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 **March 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 March 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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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 to nearest mm and in range 4.5 to 5.5 cm	**1**
1(b)	value of T in range 1.50 s to 2.50 s	**1**
	repeat readings – at least two values of at least 5T	**1**
1(c)	six sets of readings of x and T with correct trend and without help from supervisor scores 4 marks, five sets scores 3 marks etc.	**4**
	range: $x_{min} \leqslant 2.5$ cm and $x_{max} \geqslant 13.5$ cm	**1**
	column headings: each column heading must contain a quantity and a unit the presentation of quantity and unit must conform to accepted scientific convention. e.g. T^2 / s^2	**1**
	consistency: all values of raw times must be given to the nearest 0.1 s or all values to the nearest 0.01 s	**1**
	significant figures: significant figures for every value of 1 / x same as, or one greater than, the s.f. of x as recorded in table	**1**
	calculation: values of 1 / x calculated correctly	**1**

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Question	Answer	Marks
1(d)(i)	axes: sensible scales must be used, no awkward scales (e.g. 3:10) 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 which is being plotted scale markings should be no more than 3 large squares apart	**1**
	plotting of points: all observations must be plotted on the grid diameter of plotted points must be ⩽ half a small square (no blobs) plots must be accurate to within 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 plots must be no more than ± 0.05 cm^{-1} from a straight line in the 1 / *x* direction	**1**
1(d)(ii)	line of best fit: judged by 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 the full length one anomalous point is allowed only if clearly indicated (i.e. circled or labelled) by the candidate lines must not be kinked or thicker than half a small 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 both read-offs must be accurate to half a small square in both the *x* and *y* directions	**1**
	y-intercept: **Either** correct read-off from a point on the line substituted into $y = mx + c$ or an equivalent expression, with read-off accurate to half a s square in both *x* and *y* directions **Or** intercept read directly from the graph, with read-off at *x* = zero accurate to half a small square in *y* direction	**1**

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Question	Answer	Marks
1(e)	*a* equal to candidate's gradient, and *b* equal to candidate's intercept, and values are not written as fractions	**1**
	unit for *a* is correct and consistent with value unit for *b* is correct	**1**

Question	Answer	Marks
2(a)	value for *B,* with unit	**1**
2(b)	measured value(s) for *d*, with unit, to nearest mm	**1**
	evidence of repeat readings	**1**
2(c)	absolute uncertainty in *d* value $\geqslant$ 0.2 cm and correct method of calculation to obtain percentage uncertainty. if several readings have been taken, then the absolute uncertainty can be half the range if the working is clearly shown (but not zero if values are equal)	**1**
2(d)	calculation of *P* correct	**1**
	POT of *P* value matches unit	**1**
2(e)	justification based on s.f. in *d*, *m* and *g*	**1**
2(f)	value for second *B*	**1**
	value for second *d*	**1**
	Quality: *d* smaller for smaller *B*	**1**
2(g)(i)	two values of *k* calculated correctly	**1**
2(g)(ii)	sensible 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)	two *k* values are not enough to draw a valid conclusion	**4 max**
	difficult to measure *B* with reason, e.g. pressing on balloon / ruler scale doesn't start at zero / parallax	
	difficult to balance Perspex block on balloon / balloon kept moving	
	difficult to measure *d* with reason, e.g. not circular / changes when block touched / parallax / refraction changes apparent size	
	difficult to see (edges of) contact patch (clearly)	
2(h)(ii)	take more readings and plot a graph / calculate more *k* values and compare	**4 max**
	workable method of reducing parallax for *B* e.g. callipers	
	fix balloon in place with tape / glue / Blu-tack / trap between blocks at sides	
	grid on block / travelling microscope / thinner block	
	use contrasting colours for balloon and liquid	

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