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.
1 (a) (ii) Measurement of $\theta$. $5 \leq \theta \leq 10^\circ$ 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 $\theta_{\text{max}} \geq 45^\circ$. [1]

Table headings. $\theta/ \theta(\text{o})$ No unit for $1/\cos \theta$. [1]

Consistency in raw data – all values of $\theta$ given to the nearest $1^\circ$ or $0.5^\circ$. [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 $\theta$. [1]

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

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 $\leq$ half a small square).
All tabulated results to be plotted on graph grid.
Do not allow blobs (points $\geq$ 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 ($\geq$ 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.
$M = \text{intercept} / k$.
Allow e.c.f. for $k$.
Write in Supervisor’s value for $M$ underneath. [1]

[Total: 20]
2 (b) (i) Measurement of $l$. $19.0 \leq l \leq 21.0$ cm. Ignore d.p. Supervisor’s help –1.

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

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

(iv) Justification for s.f. for $\tilde{l}$. Same or one more than the raw value of $l$. Consistent with their own data. [1]

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

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

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

(e) Correct method and calculation of $k$ values. Valid comment on whether equation applies to results. 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. [1]

(f) (i) Problems [4]

A$_p$ Not enough readings (to draw a conclusion).

B$_p$ Time too fast/moves too fast/error in timing large compared to time measured.

C$_p$ Judging beginning/end of oscillation/complete oscillation.

D$_p$ Length error e.g. parallax error in reading the ruler/difficulty in establishing centre of mass/ends of blocks.

E$_p$ Difficulty in setting up the apparatus horizontally/difficulty in assembly with detail.

(f) (ii) Improvements [4]

A$_s$ More readings and plot a graph.

B$_s$ Video recorder, playback frame by frame/slow motion with timer/stroboscope with scale.

B$_s$$_1$ Longer hacksaw blade/heavier mass (to increase time of oscillation)/more oscillations than already used (larger $n$).

C$_s$ Motion/position sensor placed at side of mass/fiducial marker/(stationary) reference marker and stated purpose.

D$_s$ Find the mid-point of the mass by finding the distance to both ends and taking an average/thinner rule with reasonSCALE starts at 0 cm with reason/scale on blade/corrections for parallax error.

E$_s$ Use spirit level/measure up from bench/partner to help with setup.

[Total: 20]