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PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **October/November 2017**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)(iii)	Value of raw V with unit in the range 0.50–2.00 V and to nearest 0.01 V.	**1**
1(b)(iv)	Values of p and q with consistent unit, $q > p$ and both values < 1 m.	**1**
1(c)	Six sets of readings of R (different values), p and q with correct trend (as R increases, q decreases) and without help from Supervisor scores 5 marks, five sets scores 4 marks etc.	**5**
	Range: Values of R include 10 Ω and 33 Ω.	**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. q / cm, q/R (cm/Ω), q/R (cm Ω^{-1}). No unit given for q/p.	**1**
	Consistency: All values of p and q must be given to the nearest mm.	**1**
	Significant figures: All values of q/R must be given to 2 or 3 s.f.	**1**
	Calculation: Values of q/p are correct.	**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 $\leqslant$ 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 on the grid for this mark to be awarded. It must be possible to draw a straight line that is within ±0.10 on the q/p axis (normally *y*-axis) of all plotted points.	**1**
1(d)(ii)	Line of best fit: Judge by balance of all points on the grid about the candidate's line (at least 5 points). 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**

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Question	Answer	Marks
1(d)(iii)	Gradient: Gradient sign on answer line matches graph drawn. The hypotenuse of the triangle used must be greater than half the length of the drawn line. 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 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 $x = 0$, 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**
	Unit for *a* correct (e.g. $\Omega\,m^{-1}$ or $\Omega\,cm^{-1}$ or $\Omega\,mm^{-1}$ or Ω / m etc.) **and** *b* stated without a unit.	**1**

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Question	Answer	Marks
2(a)	Value of L with unit and $L < 50.0$ cm.	**1**
2(b)(ii)	All value(s) of raw x to nearest mm with unit.	**1**
	Repeat values of x.	**1**
2(b)(iii)	Percentage uncertainty in x based on absolute uncertainty in x in range 2–8 mm. 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(b)(iv)	Correct calculation of G where x and L have the <u>same</u> unit.	**1**
2(b)(v)	Justification for s.f. in G linked to s.f. in L and x, or L and $(2x - L)$.	**1**
2(c)(ii)	Value of T with unit in range 0.8–2.0 s.	**1**
2(d)	Second values of L and x.	**1**
	Second value of T.	**1**
	Quality: second value of $T <$ first value of T.	**1**
2(e)(i)	Two values of k calculated correctly.	**1**
2(e)(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(f)(i)	A Two readings are <u>not enough to draw a conclusion</u>. B <u>Difficult to measure *x*</u> with a reason e.g. holding ruler <u>and</u> pulling down on loop at the same time/holding string and rule/measuring at an angle/holding rule steady/stands move or tilt when loop pulled/judging end points. C Difficulty linked to the length of the pendulum e.g. knot slips/tying a knot/measuring to the centre of the bob. D Difficult to measure *L* with a reason e.g. finger gets in the way/thickness of string. E Difficulty linked to oscillation e.g. strings on rods move/stands move as the pendulum oscillates **or** difficult to judge the end of an oscillation. *1 mark for each point up to a maximum of 4.*	**4**
2(f)(ii)	A Take more readings <u>and</u> plot a graph/take more readings <u>and</u> compare *k* values. B Improved method to measure *x* e.g. clamp rule/clamp stands/hang mass on loop. C Use glue (not knots)/mark the string/attach hook or loop to pendulum/measure string and add radius to length. D Improved method to measure *L* e.g. use pins/nails/tape to table. E Clamp stands/use tape to fix strings to rods/idea of a groove **or** film/video camera with timer/frame by frame/marker at centre of oscillation. (Do not award 'clamp stands' twice for both B and E.) *1 mark for each point up to a maximum of 4.*	**4**

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