



Cambridge International AS & A Level

PHYSICS

9702/33

Paper 3 Advanced Practical Skills 1

March 2020

MARK SCHEME

Maximum Mark: 40

<p>Published</p>

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.

Cambridge International is publishing the mark schemes for the March 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **8** printed pages.

Question	Answer	Marks
1(a)	Value of x in range 10.0 to 20.0 cm	1
1(b)	Value of T in range 0.50 to 1.50 s	1
	Evidence of repeat readings: at least two values of at least $5T$	1
1(c)	Six sets of readings of x and T with correct trend and without help scores 4 marks, five sets scores 3 marks etc.	4
	Range: $x_{\min} \leq 12.0 \text{ cm}$ <u>and</u> $x_{\max} \geq 25.0 \text{ cm}$	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. $1/x \text{ (cm}^{-1}\text{)}$	1
	Consistency: All values of raw x must be given to the nearest mm	1
	Significant figures: All values of $1/x$ should be to the same s.f. as (or one more than) the s.f. in the corresponding x value	1
	Calculation: Values of $1/x$ calculated correctly	1

Question	Answer	Marks
1(d)(i)	<p>Axes: Sensible scales must be used, no awkward scales (e.g. 3:10) 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 which is being plotted. Scale markings should be no more than 3 large squares apart.</p>	1
	<p>Plotting of points: All observations must be plotted on the grid. Diameter of plotted points must be \leq half a small square (no blobs). Plots must be accurate to within half a small square in both x and y directions.</p>	1
	<p>Quality: All points in the table must be plotted (at least 5) for this mark to be awarded. Scatter of plots must be no more than $\pm 0.5 \text{ m}^{-1}$ ($\pm 0.005 \text{ cm}^{-1}$) from a straight line in the x-direction.</p>	1
1(d)(ii)	<p>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 One anomalous point is allowed only if clearly indicated (i.e. circled or labelled) by the candidate. Lines must not be kinked or thicker than half a square.</p>	1
1(d)(iii)	<p>Gradient: 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.</p>	1
	<p>y-intercept: Either Correct read-off from a point on the line substituted into $y = mx + c$ or an equivalent expression, with 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 $x = \text{zero}$ accurate to half a small square in y direction.</p>	1

Question	Answer	Marks
1(e)	a equal to candidate's gradient, and b equal to candidate's intercept. a and b are not fractions. a has two or more significant figures.	1
1(e)	Units for a and b correct (e.g. s cm or s m for a , and s for b).	1

Question	Answer	Marks
2(a)	Value of N , with no unit, in range 10 to 14.	1
2(b)	Value of L to nearest mm, with unit, in range 5.0 to 15.0 cm.	1
2(c)	Value(s) of raw θ to nearest degree and $< 90^\circ$.	1
	Value of I to nearest mA or nearest 0.1 mA, with unit	1
2(d)	Absolute uncertainty in θ value of 2 to 5° and correct method of calculation to obtain percentage uncertainty. If several readings have been taken, then the absolute uncertainty can be half the range (but not zero if values are equal) if the working is clearly shown.	1
2(e)	Correct calculation of B	1
2(f)	Second values of N and L	1
	Second values of θ and I	1
	Quality: second $\theta >$ first θ	1
2(g)(i)	Two values of k calculated correctly.	1
2(g)(ii)	Justification based on s.f. in θ , I and L .	1
2(g)(iii)	Sensible comment relating to the calculated values of k , testing against a criterion specified by the candidate.	1

Question	Answer	Marks
2(h)(i)	Two readings are not enough to draw a valid conclusion Difficult to determine I as reading not steady Parallax error when measuring θ Large % uncertainty in θ Difficult to re-wind and fix the wire / wires may touch / wire is kinked Channel moves on bench	4 max 4
2(h)(ii)	Take more readings <u>and</u> plot a graph / calculate more k values and <u>compare</u> <u>Method</u> of cleaning crocodile clips / contacts Method of overcoming parallax error, e.g. measure change of angle by turning channel on bench / measure θ on a photo / angle markings on compass / mark 'before' and 'after' positions <u>on compass</u> Use larger current / voltage Use two ready-wound channels / use new wire Method of fixing channel, e.g. tape channel to bench	4 max 4