CAMBRIDGE
International Education

Cambridge International AS & A Level

PHYSICS **9702/37**

Paper 3 Advanced Practical Skills 1 **May/June 2025**

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 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
AE	arithmetic error
AWK	awkward scale used on graph
BOD	benefit of the doubt given
CON	contradiction in response, mark not awarded
	correct point or mark awarded
ECF	error carried forward applied
FO	false origin used on graph
	incorrect point or mark not awarded
^	information missing or insufficient for credit
POT	power of ten error

Annotation	**Meaning**
RO	read-off from graph
SH	supervisor's help given
SR	supervisor's report taken into account
SV	supervisor's value/sample results taken into account
TE	transcription error
IR	value in range
OOR	value out of range

Question	Answer	Marks
1(a)	Value of E to the nearest 0.001 V with unit.	**1**
1(b)	Value of L with unit in the range 25.0–35.0 cm **and** $V < E$.	**1**
1(c)	Six sets of readings of L (different values) and V with correct trend (L increases as V decreases) and without help from Supervisor scores 4 marks, five sets scores 3 marks, etc.	**4**
	Range of L: $L_{min} \leqslant 35.0$ cm **and** $L_{max} \geqslant 80.0$ 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. $\frac{E-V}{L}$ / V cm^{-1}.	**1**
	Consistency: All values of L must be to the nearest mm.	**1**
	Significant figures: All values of $\frac{E-V}{L}$ must be given to 3 or 4 significant figures.	**1**
	Calculation: Correct calculation of $\frac{E-V}{L}$.	**1**

Question	Answer	Marks
1(d)(i)	Axes: Axes must be labelled with the required quantities. Scales must be chosen so that the plotted points occupy at least half the graph grid in both the *x* and *y* directions. Scale markings are no more than 2 cm (one large square) apart. Sensible scales must be used, no awkward scales (e.g. 3:10 or fractions).	**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 in both *x* and *y* directions.	**1**
	Quality: Trend of points must be positive. All points in the table (at least 5 points) must be plotted on the grid for this mark to be awarded. It must be possible to draw a straight line that is within $\pm$ 0.02 V on the *V*-axis of <u>all</u> plotted points.	**1**
1(d)(ii)	Line of best fit: 'Best fit' is judged by the balance of all points on the grid (at least 5 points) about the candidate's line. There must be an even distribution of points either side of the line along the full length. Lines must not be kinked or thicker than half a square. Some candidates may choose to identify an anomalous point. If 6 or more points are plotted and they identify **one** point as anomalous (e.g. by circling or labelling) then this point is to be disregarded when judging the line of best fit.	**1**
1(d)(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. Method of calculation must be correct, not $\Delta x / \Delta y$. Gradient sign on answer line must be consistent with graph drawn.	**1**
	y-intercept: Intercept read directly from the graph, with read-off at $x = 0$, accurate to half a small square in *y* direction. **or** Correct read-off from a point on the line is substituted into $y = mx + c$ or an equivalent expression. Read-off accurate to half a small square in both *x* and *y* directions.	**1**

Question	Answer	Marks
1(e)	P = candidate's gradient value **and** Q = –candidate's intercept value. Values must not be written as fractions or given to only one significant figure.	**1**
	Units for P: cm^{-1} or m^{-1} consistent with their readings **and** units for Q: $V\,cm^{-1}$ or $V\,m^{-1}$ consistent with their readings.	**1**
1(f)	Line W of larger gradient on left of original line, not crossing on graph grid.	**1**

Question	Answer	Marks
2(a)(i)	Final value of d in the range 1.6–2.6 cm with unit and raw value(s) to the nearest mm.	**1**
2(a)(ii)	Percentage uncertainty based on absolute uncertainty in d in range 2–5 mm. Correct method of calculation to find percentage uncertainty e.g. (absolute uncertainty / value from **(a)(i)**) × 100. If repeated readings have been taken, then the uncertainty can be half the range (but not zero) if the working is clearly shown.	**1**
2(b)(i)	Value of x in the range 65.0–75.0 cm to the nearest mm.	**1**
2(b)(ii)	(N =) 4.95	**1**
2(c)	Value of T (on answer line) in the range 0.70–1.20 s with unit.	**1**
	Repeats: At least two measurements of nT where $n \geqslant 5$.	**1**
2(d)	Second values of d and x.	**1**
	Second value of T.	**1**
	Second value of T < first value of T.	**1**
2(e)(i)	Two values of k calculated correctly. The final k values must not be written as fractions or given to only one significant figure.	**1**
2(e)(ii)	Justification for significant figures in k linked to significant figures in time, d and x.	**1**
2(f)	Correct calculation of percentage difference between candidate's two k values. Comparison of percentage difference with 15%, leading to a consistent conclusion.	**1**

Question	Answer	Marks
2(g)(i)	A Two (sets of) readings are not enough to draw a (valid) conclusion (**not** "not enough for accurate results", "few readings"). B Difficult to measure *d* with a reason e.g. parallax error (with sphere on rule) / ruler not precise an instrument to use **or** large percentage uncertainty in *d*. C Difficult to measure *x* with a reason e.g. difficult to locate centres of rods / rods may not be parallel. D Difficult to measure time or *T* with a reason e.g. judge start / end / completion of an oscillation. E Difficulty with the chain during oscillation e.g. chain slips (along rod) during oscillation / chain falls off the rod whilst oscillating / other modes of oscillation of the chain / movement of rods or stands during oscillation of the chain / difficult to maintain *x* to be constant whilst chain oscillating. F Difficulty with sphere e.g. not a uniform sphere / sphere falling off (paper clip) / sphere changes shape when handled. *1 mark for each point up to a maximum of 4.*	**4**

Question	Answer	Marks
2(g)(ii)	A Take more readings (for different values of *x* and *n*) and plot a graph **or** take more readings and compare *k* values (**not** "repeat readings" on its own). B Use (vernier/digital) calipers **or** use blocks (either side of sphere) with detail. C Clamp rule (to measure *x*). D Video / film / record with timer in view **or** use marker at the centre of the oscillation. E Workable method to prevent chain from slipping e.g. groove in rod **or** workable method to mitigate unwanted modes of oscillation e.g. increase the number of paper clips **or** reduce the distance between the rods **or** use metal rods **or** clamp stands (to the bench). F Use a stiffer material for the balls e.g. use baked clay / metal balls **or** use a mould / preformed balls *1 mark for each point up to a maximum of 4.*	**4**