CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 series

9702 PHYSICS

9702/35 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.

1 (a) (ii) Value of T in range $0.4 \leq T \leq 1.4$ s. [1]
Evidence of repeats. [1]

(b) Six sets of readings of m and t (or T) scores 5 marks, four sets scores 4 marks etc. [5]
Help from Supervisor –1.

Range of m : $\Delta m \geq 0.600$ kg [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. $1/T^2$/ s^{-2}.
Do not allow $1/T^2$/(s)^2

Consistency: [1]
All values of raw t must all be given to the nearest 0.1 s or 0.01 s.

Significant figures: [1]
Significant figures for every row of values of $1/T^2$ same as or one greater than t (or T) as recorded in table.

Calculation: [1]
Values of $1/T^2$ calculated correctly

(c) (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").
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 s^{-2} of $1/T^2$ from a straight line.

(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.

(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.

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.

(d) Value of *P* = candidate's gradient. Value of *Q* = candidate's intercept. [1]

Unit for *P* ($kg^{-1}\ s^{-2}$) correct and consistent with value and *Q* (s^{-2}) [1]

[Total: 20]

2 (a) (i) Value of *L* in range $8.0 \leq L \leq 12.0$ cm with consistent unit to the nearest mm. [1]

(ii) Absolute uncertainty $1 \leq \Delta L \leq 3$ mm.
If repeated readings have been taken, then the uncertainty can be half the range.
Correct method of calculation to get percentage uncertainty. [1]

(b) (iii) Value of raw N_1 an integer. [1]

(c) (iii) Value of $N_2 \geq N_1$. [1]

Evidence of repeats for N_1 or N_2 either here or in **(b)(iii)**. [1]

(d) Correct calculation of *F*. [1]

(e) Second value of *L*. [1]
Second values of N_2 and N_1. [1]
Second (average) value of N_1 > first (average) value of N_1. [1]

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

(ii) Justification of s.f. in *k* linked to significant figures in *L* and $(N_1 - N_2)$ and *m.* [1]

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

(g)

	(i) Limitations **4 max.**	**(ii)** Improvements **4 max.**	Do not credit
A	two readings not enough (to draw a conclusion)	take more readings and plot a graph/calculate more *k* values and compare	repeat readings/few readings/only one reading/take more readings and average *k*
B	friction at pulley	method of reducing friction of pulley with location	
C	wet string added to force/ mass of string not accounted for	waterproof/nylon/wire	
D	can only measure to nearest 0.4g / paperclip	use smaller masses e.g. half paperclips, riders, graph paper	newton meter
E	change in *N* are very small	reasoned explanation for changing length of wire	helpers parallax errors
F	copper wire is not flat/straight/exit not parallel to water level	circular wire shape	change liquid/wire

[Total: 20]