UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9702 PHYSICS

9702/32 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 **(b)** Raw reading for nail height H, to nearest mm. [1]

(d) **(i)** Reading for string height h, less than H. [1]

(e) No help from supervisor. [1]

Six sets of readings scores 4 marks, five sets scores 3 marks etc. [4]
Incorrect trend then –1.

Range: m values must include 180 g or more. [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.

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

Significant figures: [1]
S.f. for $1/(H–h)^2$ must be the same as, or one more than, the s.f. given for $(H–h)$.

Calculation: [1]
$1/(H–h)^2$ calculated correctly.

(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 must occupy at least half the graph grid in both x and y directions.
Scales must be labelled with the quantity which 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 ± 2000 g^2 on the m^2 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.

(f) (iii) Gradient: [1]
The hypotenuse must be at least half the length of the drawn line.
Both read-offs must be accurate to half a small square. If incorrect, write in the correct value(s). Do not allow use of points from the table unless they are on the line. Do not allow $\Delta x/\Delta y$.

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) Correct method used to find a and b. [1]
Correct unit for a and correct unit for b. [1]

[Total: 20]

2 (a) (ii) y in range 65 to 75 cm. [1]

(iii) Value for h to nearest mm and in range 1 to 20 cm, with unit. [1]

(b) (ii) First value of x in range 8 to 11 cm. [1]

(iii) First value of h_1. [1]

(c) (i) First value of d calculated correctly. [1]

(ii) Percentage uncertainty in d calculated using correct method and using absolute uncertainty of 1 or 2 mm (or half the range if repeated readings have been taken). [1]

(e) (ii) Second value of x. [1]
Second value of h_1. [1]

Repeats: Any evidence of repeats for height values or x values. [1]

Quality: Second value of d less than first value. [1]

(f) (i) Two values of k calculated correctly. [1]

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

(g)

	(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	*d* is very small.	1. Use larger mass/use larger *x* value. 2. Use thinner rule.	Parallax error.
C	Difficult to measure *h* (with reason).	Use vernier caliper/travelling microscope/dial gauge/position sensor above rule.	
D	Difficult to measure *x* (with reason)/difficult to judge position of mass.	Method of improving measurement of *x* (e.g. hang masses below rule).	
X	Other specific relevant problem with apparatus.	Relevant solution.	Apparatus slips.

Do not accept 'repeated readings' or 'light gates'.

[Total: 20]