UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2009 question paper for the guidance of teachers

9702 PHYSICS

9702/34 Paper 34 (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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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1 **(b)** Value for V_0 in range 1.3 to 1.7V, with unit [1]

(c) **(ii)** First value of V less than V_0 [1]

(d) No help from Supervisor (-1 for minor help, -2 for major help) [2]

(d) Measurements table [3]
Six sets of readings of R and V scores 3 marks, five sets scores 2 marks etc.
Wrong trend in table then –1.

(d) Table - range [1]
Values of R must include one of 100/220Ω and one of 3300/4700Ω.

(d) Table - 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.
Ignore units in the body of the table. R/(1000+R) has no unit.

(d) Table - consistency of presentation of raw readings. [1]
All values of raw V must be given to the same number of decimal places.

(d) Table – calculated values [1]
Check the specified value of $R/(1000+R)$ is calculated correctly.
If incorrect, write in the correct value. Ignore rounding errors.

(d) Table - significant figures [1]
S.f. for $1/V$ must be the same as, or one more than, s.f. for raw V.
Check each row in the table.

(e) **(i)** (Graph) Axes – [1]
Sensible scales must be used. Awkward scales (e.g. 3:10) are not allowed. 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 plotted. Ignore units. Allow inverted axes, –1 wrong quantities plotted. No more than 3 large squares between scale markings.

(Graph) Plotting – [1]
All observations must be plotted. Ring and check a suspect plot, tick if correct. Re-plot if incorrect. Plots should be no more than ½ a small square from correct position in x or y direction. Diameter must be less than or equal to ½ small square.

(e) **(ii)** (Graph) Line of best fit – [1]
At least 5 trend plots are needed.
Judge by scatter of points about the candidate's line. There must be a fair scatter of points either side of the line. Indicate best line if candidate's line is not the best line. If trend curved allow a smooth drawn curve not straight line.

(Graph) Quality of results – [1]
All table points must be plotted (minimum of 5 needed). Judge by scatter of **all** plots which must be within ± 0.02 V^{-1} of assessors line.

(e) (iii) Gradient – [1]
The hypotenuse of the Δ must be at least half the length of the drawn line.
Both read-offs must be accurate to half a small square. Check for $\Delta y / \Delta x$.
Check sign is consistent with trend.

(e) (iii) Intercept – [1]
Correctly read-off from graph (indicate a false origin) or the method of calculation is correct (check substitution of point on line).

(f) Method of calculation of P is correct with gradient and intercept values used. [1]

(f) Value for P in range 630 to 730Ω, with unit. [1]
Substitution loses both marks.

[Total: 20]

2 (c) (i) Value of l < 25cm, with unit. [1]

(c) (i) l to nearest mm. [1]

(c) (iii) Evidence of repeated measurements of h_{final} [1]

(c) (iii) Value of h_{final} in range 5.0 to 50.0 cm. [1]

(d) Percentage uncertainty in h_{final}. [1]
If repeated readings have been done then the uncertainty could be half the range, otherwise absolute uncertainty must be in range 2 mm to 20 mm.
Correct ratio idea required.

(e) E_p to no more than 3 s.f. [1]

(e) Value for E_p consistent with unit. [1]

(f) Second value of l greater than first value. [1]

(f) Second value of h_{final} [1]

(f) Second value of h_{final} shows correct trend (i.e. $l \uparrow h \uparrow$ or $l \downarrow h \downarrow$). [1]

(g) Check calculation of the two values of $E_p/\sqrt{l}$ or equivalent. [1]

(g) Valid conclusion based on the calculated values. Consistent with 20% or with candidate's stated criterion. [1]

(h)

	Limitation (4 max)	**Improvement (4 max)**
A	Two sets of readings are not enough / only two sets	Take more readings and plot a graph
B	Difficult to take measurements (h/l) because the ruler moves / is not vertical	Clamp rule / ensure rule is vertical using a set square on the bench
C	Change in properties / deterioration of the thread due to repeated drops	Use a new thread each time
D	Poor accuracy due to size of increment / only note measured h_{final} values not the values between.	Use smaller increments
E	Obtaining constant loop length for repeats at one value of loop length / variation in h_{final} values for repeats at one loop length	Sensible method to ensure constant loop length for repeats
F	Tangling cotton	

Do not allow 'repeated readings', centres of mass, or nail, knots, time ideas.
Do not allow use of video, 'use a computer to improve experiment', sensors.
Do not allow amount of tape/plasticine/glue, thinner/thicker thread, fans.
Do not allow 'eye level'.

[Total: 20]