Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

PHYSICS **9702/32**

Paper 3 Advanced Practical Skills 2 **May/June 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 will not enter into discussions about these mark schemes.

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Question	Answer	Marks
1(a)(v)	Value of p in the range 20.0–30.0 cm, with unit.	**1**
	Value of q less than p.	**1**
1(b)	Six sets of readings of p, q and V (with correct trend and without help from Supervisor) scores 5 marks, five sets scores 4 marks etc.	**5**
	Range: $p_{max} \geqslant 40.0$ cm and $p_{min} \leqslant 10.0$ 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. $1/p/\text{cm}^{-1}$.	**1**
	Consistency: All values of p and q must be given to the nearest mm.	**1**
	Significant figures: Significant figures for every value of $1/q$ must be same as, or one greater than, the s.f. of q as recorded in table.	**1**
	Calculation: Values of $1/q$ calculated correctly.	**1**
1(c)(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”). Plots must be accurate to within half a small square in both x and y directions.	**1**

Question	Answer	Marks
	Quality: All points in the table must be plotted (at least 5) for this mark to be awarded. It must be possible to draw a straight line that is within $\pm$ 1.0 m^{-1} ($\pm$ 0.01 cm^{-1}) of all the plotted points in the $1/q$ direction.	**1**
1(c)(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(c)(iii)	Gradient: The hypotenuse of the triangle used must be greater than half the length of the drawn line. 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 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 *y* direction.	**1**
1(d)	Value of *a* = candidate's gradient **and** value of *b* = candidate's intercept. Values must not be fractions.	**1**
	There must be no unit for *a*. Unit for *b* correct e.g. m^{-1} or cm^{-1}.	**1**

Question	Answer	Marks
2(a)(ii)	Value of h_1 to nearest 0.1 cm.	**1**
	$h_2 < h_1$.	**1**
2(a)(iv)	Absolute uncertainty in h_2 of 2–5 mm and correct method of calculation to obtain percentage uncertainty. If repeated readings have been taken, then the absolute uncertainty can be half the range (but not zero) if the working is clearly shown.	**1**
2(b)(i)	Correct calculation of *k*.	**1**
2(b)(ii)	Justification for s.f. in *k* linked to s.f. in *m*, *g* and (h_1–h_2) **or** *m*, *g*, h_1 and h_2.	**1**
2(c)(iii)	Value of *T* in range 1.00–3.00 s.	**1**
	Evidence of repeat readings of *nT* with $n \geqslant 5$.	**1**
2(d)	Second values of h_1 and h_2.	**1**
	Second value of *T*.	**1**
	Quality: *T* for three springs > *T* for two springs.	**1**
2(e)(i)	Two values of *C* calculated correctly.	**1**
2(e)(ii)	Valid comment consistent with the calculated values of *C*, testing against a criterion specified by the candidate.	**1**

Question	Answer	Marks
2(f)(i)	A Two readings are not enough to draw a (valid) conclusion (**not** "not enough for accurate results", "few readings"). B (Difficulty) measuring *h* because of parallax/metre rule not vertical. C Oscillation dies away quickly/oscillation damped. D Difficult to judge/tell end of oscillation/decide when to operate stopwatch. E Other modes of oscillation occur. F Some movement at joints still occurs. *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 *C* values (**not** "repeat readings" on its own). B Use set square against rule (with detail)/use pointer attached to bottom of mass/use set square from rule to bottom of mass. C Twist through larger angle to get more rotations. D View (video) recording/film of motion with timer in view **or** put mark on mass to make it easier to see motion. E Workable method of restricting vertical/swinging movement (e.g. enclose in transparent tube). F Better method of fixing joints/use two complete springs. *1 mark for each point up to a maximum of 4.*	**4**