Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **October/November 2019**

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.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)	Value of x in range 13.0–17.0 cm.	**1**
1(b)	Evidence of repeat readings of nT with $n \geqslant 5$.	**1**
1(c)	Six sets of readings of x and time with correct trend and without help from the Supervisor scores 4 marks, five sets scores 3 marks, etc.	**4**
	Range: $x_{min} \leqslant 5.0$ cm **and** $x_{max} \geqslant 20.0$ cm.	**1**
	Column headings: Each column heading must contain a quantity, a unit and a separating mark. The presentation of quantity and unit must conform to accepted scientific convention. e.g. T^2 / s^2.	**1**
	Consistency: All values of x must be given to the nearest 0.1 cm.	**1**
	Significant figures: All values of x^2 must be given to the same number of s.f. as, or one greater than, the number of s.f. of x as recorded in the table.	**1**
	Calculation: Values of T^2 calculated correctly.	**1**
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 points plotted on the grid 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. Points must be plotted to an accuracy of half a small square in both x and y directions.	**1**
	Quality: All points in the table must be plotted (at least 5). Trend of points on graph must be positive. Scatter of points must be no more than ±25 cm^2 (to scale) from a straight line in the x^2 direction.	**1**

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Question	Answer	Marks
1(d)(ii)	Line of best fit: Judge by the 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 its full length. One anomalous point is allowed only if clearly indicated (i.e. circled or labelled) by the candidate. There must be at least 5 points left after the anomalous point is disregarded. Line must not be kinked or thicker than half a square.	**1**
1(d)(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 $\Delta x / \Delta y$. 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 must be 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)	a equal to candidate's gradient **and** b equal to candidate's intercept. The values must not be fractions.	**1**
	Unit for a is correct (e.g. $s^2 m^{-2}$) **and** unit for b is correct (s^2).	**1**
1(f)	Value for g calculated correctly.	**1**

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Question	Answer	Marks
2(a)	Value for h to nearest mm and in range 7–13 mm.	**1**
2(b)	Value for W to nearest 0.1 N and in the range 1.0 N $\leqslant W \leqslant$ 5.0 N.	**1**
2(c)(i)	Evidence that d has been measured to find r.	**1**
2(c)(ii)	Correct calculation of α.	**1**
2(c)(iii)	Justification based on s.f. in $(r - h)$ and r.	**1**
2(d)	Raw values for F to nearest 0.1 N with unit.	**1**
	Evidence of repeat readings of F.	**1**
2(e)	Percentage uncertainty based on an absolute uncertainty in F of 0.1–0.4 N. 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(f)	Values for second W, r and F.	**1**
	Quality: Second F less than first F.	**1**
2(g)(i)	Two values of k calculated correctly.	**1**
2(g)(ii)	Valid comment relating to the calculated values of k, testing against a criterion specified by the candidate.	**1**

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Question	Answer	Marks
2(h)(i)	A Too few readings/(only) two readings not enough to draw a (valid) conclusion (**not** 'not enough for accurate results', 'few readings'). B Large percentage uncertainty in *h* **or** *h* is small so large uncertainty in *h.* C Difficult to measure <u>diameter</u> with reason, e.g. because diameter not clearly defined, edge is tapered. D Difficult to measure *F*/read newton meter with a reason, e.g. difficult to judge moment when cylinder starts to roll/cylinder moves suddenly/non-zero reading on newton meter when horizontal. E Force applied at different angles for each cylinder/difficult to pull newton meter horizontally. F Large percentage uncertainty in *F* **or** values of *F* small so large uncertainty in *F*. *1 mark for each point up to a maximum of 4.*	**4**
2(h)(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 Use vernier/digital calipers or micrometer. C Improved method of measuring diameter, e.g. measure between set squares/put blocks either side and measure between blocks. D Use system of pulley and weights/sand **or** Pointer/marker that stays in maximum position on newton mete/use force sensor and data-logger **or** Video/film/record experiment with newton meter in view. E Method of applying force horizontally, e.g. use longer loop of thread/support newton meter with additional board. F Use e.g. 0–5 N newton meter (**not** 'more accurate meter'). *1 mark for each point up to a maximum of 4.*	**4**

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