



## Cambridge International AS & A Level

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**PHYSICS**

**9702/34**

Paper 3 Advanced Practical Skills 2

**May/June 2020**

**MARK SCHEME**

Maximum Mark: 40

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<b>Published</b>
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Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

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This document consists of **9** printed pages.

**6** Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form, (e.g.  $a \times 10^n$ ) in which the convention of restricting the value of the coefficient ( $a$ ) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

**7** Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer	Marks
1(a)	Value of $d$ in range 14.0–16.0 cm.	1
1(b)	Value of $t$ in range 10.00–20.00 s.	1
	Evidence of repeated readings of $t$ .	1
1(c)	Six sets of readings of $d$ and $T$ showing the correct trend and without help from the Supervisor scores 4 marks, five sets scores 3 marks etc.	4
	Range: $d_{\min} \leq 10.0$ cm and $d_{\max} \geq 20.0$ cm.	1
	Column headings: Each column heading must contain a quantity, a unit and a separating mark where appropriate. The presentation of quantity and unit must conform to accepted scientific convention. e.g. $1/d$ / cm <sup>-1</sup>	1
	Consistency: All values of $d$ must be given to the nearest 0.1 cm.	1
	Significant figures: Number of significant figures for every value of $1/d$ the same as, or one more than, the number of s.f. of $d$ as recorded in table.	1
	Calculation: Values of $1/d$ calculated correctly.	1
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 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 $\leq$ half a small square. Points must be plotted to an accuracy of half a small square.	1

Question	Answer	Marks
1(d)(i)	Quality: All observations in the table (at least 5) must be plotted on the grid. Trend of points must be correct. It must be possible to draw a straight line that is within $\pm 20 \text{ s}^2$ in the $t^2$ direction of all plotted points.	1
1(d)(ii)	Line of best fit: Judge 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 curve along the full length. If there are 6 or more points, 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(d)(iii)	Gradient: The hypotenuse of the triangle used must 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.	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. <b>or</b> Intercept read directly from the graph with read-off at $1/d = 0$ accurate to half a small square.	1
1(e)	Value of $a$ equal to candidate's gradient and value of $b$ equal to candidate's intercept. The values must not be fractions.	1
	Correct units for $a$ (e.g. $\text{cm s}^2$ ) and $b$ ( $\text{s}^2$ ).	1

Question	Answer	Marks
2(a)(i)	Value of $T$ in the range 0.50–1.00 s.	1
2(a)(ii)	Correct calculation of $k$ .	1
2(b)	Value of $y$ to nearest 0.001 m and in range 0.050–0.150 m.	1
2(c)	Value for $H$ .	1
	Evidence of repeated readings of $H$ .	1
2(d)	Percentage uncertainty in $H$ based on an absolute uncertainty of 4–8 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(e)	Second values of $y$ and $H$ .	1
	Quality: second $H <$ first $H$ .	1
2(f)(i)	Two values of $c$ calculated correctly <b>and</b> both values given to two or more significant figures.	1
2(f)(ii)	Justification based on significant figures in $H$ and $y$ .	1
2(f)(iii)	Valid comment consistent with calculated values of $c$ , testing against a criterion stated by the candidate.	1
2(g)	Correct calculation of $g$ , with unit.	1

Question	Answer	Marks
2(h)(i)	<p>A Two readings are not enough to draw a (valid) conclusion (<b>not</b> “not enough for accurate results”, “few readings”).</p> <p>B Mass oscillates horizontally as well as vertically.</p> <p>C <math>y</math> varies around the masses/other specific problem with <math>y</math>.</p> <p>D Difficult to judge end points of oscillation.</p> <p>E <math>H</math> decreases with time/oscillations damped.</p> <p>F Parallax error when taking measurements for <math>H</math>.</p> <p>G Difficult to raise masses to same position for repeats.</p> <p><i>1 mark for each point up to a maximum of 4.</i></p>	<b>4</b>
2(h)(ii)	<p>A Take more readings <u>and</u> plot a graph or take more readings <u>and</u> compare <math>k</math> values (<b>not</b> “repeat readings” on its own).</p> <p>B Valid method of restricting oscillation to vertical direction e.g. a guide.</p> <p>C Take several readings and average/clamp ruler vertically to measure <math>y</math>.</p> <p>D Video with rule in view and play back.</p> <p>E Use ‘peak-hold’ indicator to indicate maximum and minimum/use data logger with position sensor under mass hanger.</p> <p>F Hold rule in a clamp/other valid method to reduce parallax.</p> <p>G Use a stop e.g. horizontal piece of wood held by clamp.</p> <p><i>1 mark for each point up to a maximum of 4.</i></p>	<b>4</b>