CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 series

9702 PHYSICS

9702/33 Paper 3 (Advanced Practical Skills 1), 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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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1 (a) (i) Value of raw d in the range $0.15\,\text{mm} \leq d \leq 0.44\,\text{mm}$. [1]

(b) (v) Value of l in range $0.1\,\text{m} < l < 1\,\text{m}$. Value of V in range $0.1\,\text{V} \leq V \leq 2.0\,\text{V}$. [1]

(d) Six sets of readings of l and V scores 5 marks; five sets scores 4 marks etc. [5]
Major help from Supervisor –2 (setting up apparatus). Minor help from Supervisor –1.

Range of l : $\Delta l \geq 60\,\text{cm}$. [1]

Column headings: [1]
Each column heading must contain a quantity and a unit.
The presentation of quantity and unit must conform to accepted scientific convention.
e.g. $1/l\,/\text{m}^{-1}$, $V/l\,/\,\text{V}\,\text{m}^{-1}$.
Do not allow $1/l$ (m), V(V) / l (m).

Consistency: [1]
All values of raw l must be given to the nearest mm.

Significant figures: [1]
Significant figures for every row of values of $1/l$ same as or one greater than l as recorded in table.

Calculation: [1]
Values of V/l calculated correctly

(e) (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.
Scale markings should be no more than three large squares apart.

Plotting of points: [1]
All observations in the table must be plotted.
Diameter of points must be ≤ half a small square (no "blobs").
Check that the points are plotted correctly.
Work to an accuracy of half a small square.

Quality: [1]
All points in the table must be plotted (at least 5) for this mark to be awarded. Scatter of points must be less than $0.1\,\text{m}^{-1}$ from a straight line on the $1/l$ axis.

(ii) Line of best fit: [1]
Judge by balance of all points on the grid about the candidate's line (at least 5 points)
There must be an even distribution of points either side of the line along the full length.
Allow one anomalous point only if clearly indicated (i.e. circled or labelled) by the candidate. Line must not be kinked or thicker than half a small square.

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

y-intercept: [1]
Either:
Correct read-off from a point on the line and substituted into $y = mx + c$.
Read-off must be accurate to half a small square in both *x* and *y* directions.
Or:
Correct read-off of the intercept directly from the graph.

(f) (i) Value of M = candidate's gradient. Value of N = –(candidate's intercept). [1]

(ii) Answer in range ρ: $2.0 \leq \rho \leq 20.0 \times 10^{-7}\,\Omega\,\text{m}$. Consistent with units. [1]

[Total: 20]

2 (a) (ii) Measurement of raw H in range $10.0\,\text{cm} < H < 20.0\,\text{cm}$ consistent with unit. [1]

(b) (ii) Measurement of raw h_1 to nearest mm with unit. [1]

(iii) Absolute uncertainty in h_1 in the range 2–5 mm. If repeated readings have been taken, then the absolute uncertainty can be half the range. Correct method of calculation to get percentage uncertainty. [1]

(c) (iii) Measurement of h_2 less than h_1. [1]
Evidence of repeat readings here or in **(e)**. [1]

(d) Correct calculation of F with no units. [1]

(e) Second value of h_1. [1]
Second value of h_2. [1]
Second value of h_2 < first value of h_2. [1]

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

(ii) Justification of s.f. in k linked to significant figures in h_1 and $(h_1 - h_2)$. [1]

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

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(g)

	(i) Limitations **4 max.**	**(ii)** Improvements **4 max.**	Do not credit
A	two readings not enough (to draw a conclusion)	take many readings and plot a graph/calculate more *k* values and compare	repeat readings /few readings /take more readings and (calculate) average *k* /only one reading
B	discontinuous movement at bottom	method of providing continuous ramp e.g. tape join	alignment /stick /fix
C	parallax error (or wtte) in h_1 or h_2 or heights	ruler and set square with detail e.g. set square from ruler to track or ball	ruler perpendicular to bench /parallax error in height
D	difficult to measure h_1/h_2 with reason e.g. cannot see bottom of marble/bottom of track not at bottom of marble/thickness of track not taken into account	measure to top of marble. /measure diameter of marble and subtract it from height to top of marble	*H* /clear ramps
E	difficult to release marble without applying a force	description of mechanical method of releasing marble e.g. card gate	string method /use of helpers
F	difficult to measure h_2 with reason related to time e.g. short time interval/doesn't stay still at h_2 for long	method of improved measurement of h_2 e.g. video with (clamped) rule/multiflash photography with (clamped) rule/trial and improvement method/position sensore at top of ramp/grid behind runway/scale on runway	too fast/ball travelling too quick, etc. /high speed camera or slow motion camera

[Total: 20]

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