UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2008 question paper

9702 PHYSICS

9702/31 Paper 31 (Advanced Practical Skills 1), maximum raw mark 40

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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1 (c) Value of t in range 8 to 18 s. [1]

Table

(d) Six sets of readings scores 5 marks, five sets scores 4 marks, etc.
Write number of sets (ringed) next to table.
Help from Supervisor then –1.
t should show general increase with l. If not then –1. [5]

Repeated readings for t (do not credit if values identical for every row). [1]

$l_{min} \leq 0.35$m and $l_{max} \geq 0.55$m. [1]

Table headings – every column should have a label and an appropriate unit. [1]

Consistency in raw data – all values of t should be given to 0.1 or all given to 0.01s. [1]

Check value of $1/\sqrt{l}$ (for largest l) and tick if correct. [1]

Each value of $1/t$ should be to the same s.f. as (or one more than) the raw value of t. [1]

Quality of data – judge from scatter of all plotted points (at least five) about line of best fit.
Allow scatter of ±0.025 $m^{-½}$ in the $1/\sqrt{l}$ direction. This mark cannot be scored for wrong graph or wrong trend, or if all points have not been plotted. [1]

Graph

(e) Points should occupy at least half the grid in both directions and scales should be sensible (not 3:10, etc.) and labelled with a quantity. Allow reversed axes. [1]

Check that the 'worst' point is correctly plotted.
This mark cannot be scored unless all data from the table has been plotted – write number of plots (ringed) on the graph.
Do not allow blobs (diameter ⩾ half a small square). [1]

Line of best fit. Allow five trend plots. [1]

(f) Triangle chosen has a hypotenuse at least half the length of the drawn line.
Vertices lie on the line and read-offs are correct (to half a small square in both directions) and method of calculation of gradient is correct. Ignore POTE. [1]

Intercept calculated using readings from line and a valid method (or read from y-axis provided there is no FO).
Ignore any POTE. [1]

Conclusions

(g) Gradient equated with p.
Value of p in range 0.400 to 0.600 $m^{½}s^{-1}$ inclusive. [1]

(h) q calculated starting with 'intercept value = – p/q', and correct substitution.
q must be opposite sign to intercept unless gradient is negative. [1]

[Total: 20]

2 (a) (i) Raw value(s) of d recorded to the nearest mm. [1]

Repeated readings for d. [1]

(ii) Absolute uncertainty of 1 or 2 mm (or half the range) used in a correct percentage uncertainty calculation. [1]

(iii) Calculated value of x correct. [1]

(c) (i) First value for n.
First value for V in range $0.5 \leqslant V \leqslant 2.0$.
First value for I with $I < 1.0$ A (unit required).
If significant help from Supervisor then –1. [3]

(d) Second set of measurements (with different n). [1]

Correct calculation of second R. [1]

Calculated value of second μ correct (allow e.c.f.). [1]

Quality – the two values of μ are within 20% of each other. [1]
(This will require a check calculation of first value of μ).

Drawing conclusions

(e) Valid comment on whether R proportional to n, based on comparison of two calculated ratios (e.g. two values of μ or two values of R/n).
Validity can be based on the candidate's own stated criterion (e.g. 'values within 10%') or, if not stated, on 20% difference.
Accept reversed trend as evidence for R not proportional to n. [1]

	(f) (i) Problems [4]	**(f) (ii) Improvements** [4]
A	Two sets of readings are not enough (to draw a conclusion)/only two readings.	Take more readings and plot graph.
B	Tube not circular/tube not rigid.	Repeated measurements of d in different directions.
C	Coils not circular (helix inferred)/different turns have different lengths/wire kinked or loosely wound/x different to πd/turns unevenly spaced.	Measure the length in one turn by wrapping string, then unwrapping and measuring/workable method of getting even spacing of turns.
D	Difficult to judge whole number of turns when positioning contacts/large contact area.	Mark lateral line on tube to give positions for contacts/use knife edge contact or smaller plug.
E	Contact resistance/lead resistance/circuit resistance/fluctuating or changing readings.	Measure lead resistance and subtract from R/reposition voltmeter connections closer to contacts/clean the contacts/use shorter leads.
F		Use vernier calipers to measure d.

[Total: 20]