Cambridge Assessment International Education

Cambridge International AS & A Level

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **October/November 2020**

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.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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

[Turn over

Question	Answer	Marks
1(a)	Value of I with unit in the range 30.0–50.0 mA.	**1**
1(b)	Six (or more) sets of readings of R and I (different values of R) with the correct trend and without help from the Supervisor scores 5 marks, five sets scores 4 marks, etc.	**5**
	Range: Must use $R = 204\ \Omega$ **and** $22.7\ \Omega$.	**1**
	Column headings: Each column heading must contain a quantity, a unit and a separating mark where appropriate. The presentation of quantity and unit must conform to accepted scientific convention, e.g. $1/I$ (mA^{-1}).	**1**
	Consistency of presentation: All raw values of I must be given to 0.1 mA or all to 0.01 mA.	**1**
	Significant figures: All values of $1/I$ must be given to the same number of s.f. as (or one more than) the number of s.f. in raw I.	**1**
	Calculation: Values of $1/I$ are correct.	**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 in the table must be plotted on the grid. Diameter of plotted points must be $\leqslant$ half a small square. Points must be plotted to an accuracy of half a small square.	**1**
	Quality: All points in the table must be plotted (at least 5) on the grid for this mark to be awarded. Trend of points must be correct. It must be possible to draw a straight line that is within $\pm 4\ \Omega$ (to scale) on the R axis (normally x-axis) of all plotted points.	**1**

Question	Answer	Marks
1(c)(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**
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, e.g. not Δx / Δy. Gradient sign on answer line matches graph drawn. 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 R = zero, accurate to half a small square.	**1**
1(d)	E = 1 / gradient	**1**
	$X = E \times y$-intercept **or** X = y-intercept / gradient	**1**
	Units for E and X correct (e.g. V and Ω).	**1**

Question	Answer	Marks
2(a)(i)	$p = 7.0 \pm 0.2$ cm $q = 21.0 \pm 0.2$ cm $w = 24.0 \pm 0.2$ cm	**1**
	All raw values recorded to the nearest millimetre.	**1**
2(a)(ii)	Correct calculation of $\frac{2q}{p+q}$.	**1**
2(b)(i)	Value of d.	**1**
2(b)(ii)	Percentage uncertainty based on an absolute uncertainty Δd in the range 2–5 mm. If repeated readings have been taken, then the absolute uncertainty can be half the range (but not zero) if working is clearly shown. Correct method of calculation to obtain percentage uncertainty.	**1**
2(b)(iii)	Value of $(w - d)$ correctly calculated from w and d.	**1**
2(c)(i)	Valid method, e.g. measure q / 2 in several places and draw a straight line with a ruler.	**1**
2(c)(ii)	Second q recorded to the nearest mm and half original value of $q \pm 1$ mm.	**1**
2(c)(iii)	Second value of d recorded.	**1**
	Second value of d is larger than first value of d.	**1**
2(d)(i)	Two values of k calculated correctly. The final k values must not be fractions.	**1**
2(d)(ii)	Valid comment consistent with the calculated values of k, testing against a criterion stated by the candidate.	**1**

Question	Answer	Marks
2(e)(i)	A Two readings are not enough to draw a (valid) conclusion (**not** "not enough for accurate results", "few readings"). B Difficult to judge when top edge of card is horizontal/difficult to keep card horizontal. C Difficult to accurately locate the centre of the paper clip, e.g. clip too large/clip not vertical/sides of clip not straight. D Difficulty with the attachment, e.g. paper clip does not grip/card falls. E Difficult to measure *d* with reason, e.g. touching disturbs equilibrium/ruler held by hand in mid-air/parallax error. F Card bends easily **or** corners on card may not be at right angles. *1 mark for each point up to a maximum of 4.*	**4**
2(e)(ii)	A Take more readings <u>and</u> plot a graph or take more readings <u>and</u> compare *k* values (**not** "repeat readings" on its own). B Method to improve judgement of horizontal, e.g. use of spirit level/clamped ruler with detailed method to ensure horizontal/place a grid behind the apparatus with method to ensure horizontal/turn off air conditioning. C Method to improve location of centre of paper clip, e.g. use narrower paper clip/measure to either side of clip and average/use calipers to measure width of clip. D Improved method of suspension, e.g. place pin through card/hole with needle/add adhesive putty. E Improved method to measure *d*, e.g. clamp ruler/write scale on card/carefully remove with paper clip and measure on bench. F Use of named more rigid material **or** detailed use of a set square or protractor. *1 mark for each point up to a maximum of 4.*	**4**