Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

PHYSICS **9702/33**

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.

Cambridge International is publishing the mark schemes for the May/June 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

PUBLISHED

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.

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.

Question	Answer	Marks
1(a)	Values of V_1 and V_2 with units and to the nearest 0.01 V.	**1**
	$\|V_2\| > \|V_1\|$.	**1**
1(b)	Six sets of readings of x, V_1 and V_2 (different values) showing the correct trend and without help from the Supervisor scores 5 marks, five sets scores 4 marks etc.	**5**
	Range: $x_{min} \leqslant 10.0$ cm and $x_{max} \geqslant 70.0$ 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. $(V_1/x)/\text{V m}^{-1}$.	**1**
	Consistency: All values of x must be given to the nearest mm.	**1**
	Significant figures: All values of V_1/x must be given to 2 or 3 s.f.	**1**
	Calculation: Values of V_1/x 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 (no "blobs"). 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 0.040 on the $(V_2 - V_1)$ 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). 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**
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 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 P = candidate's gradient **and** value of Q = candidate's intercept. The values must not be fractions.	**1**
	Unit for P correct (e.g. m or cm or mm) **and** unit of Q correct (e.g. V) unless zero.	**1**

Question	Answer	Marks
2(a)	Value of L to the nearest mm with unit and in range 50.0–60.0 cm.	**1**
2(b)(i)	Value of A to the nearest degree with unit and in the range 11–17°.	**1**
2(b)(ii)	Percentage uncertainty in A based on absolute uncertainty of 2°–5°. 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)	Value of T in the range 1.20–1.60 s with unit.	**1**
	Evidence of at least two sets of nT where $n \geqslant 5$.	**1**
2(c)(ii)	Correct calculation of d.	**1**
2(c)(iii)	Justification for s.f. in d linked to s.f. in A (or measured angle).	**1**
2(d)	Second value of A.	**1**
	Second value of T.	**1**
	Quality: second value of T > first value of T.	**1**
2(e)(i)	Two values of k calculated correctly.	**1**
2(e)(ii)	Valid comment consistent with calculated values of k, testing against a criterion specified by the candidate.	**1**

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 Difficult to measure *L* with reason e.g. locating centre of bob/parallax/bob or cork gets in the way of the ruler. C Difficult to measure *A* or 45° or angle with a reason e.g. no indication of vertical/hard to hold and measure from protractor/hard to hold protractor steady/string too thick/parallax error. D Problem with bob moving between setting and releasing. E Difficulty setting rod at *L*/2 with reason e.g. setting rod and angle at the same time/rod moves when tightening the clamp/rod moves when pendulum hits. F Difficulty in judging start/end of oscillation. *1 mark for each point up to a maximum of 4.*	**4**
2(f)(ii)	A Take many readings (for different values of *A*) and plot a graph or take more values of *k* and compare (**not** "repeat readings" on its own). B Improved method of measuring *L* e.g. measure diameter and add on (or take away) radius from length of string from cork to top (bottom) of bob, or e.g. clear use of pointer(s). C Improved method of measuring angle e.g. use a plumb line/clamp protractor/use thinner string, or e.g. shadow projection ideas/photograph and measure angle. D Improved mechanism of releasing the bob e.g. clamp bob/use a card gate/add a stop. E Mark string. F Method of improving timing e.g. put a marker anywhere except at the ends/video with timer (or replay frame by frame). *1 mark for each point up to a maximum of 4.*	**4**