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 **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.

Cambridge International is publishing the mark schemes for the October/November 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

© UCLES 2019

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.

© UCLES 2019

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.

© UCLES 2019

Question	Answer	Marks
1(a)	Value of x in the range 28.0–32.0 cm with unit.	**1**
	Value of y in the range 45.0–55.0 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: Must include one value of $x \leqslant 10.0$ cm **and** one value of $x \geqslant 50.0$ cm.	**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 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 (at least 5) must be plotted on the grid. Trend of points on graph must be positive. All points must be within ±1.0 cm (to scale on the axis with the y values) of a straight line.	**1**

© UCLES 2019

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. 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 small square.	**1**
1(c)(iii)	Gradient: The hypotenuse of the triangle used must be greater than half the length of the drawn line. Both read-offs must be accurate to half a small square in both the x and y directions. The method of calculation must be correct e.g. not $\Delta x / \Delta y$. The sign of the gradient on the answer line must match the 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**
	A has no unit **and** unit for B correct (m, cm or mm).	**1**
1(e)	Correct calculation of M with a consistent unit.	**1**
	Answer on the answer line to 3 significant figures.	**1**

© UCLES 2019

Question	Answer	Marks
2(a)(i)	Value of x in the range 6.5–7.5 cm to the nearest mm with unit.	**1**
2(a)(ii)	Percentage uncertainty in x based on absolute uncertainty in the range 2–4 mm. 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(b)(i)	Value of T_1 in the range 0.4–1.0 s.	**1**
	At least two values of nT recorded where $n \geqslant 5$.	**1**
2(b)(ii)	Value of T_2 greater than T_1.	**1**
2(b)(iii)	Correct calculation of $T_2 - T_1$.	**1**
2(c)	Second value of x.	**1**
	Second values of T_1 and T_2.	**1**
	Quality: Second value of $\lvert T_2 - T_1 \rvert$ < first value of $\lvert T_2 - T_1 \rvert$.	**1**
2(d)(i)	Two values of k calculated correctly.	**1**
2(d)(ii)	Justification for s.f. in k linked to s.f. in x and $(T_2 - T_1)$.	**1**
2(d)(iii)	Valid comment consistent with calculated values of k, testing against a criterion stated by the candidate.	**1**

© UCLES 2019

Question	Answer	Marks
2(e)(i)	A Too few readings/(only) two readings not enough to draw a (valid) conclusion (**not** 'not enough for accurate results', 'few readings'). B Problem with attaching spring to magnet e.g. tape not sticky enough, magnet falls from tape **or** Problems with additional modelling clay falling off magnet. C Difficult to line up magnets (because they repel). D Difficulty setting or measuring x with a reason e.g. holding metre rule by hand/metre rule or magnet moves/metre rule not vertical/parallax error/magnet is tilted so x varies across the width of the magnet/difficult to adjust boss so that x has the constant value. E ($T_2 - T_1$) is short **or** Percentage uncertainty in ($T_2 - T_1$) is large **or** Difficult to judge start of/end of/complete oscillation. F Others modes of oscillation e.g. magnet swinging **or** Magnets are attracted/stick to the stand (metal rod) and/or G-clamp/metal table. *1 mark for each point up to a maximum of 4.*	**4**

© UCLES 2019

Question	Answer	Marks
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 Better method of attaching magnet to spring system e.g. glue spring to magnet/stickier tape/magnet with hook/attach string **or** Improved method of adding weight to magnet e.g. use adhesive putty/tape. C Put magnets in a (transparent) tube. D Improved method of measuring *x* e.g. place a mm grid behind magnets/clamp metre rule/use set square between ruler and bench/plumb-line to check ruler vertical/use a lab jack to raise magnet B/use travelling microscope. E Improved method of timing e.g. video/film/record with timer/view frame-by-frame, fiducial marker at centre of oscillation, force meter attached to springs. F Use wooden/plastic stand/longer wooden rod **or** Another named method of fixing magnet B to bench e.g. adhesive putty. *1 mark for each point up to a maximum of 4.*	**4**

© UCLES 2019