

**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.



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- 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  $\theta_{\max} \geq 45^\circ$ . [1]
- Table headings.  $\theta$  /  $\theta(^\circ)$  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. [1]  
 – **all** values of  $1/\cos\theta$  should be to the same s.f. as (or one more than) the raw value of  $\theta$ .
- 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]

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- 2 (b) (i) Measurement of  $l$   $19.0 \leq l \leq 21.0$  cm. Ignore d.p. Supervisor's help –1. [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  $l^3$  ( $20^3 = 8000$ ). 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  $T$ .  $0.2 \leq T \leq 2.0$  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  $n \geq 10$  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]
<b>A<sub>p</sub></b> Not enough readings (to draw a conclusion).	<b>A<sub>s</sub></b> More readings <u>and</u> plot a graph.
<b>B<sub>p</sub></b> Time too fast/moves too fast/error in timing large compared to time measured.	<b>B<sub>s1</sub></b> Video recorder, playback frame by frame/ slow motion with timer/stroboscope with scale. <b>B<sub>s2</sub></b> Longer hacksaw blade/heavier mass (to increase time of oscillation)/more oscillations than already used (larger $n$ ).
<b>C<sub>p</sub></b> Judging beginning/end of oscillation/complete oscillation.	<b>C<sub>s</sub></b> Motion/position sensor placed at side of mass/fiducial marker/(stationary) reference marker and stated purpose.
<b>D<sub>p</sub></b> Length error e.g. parallax error in reading the ruler/difficulty in establishing centre of mass/ ends of blocks.	<b>D<sub>s</sub></b> 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.
<b>E<sub>p</sub></b> Difficulty in setting up the apparatus horizontally/difficulty in assembly with detail.	<b>E<sub>s</sub></b> Use spirit level/measure up from bench/ partner to help with <u>set up</u> .

[Total: 20]