)(ii)	Second value of u in range 20.0–24.0 cm.	**1**
	Second value of v.	**1**
	Quality: second value of v_w > first value of v_w.	**1**
2(h)(i)	Two values of k calculated correctly.	**1**
2(h)(ii)	Valid comment consistent with calculated values of k, testing against a criterion stated by the candidate.	**1**

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Question	Answer	Marks
2(i)(i)	A Two readings/too few readings/only two readings <u>not enough to draw a (valid) conclusion</u>. B Difficult to judge/obtain sharp image/hard to focus. C Difficult to keep screen steady/vertical (to measure *v*) **or** difficult to hold screen and measure distance (at the same time). D Difficult to measure <u>*u*</u> (or <u>*v*</u>) with reason e.g. parallax error/judging front of torch/judging centre of lens. E LEDs not at the front of torch/*u* should be measured to the LEDs. F Difficult to align torch, lens and screen **or** torch and lens at different heights **or** lens not vertical. *1 mark for each point up to a maximum of 4.*	**4**
2(i)(ii)	A Take more readings <u>and</u> plot a graph/calculate more *k* values and <u>compare</u>. B Use dark(ened) room/turn off lights **or** use improved 'object' e.g. cross-hairs/filament lamp/smaller LEDs. C Mount screen in holder/clamp screen **or** clamp ruler/fix ruler to bench. D Make alignment mark on container **or** use set squares with explanation of use. E Use LEDs outside the torch/remove glass from torch. F Use optical bench **or** draw line/scale/grid on bench **or** use lens holder to keep lens <u>vertical</u>. *1 mark for each point up to a maximum of 4.*	**4**

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