UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9702 PHYSICS

9702/34 Paper 3 (Advanced Practical Skills 2), 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 **(c)** Angle *x*, with unit. [1]

(d) **(iii)** Angle *y*, greater than *x*. [1]

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

Range: *m* values must include 190 g or greater. [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. m / g.

Consistency of presentation of raw readings: [1]
All values of *y* must be given to the nearest degree or half degree.
All values of *m* must be given to the nearest gram (e.g. 190 g or 0.190 kg).

Significant figures: [1]
S.f. for $\sin\theta$ must be the same as, or one more than, the s.f. given for θ.

Calculation: Values of $\sin\theta$ calculated correctly. [1]

(f) **(i)** Axes: [1]
Sensible scales must be used, no awkward scales (e.g. 3:10).
Scales must be chosen so that the plotted points occupy at least half the graph grid in both *x* and *y* directions.
Scales must be labelled with the quantity that is being plotted. Ignore units.
Scale markings must be no more than 3 large squares apart.

Plotting of points: [1]
All observations in the table must be plotted.
Check that the points are correctly plotted. 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 5) for this mark to be scored.
Scatter of points must be less than ± 0.02 on the $\sin\theta$ axis from a straight line.

(ii) Line of best fit: [1]
Judge by balance of all the points (at least 5) about the candidate's line. There must be an even distribution of points either side of the line along the full length.

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(iii) Gradient: [1]
The hypotenuse of the triangle used must be at least half the length of the drawn line. Both read-offs must be accurate to half a small square.
The method of calculation must be correct.

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

(g) (ii) Raw value(s) of r in range 30 to 50 mm (or SV diameter/2 ± 10 mm) and given to nearest mm, with unit. [1]

(h) Method of calculation of a is correct and uses the gradient value. [1]
Unit for a has dimensions mass × length (e.g. g cm). [1]

[Total: 20]

2 (a) (ii) Value for R, with unit, in range 10 to 50 mm. [1]
Diameter is measured to determine R (either here or in **(d)**). [1]

(iii) Percentage uncertainty in R calculated by correct method, with absolute uncertainty of 0.5 mm or 1 mm or half the range of any repeats. [1]

(b) (ii) First measurement of T, with unit, in range 0.5 s to 10.0 s. [1]
Evidence of repeat measurements of T. [1]

(c) First value of C calculated correctly, with correct unit (e.g. kg mm^2). [1]

(d) (ii) Second value for R. [1]
Second value for T. [1]

Quality: Second T < first T. [1]

Second value of C calculated correctly. [1]

(e) (i) Both values of k calculated correctly. [1]

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

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(f)

	(i) Limitations **4 max**	**(ii)** Improvements **4 max**	Do not credit
A	Two readings are not enough (to draw a conclusion)	Take more readings and plot a graph/calculate more *k* values (and compare). Allow 'repeat readings and plot a graph'	Few readings/take more readings and calculate average *k*/only one reading.
B	Difficult to judge the end of an oscillation.	1. Use video (+ playback) + timer/use clock on video 2. Use (fiducial) marker/ pointer, with reference point on mass hanger	Difficult to measure the time/human error/references to reaction times/difficult to release from the same point each time. Data logging/light gates motion sensor/"release when marks line up".
C	Diameter/radius of a mass hanger not constant.		Comparison of diameters of 50 g and 100 g mass hangers.
D	Mass tends to swing as well as rotate.		Switch off fans.
E	*T* affected when rubber band extends.		
F		Method of measuring diameter. Use more precisely (e.g. vernier calipers).	
G		Method of increasing *T* (e.g. use larger mass/diameter or longer/thinner rubber band).	
H	Labelled values of mass may not be accurate.	Method of finding mass (e.g. top pan balance).	

Do not allow "parallax error".

[Total: 20]

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