UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9702 PHYSICS

9702/33 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) (i) Value of x in the range 1 cm – 3 cm. [1]

(b) (ii) Value of T in range 1.8 s $\leq T \leq$ 4.5 s with consistent unit. [1]
If outside this range allow SV ± 40% (write in SV if used).

Evidence of repeat times. [1]

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

Range of x : To include 1 cm and 6 cm. [1]

Column headings: [1]
Each column heading must contain a quantity and a unit.
There must be some distinguishing mark between the quantity and the unit e.g. T / s.
Ignore POT errors. Ignore units in body of table.

Consistency of presentation of raw readings: [1]
All values of x must be given to the nearest mm.

Significant figures:
Significant figures for every row of $1/x$ same as, or one more than, raw x. [1]

Calculation: $1/x$ calculated correctly. [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. Indicate false origin with FOX.
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 0.05 cm^{-1} of $1/x$ from a straight line.

(ii) Line of best fit: [1]
Judge by the balance of all the points (at least five) about candidate's 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.

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

(e) *a* is the value of candidate's gradient with consistent unit (s(c)m or (c)ms). [1]
b is the value of candidate's *y*-intercept with consistent unit (s).

(f) Either: Strip too wide for clips. [1]
Or: time too small (to measure).

[Total: 20]

2 (a) (ii) Measurement of raw l to nearest mm in the range 90 cm – 100 cm. [1]

(iii) Value of h_0 with unit. [1]

(b) (ii) Value of $h < h_0$. [1]

(iii) Check correct calculation of *d*. [1]

(c) Absolute uncertainty in *d* in the range 1 mm – 2 mm or half the range of repeated readings, unless zero. Correct method of calculation to get percentage uncertainty. [1]

(d) Second value of l in range 55 cm $\leq l \leq$ 65 cm. [1]

Second value of h_0. [1]

Second value of $h < h_0$. [1]

Quality : second value of $|d|$ < first value of $|d|$. [1]

(e) (i) Correct calculation of two values of *k*. [1]

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

(iii) Justification of sf in *k* linked to *l* and *d*. [1]

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(f)

	(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
$\mathbf{B_p}$	Difficult to measure *h* with reason/ parallax error in *h*	$\mathbf{B_s}$	Detailed use of set square or pointer to improve parallax/ method for easier access/ method of reducing parallax	Mass gets in the way.
$\mathbf{C_p}$	*d* is small	$\mathbf{C_{s1}}$ $\mathbf{C_{s2}}$	Larger mass Method to measure *d* directly e.g. using a travelling microscope or position sensor	
$\mathbf{D_p}$	Rule may not be vertical (when measuring *h*)	$\mathbf{D_s}$	Detailed use of set square (table level)	
$\mathbf{X_p}$	Specific problem candidate encountered e.g. ruler slips on support/supports slip on block	$\mathbf{X_s}$	e.g. glue support to block	Ignore reference to computers, using assistance, draughts

[Total: 20]

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