UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 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 (a) Measurement for V in range +0.10 V to +0.90 V, with unit. [1]

(c) (ii) Six sets of values for R and V scores 6 marks, five sets scores 5 marks etc. [6]
Incorrect trend –1.
Major help from supervisor –2, minor help –1.

Range: [1]
R values must include 0.33 kΩ or less and 4.7 kΩ or more.

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 raw values of V must be given to the same precision and at least 2 d.p.

Significant figures: [1]
$R/(R + 1)$ must be given to the same as or one more than the s.f. for R.

Calculation: [1]
$R/(R + 1)$ calculated correctly.

(d) (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.
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 ± 0.04 V on the V axis from a straight line.

(ii) Line of best fit: [1]
Judge by balance of all the points on the grid (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.
Allow one anomalous point only if clearly indicated (i.e. circled or labelled) by the candidate. There must be 5 points left after the anomalous point is disregarded.

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(d) (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 or better in both *x* and *y* directions.
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 in both x and y directions. Allow ecf of gradient value.
Or:
Check the read-off of the intercept directly from the graph

(e) a = value of gradient, b = –(value of intercept). Do not allow a fraction. [1]

Value of $|b|$ is in range 1.0 V to 2.0 V, with unit V. [1]

[Total: 20]

2 (a) Value of *t* in range 0.01 to 0.05 mm, with unit. [1]

(b) (i) Value of *w* in range 5 to 15 mm. Raw reading(s) must be to nearest mm. [1]

Evidence of repeated readings of *w.* [1]

(ii) Percentage uncertainty in *w* based on absolute uncertainty of 1 mm [1]
(but if repeated readings have been taken then the absolute uncertainty could be half the range, unless this is zero).
Correct method used to find the % uncertainty.

(c) Correct calculation of *A* using candidate's values from **(a)** and **(b)**. [1]

(d) (iii) At least three measurements of *F* used. [1]

Average calculated correctly, with unit. [1]

(e) Second value of *w*. [1]

Second value of *F.* [1]

F increases as *w* increases. [1]

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

(ii) 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 are not enough (to draw a conclusion)	Take more readings and plot a graph/calculate more k values (and compare)	'Few readings'/'take more readings and calculate average *k*'/'only one reading'
B	Difficult to see maximum/breaking *F*/break happens suddenly	Video (plus 'slow motion' or 'to view force' or 'to view newton-meter') use maximum-hold newton-meter/ use weights (e.g. sand) to measure *F*	Just 'use video camera'
C	Difficult to see ends of cuts/difficult to measure *w* because strip is transparent/ same colour as background	Use contrasting background/mark ends of cuts	'Difficult to measure *w*'/use coloured polythene
D	*w* measurement has low precision	Improved method of measuring *w* e.g. use vernier calliper or use travelling microscope/use larger *w*	
E	*t* not constant	Measure *t* between cuts	Micrometer squashes polythene
F	Large (%) uncertainty/error in *t*	Improved method of measuring *t* e.g. measure several layers or use digital micrometer <u>for better precision</u>	
G	Sellotape detaches from bench	Improved method of fixing to bench e.g. use clamp or use wider tape or use glue or use stickier tape	'use stronger tape'
H	*t* (or *w*) changes as strip stretches/as *F* increases	Measure just before or after strip breaks	

Do not allow 'repeated readings'
Do not allow 'use a computer to improve the experiment'

[Total: 20]

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