Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 2018**

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)(i)	Value of z in the range 29.0–31.0 cm to the nearest mm with unit.	**1**
1(a)(ii)	Value of y with unit and $y \leqslant 35.0$ cm.	**1**
1(b)	Six sets of readings of x and y (different values) showing the correct trend and without help from the Supervisor scores 5 marks, five sets scores 4 marks etc.	**5**
	Range: values of x must include at least one negative value.	**1**
	Column headings: Each column heading must contain a quantity and a unit where appropriate. The presentation of the quantity and unit must conform to accepted scientific convention e.g. x/m.	**1**
	Consistency: All raw values of x and y must be given to the nearest mm.	**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 point must be $\leqslant$ half a small square (no “blobs”). All 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 1.0 cm (to scale) on the y-axis of all plotted points.	**1**
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 by the candidate. Line must not be kinked or thicker than half a small square.	**1**

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Question	Answer	Marks
1(c)(iii)	Gradient: The hypotenuse of the triangle used should be greater than half the length of the drawn line. The 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. Sign of gradient must match graph.	**1**
	y-intercept: Correct read-off from a point on the line and substituted into $y = mx + c$. 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.	**1**
1(d)	Value of A = candidate's gradient **and** value of B = candidate's intercept. The values must not be fractions.	**1**
	No unit for A **and** unit for B correct (m, cm, mm).	**1**
1(e)	Correct calculation of p to the number of s.f. given by the candidate.	**1**
1(f)	Line W drawn with the same gradient but lower value of y-intercept.	**1**

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Question	Answer	Marks
2(a)(i)	Value of T less than 1.0 s with unit **and** evidence of at least two sets of nT where $n \geqslant 5$.	**1**
2(a)(ii)	Correct calculation of f to the number of s.f. given by the candidate.	**1**
2(a)(iii)	Justification for s.f. in f linked to s.f. in time or period.	**1**
2(b)(i)	Value of n.	**1**
2(b)(ii)	Value of I.	**1**
2(b)(iii)	Percentage uncertainty in I based on absolute uncertainty $\geqslant 0.2\,\mu A$. 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(c)(i)	Second value of T.	**1**
	Second value of T > first value of T.	**1**
2(c)(ii)	Values of n and I.	**1**
	Quality: second I < first I.	**1**
2(d)(i)	Two values of k calculated correctly.	**1**
2(d)(ii)	Valid comment consistent with calculated values of k, testing a criterion specified by the candidate.	**1**

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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 Reason for difficulty with oscillation e.g. magnet struck top of tube/magnet not passing through all turns/some turns are not near magnet/magnet oscillates outside of coil. C Difficulty in judging end/start of (complete) oscillation. D Difficulty with the current readings with reason e.g. because of positive and negative values/meter does not refresh quickly enough/current small/resistance of connecting leads high/maximum current lasts for short time. E Difficulty with the practical setup e.g. tube fell over/magnet fell off/spring moving along rod. F *n* is not a whole number. *1 mark for each point up to a maximum of 4.*	**4**
2(e)(ii)	A Take many readings (for different values of *n* or *f*) and plot a graph or take more values of *k* and compare (**not** "repeat readings" on its own). B Method of improving difficulty with oscillation e.g. use wider tube/use shorter tube/bunch up coils/longer magnet. C Method of improving timing e.g. put a marker with position (except at the ends)/video with timer (or replay frame by frame)/position or motion sensor placed below. D Method to reduce difficulties with current e.g. use (centre-zero) analogue meter/use c.r.o./galvanometer/use more turns of wire/smaller masses/stiffer spring/stronger magnet/sand contacts/video ammeter and replay to find maximum current. E Named method of attaching to table/holder e.g. clamp tube/tape magnet to weight/tape spring to rod/tape tube to table. F Calculate *n* from the length of the wire and the diameter of the tube. *1 mark for each point up to a maximum of 4.*	**4**

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