UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9702 PHYSICS

9702/35 Paper 3 (Advanced Practical Skills 1), maximum raw mark 40

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.

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1 **(a)** Value of l_0 with unit in range 1.5 cm $\leq l_0 \leq$ 3.0 cm. [1]

(b) **(iv)** Value of T with unit 20 s $\leq T \leq$ 5 s. [1]
Evidence of repeat times.

(c) Six sets of readings of l and T scores 4 marks, five sets scores 3 marks etc. [4]
Incorrect trend then –1 Help from supervisor –1.

Range : $\Delta x \geq 7$ cm. [1]

Column headings: [1]
Each column heading must contain a quantity and a unit where appropriate.
There must be some distinguishing mark between the quantity and the unit
e.g. T / s, x / cm.

Precision of x from raw values of l and l_0. [1]

Check values of x the same as the least precision in l or l_0. [1]

(d) **(i)** Axes: [1]
Sensible scales must be used. Awkward scales (e.g. 3:10) are not allowed.
Scales must be chosen so that the plotted points on the grid occupy at least half the graph grid in both x and y directions. Scales must be labelled with the quantity which is being plotted. Ignore units. Scale markings should not be more than three large squares apart.

Plotting of points: [1]
All observations in table must be plotted.
Write a ringed total of plotted points ignoring any point off the grid. Check points plotted correctly. Tick if correct. Re-plot if incorrect. Work to an accuracy of half a small square. Do not accept 'blobs' (points with diameter greater than half a small square).

Quality: [1]
All points in the table must be plotted (at least five) for this mark to be scored. Judge by scatter of all points about straight line. All points must be within 4 mm to scale from a straight line. Indicate tolerance on graph. Indicate reason if mark is not awarded.

(ii) Line of best fit: [1]
Judge by the balance of all the points (at least five) about candidates' line. There must be an even distribution of points either side of the line along the whole length. If mark is not awarded indicate rotation or direction of best fit line. Lines must not be kinked.

(iii) Gradient: [1]
The hypotenuse of the triangle must be at least half the length of the drawn line.
Read-offs must be accurate to half a small square.
Check for $\Delta y/\Delta x$ (i.e. do not allow $\Delta x/\Delta y$).
If incorrect, write in the correct value(s).

y-intercept: [1]
Either: check correct read off from a point on the line and substitute into $y = mx + c$.
Read off must be accurate to half a small square. Allow ecf of gradient value.

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Or: check read-off of intercept directly from graph.

(e) p is the value of the candidate's gradient in $\mathrm{s\,m^{-1}}$, $\mathrm{s\,cm^{-1}}$, $\mathrm{s\,mm^{-1}}$, $\mathrm{mm^{-1}\,s}$. [1]
q is the value of the candidate's y-intercept in s.

(f) Value of x (10 – 100 cm) with consistent unit when T = 75 s. [1]
Correct method seen.

[Total: 20]

2 **(a)** Measurement of d to nearest 0.01 mm with consistent unit. [1]
Evidence of repeat readings.

(c) **(ii)** Value of h in the range 9 cm – 11 cm with unit. [1]

(d) **(ii)** Value of x in the range 1 cm – 5 cm to the nearest mm with unit. [1]

(iii) Value of $y = x – (10 \pm 2)$ mm. [1]

(e) Absolute uncertainty in y in range 2 – 5 mm (or half the range of repeated readings). [1]
Correct calculation to get percentage uncertainty.

(f) Second value of d < **(a)**. [1]

Second value of x. [1]

Quality : second value of y > first value of y. [1]

(g) **(i)** Values of k calculated correctly. [1]

(ii) Sensible comment relating to the calculated values of k, testing against a specified criterion. [1]

(iii) Justification of s.f. in k linked to least s.f. in d and y or x. [1]

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(h)

	(i) Limitations **4 max**		**(ii)** Improvements **4 max**	Do not credit
$\mathbf{A_p}$	Two readings (of *d* and *l*) not enough/ only two readings/too few readings.	$\mathbf{A_s}$	Take more readings and plot a graph/more values of *k* (and compare).	Take more readings and calculate average *k* / only one reading.
$\mathbf{B_p}$	Maintaining *h* constant.	$\mathbf{B_s}$	Clamp mass hanger/specified release mechanism/hold against fixed pointer.	
$\mathbf{C_p}$	Explain difficulty in getting measurement of *x*/depth accurately with finger/position of finger and line may not be in line.	$\mathbf{C_s}$	Put mark on rod/use a clip/ measure rod out of sand with scale or ruler/scale marked on ruler/draw mark all the way round.	
$\mathbf{D_p}$	Rod falls sideways/not entering sand vertically.	$\mathbf{D_s}$	Practical method to keep rod vertical e.g. guide for rod.	
$\mathbf{E_p}$	Cannot see if mass is directly above rod.	$\mathbf{E_s}$	Practical method to ensure centralisation of mass e.g. guide for mass.	Do not credit use of computers, assistants, dataloggers.
$\mathbf{F_p}$	Depth/*x* very small	$\mathbf{F_s}$	Increase height/mass	
$\mathbf{X_p}$	Specific problem candidate encountered e.g. uniformity of sand.	$\mathbf{X_s}$	e.g. solution to specific problem candidate encountered.	Ignore uneven surface.

[Total: 20]

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