UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9702 PHYSICS

9702/31 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.

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1 (b) (iii) Value of I non-zero value and 10 mA with unit. [1]
Value of V 0.5 V 1.5 V with unit. [1]

(c) Six sets of readings of I and V scores 5 marks, five sets scores 4 marks etc. [5]
Incorrect trend then –1. Minor help from supervisor –1; major help –2.

Range: Range of I at least 0.3 mA. [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 e.g. V / V.

Consistency of presentation of raw readings: [1]
All values of I must be given to the same number of decimal places. All values of V must be given to the same number of decimal places.

Significant figures: [1]
Significant figures for $1/V$ the same as, or one more than, that for V.

Calculation: Check the values of $1/V$ and $1/I$. [1]

(d) (i) 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 on the grid occupy at least half the graph grid in both x and y directions. Scales must be labelled with the quantity that is being plotted. Ignore units.
Scale markings should not be greater than three large squares apart.

Plotting of points: [1]
All the observations in the table must be plotted. Check the points are plotted correctly. 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. Judge by the scatter of all points about a straight line. All points must be within 0.01 V^{-1} on the $1/V$ axis from a straight line.

(ii) Line of best fit: [1]
Judge by the 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.

(iii) Gradient: [1]
The hypotenuse of the triangle must be at least half the length of the drawn line. Read-offs must be accurate to half a small square.

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.

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(e) Correct method to find R. [1]

Answer in range 40 – 60 Ω with unit. [1]

[Total: 20]

2 **(a)** Measurement of *t* in the range 0.20 cm – 1.00 cm to 0.1 mm or 0.01 mm with unit. [1]

(b) **(i)** Measurement of *d* in the range 3 cm – 9 cm with unit. [1]

(ii) Correct calculation of *w.* [1]

(c) **(ii)** Value of *T* in the range 3 s – 5 s. [1]

Evidence of repeat readings. [1]

(d) Absolute uncertainty in *T* in range 0.1 s – 0.6 s. [1]
If repeated readings have been taken, then the uncertainty can be half the range.
Correct method of calculation of percentage uncertainty.

(e) Second value of *d* in the range 14 cm – 31 cm . [1]

Correct calculation of second value of *w*. [1]

Second value of *T*. [1]

Second value of *T* < first value of *T.* [1]

(f) **(i)** Correct calculation of two values of *k.* [1]

(ii) Sensible comment relating to the calculated values of *k*, testing against a specified criterion. [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) Allow 'repeat readings and plot a graph'	Few readings Take more readings and calculate average *k* Only one reading
B	Rule hits bench	Method of preventing rule hitting bench e.g. project end of cylinder over bench or elevate apparatus	Ignore amplitude changes/difficult to start at the same amplitude each time
C	rule used for wider diameter/ couldn't use calipers	Method to improve measurement of larger diameter e.g. use set squares held against ruler/wrap string or paper around and measure circumference/use calipers and hold against ruler/travelling microscope	Use larger Vernier calipers
D	Difficult to judge <u>when</u> oscillation is complete	1.Use video (+ playback) + timer/use clock on video / use position or motion sensor placed above/below rule (not above centre) / use of light gate with detailed method. 2.Use (fiducial) marker/pointer at centre (of oscillation)	Difficult to measure the time/human error/ references to reaction times
E	Oscillations die away quickly/too few oscillations/ damped		
F		Use same surface/material (for cylinders)	

Ignore 'parallax problems', 'use assistant' or references to draughts, fans, air conditioning.

[Total: 20]

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