UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2008 question paper

9702 PHYSICS

9702/32 Paper 32 (Advanced Practical Skills 2), maximum raw mark 40

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2008 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

UNIVERSITY of CAMBRIDGE
International Examinations

1 (a) (ii) Measurement of θ. $5 \leqslant \theta \leqslant 10°$ Ignore d.p. [1]

(b) Six sets of readings scores 6 marks, five sets scores 5 marks, etc.
Help given, –1 (e.g. putting plumbline into position).
Generally wrong trend, –1. Allow $n = 0$. [6]

Range. Maximum angle $\theta_{max} \geqslant 45°$. [1]

Table headings. θ/° θ(°) No unit for $1/\cos\theta$. [1]

Consistency in raw data – all values of θ given to the nearest 1° or 0.5°. [1]

Calculated quantities. Allow small rounding errors.
– check the specified value of $1/\cos\theta$ and tick if correct.
Specified value is the largest value of θ. [1]

Significant figures. [1]
– **all** values of $1/\cos\theta$ should be to the same s.f. as (or one more than) the raw value of θ.

Quality of data.
5 points close to Examiner's straight line.
Wrong trend/curved trend – no mark. [1]

(c) Points should occupy at least half the grid in both directions and scales should be sensible (not 3, 6, 9 or other awkward) and labelled with a quantity.
Do not penalise reversed axes. Label FO. Ignore units. [1]

Check that one point is correctly plotted (error $\leqslant$ half a small square).
All tabulated results to be plotted on graph grid.
Do not allow blobs (points $\geqslant$ half a small square).
If plot incorrect indicate correct position. [1]

Line of best fit.
At least 5 trend plots. Allow curved trend.
No hairy or thick lines ($\geqslant$ half a small square). No kinks. [1]

(d) Gradient.
Triangle chosen for gradient as a hypotenuse at least half the length of the drawn line.
Read-offs are on the line correct to within half a small square and correct substitution.
Gradient mark = 0 if curve used. If wrong write in correct read-off. Correct sub into $\Delta y/\Delta x$. [1]

Intercept calculated by a correct method or using the graph.
Allow for extrapolation for curve at $n = 0$ (i.e. do not allow algebraic errors with y = mx + c). [1]

(e) Correct method and substitution. k equal to $\left(\frac{\text{gradient}}{2m}\right)$. [1]

Method and value of M within 50% of Supervisor's value.
M = intercept / k.
Allow e.c.f. for k.
Write in Supervisor's value for M underneath. [1]

[Total: 20]

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2 (b) (i) Measurement of l $19.0 \leqslant l \leqslant 21.0$ cm. Ignore d.p.
Supervisor's help –1. [1]

(ii) Correct method of estimation of percentage uncertainty.
Δl = 1 mm or 2 mm or half the range. [1]

(iii) Correct calculation of first value of l^3 ($20^3 = 8000$).
If incorrect write in correct value. Accept small rounding errors. [1]

(iv) Justification for s.f. for l^3. Same or one more than the raw value of l.
Consistent with their own data. [1]

(c) Measurement of T. $0.2 \leqslant T \leqslant 2.0$ s [1]

(c) or **(d)** Measurement of raw t to the nearest 0.1 s or 0.01 s. [1]
Evidence of repeat readings of t. [1]
Evidence of $n \geqslant 10$ oscillations. [1]

(d) Measurement of second l to nearest mm. [1]
Measurement of second $T_{(d)} < T_{(c)}$. Penalise wrong trend. [1]

(e) Correct method and calculation of k values. [1]
Valid comment on whether equation applies to results. [1]
Allow e.c.f. on arithmetic errors of k values. Evidence of correct ratio for one value of k is necessary to access this mark. k values within 10% to support relationship. Allow up to 20% if candidate stated a value.

(f) (i) Problems [4]	**(f) (ii) Improvements** [4]
A_p Not enough readings (to draw a conclusion).	**A_s** More readings <u>and</u> plot a graph.
B_p Time too fast/moves too fast/error in timing large compared to time measured.	**$B_{s\,1}$** Video recorder, playback frame by frame/ slow motion with timer/stroboscope with scale. **$B_{s\,2}$** Longer hacksaw blade/heavier mass (to increase time of oscillation)/more oscillations than already used (larger n).
C_p Judging beginning/end of oscillation/complete oscillation.	**C_s** Motion/position sensor placed at side of mass/fiducial marker/(stationary) reference marker and stated purpose.
D_p Length error e.g. parallax error in reading the ruler/difficulty in establishing centre of mass/ ends of blocks.	**D_s** Find the mid-point of the mass by finding the distance to both ends and taking an average/ thinner rule with reason/scale starts at 0 cm with reason/scale on blade/corrections for parallax error.
E_p Difficulty in setting up the apparatus horizontally/difficulty in assembly with detail.	**E_s** Use spirit level/measure up from bench/ partner to help with <u>set up.</u>

[Total: 20]

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