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 **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)	Value of V_S in range 2.00–4.00 V, with unit.	**1**
1(b)	Value of V less than V_S.	**1**
	Evidence of repeat readings of V.	**1**
1(c)	Six sets of readings of n and V with the correct trend and without help from the Supervisor scores 4 marks, five sets scores 3 marks, etc.	**4**
	Range: $n_{min} = 1$ or 0 and $n_{max} \geqslant 7$.	**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. $(1/V)/V^{-1}$ or $1/V$ (V^{-1}).	**1**
	Consistency: All raw values of V must be given to 0.01 V, without trailing zeros.	**1**
	Significant figures: Significant figures for every value of $1/V$ the same as, or one greater than, the s.f. of V as recorded in the table.	**1**
	Calculation: Values of $1/V$ 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 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 (no “blobs”). 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) for this mark to be awarded. Scatter of points must be no more than $\pm$ 0.025 V^{-1} from a straight line in the $1/V$ direction.	**1**

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Question	Answer	Marks
1(d)(ii)	Line of best fit: Judge by balance of all points on the grid 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 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 small square.	**1**
1(d)(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 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 $n = 0$, accurate to half a small square in the y direction.	**1**
1(e)	Value of a equal to candidate's gradient **and** value of b equal to candidate's intercept.	**1**
	Unit for a is V^{-1} **and** unit for b is V^{-1}.	**1**

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Question	Answer	Marks
2(a)	Correct calculation of M.	**1**
2(b)(i)	Value for T in range 0.50–1.00 s, with unit.	**1**
	Evidence of repeat readings of time, with at least two sets of nT where $n \geqslant 5$.	**1**
2(b)(ii)	Absolute uncertainty in time measurement of 0.20–0.50 s 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(c)(i)	Second value of M.	**1**
2(c)(ii)	Second value of T.	**1**
	Quality: T greater for greater M.	**1**
2(d)(i)	Two values of k calculated correctly.	**1**
2(d)(ii)	Valid comment relating to the calculated values of k, testing against a criterion specified by the candidate.	**1**
2(e)(i)	Value(s) for D to nearest mm **and** value for D (on answer line) in range 0.050–0.200 m.	**1**
2(e)(ii)	Correct calculation of A.	**1**
2(e)(iii)	Correct calculation of ρ using second value of k.	**1**

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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 Reason for *M* not being accurate, e.g. mass of bottle ignored/uncertainty in the volume of water linked to precision of beaker. C Difficulty with oscillation with reason, e.g. masses move/bottle hits side of bucket/does not oscillate vertically/other modes of oscillation. D Difficult to measure *D* with reason, e.g. bottle flexes when measuring *D*/non-uniform *D*/bottle not circular/*D* varies with depth. E Difficult to judge when an oscillation starts/ends/is completed. *1 mark for each point up to a maximum of 4.*	**4**
2(f)(ii)	A Take more readings and plot a graph or take more values of *k* and compare (**not** "repeat readings" on its own). B Use electronic balance/top-pan balance **or** use measuring cylinder. C Method of fixing mass hanger in position in bottle, e.g. Blu-Tack, glue, tape **or** use suitable alternative to slotted masses, e.g. sand/lead shot/single mass **or** use wider bucket/larger diameter. D Use vernier/digital calipers **or** details of alternative method to find *D*, e.g use two set squares/two wooden blocks **or** measure *D* in different directions/positions and find average. E Use video and timer/video and view frame by frame **or** position/motion sensor above bucket. *1 mark for each point up to a maximum of 4.*	**4**

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