CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level

MARK SCHEME for the October/November 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.

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1 (a) Value for L in the range 0.500–0.600 m. [1]

(c) (iv) Value for n in the range 3–8. [1]

(d) Six sets of readings of D and n scores 5 marks, five sets scores 4 marks etc. [5]
Help from Supervisor –1.

Range of D: $D_{min} < 45$ cm and $D_{max} > 50$ cm. [1]

Column headings: [1]
Each column heading must contain a quantity and a unit where appropriate.
The unit must conform to accepted scientific convention e.g. D/m.

Consistency: [1]
All values of D must be given to the nearest mm.

Significant figures: [1]
Every value of $((n + 1)/n)^2$ should be given to 2 or 3 s.f.

Calculation: [1]
Values of $((n + 1)/n)^2$ calculated correctly.

(e) (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 plotted point 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 on the grid for this mark to be awarded.
All points must be no more than 0.04 of $((n + 1)/n)^2$ from a straight line.

(e) (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 by the candidate. Line must not be kinked or thicker than half a small square.

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(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.
The method of calculation must be correct.

y-intercept: [1]
Either:
Check 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:
Check read-off of the intercept directly from the graph.

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

Unit for P (e.g. m^{-1}) consistent with value and no unit for Q. [1]

[Total: 20]

2 (b) (i) Value for V_0 in range 25.0 – 35.0 cm^3. [1]

(ii) Evidence of two volumes added together. [1]

(v) Correct calculation of V. [1]

(vi) Absolute uncertainty in V in range 1 cm^3–3 cm^3.
If repeated readings have been taken, then the uncertainty can be half the range (but not zero if values are equal).
Correct method of calculation to find percentage uncertainty. [1]

(c) (iii) Value(s) of *x*. [1]
Evidence of repeat readings of *x* (either here or in **(d)(ii)**). [1]

(d) (ii) Second value of *V*. [1]
Second value of *x*. [1]
Quality: second value of *x* less than first value of *x*. [1]

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

(ii) Justification of s.f. in *k* linked to significant figures in *x* and *V*. [1]

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

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(f)

	(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/take more readings, calculate more *k* values and compare	'few readings'/'take more readings and calculate average'/'only one reading'/ 'repeat readings' on its own
B	Difficult to remove correct amount of water because air drawn into syringe	Use syringe with longer nozzle/needle Tilt/invert ball	'nozzle too short' on its own
C	Blu-tack not sticky enough/water leaks from ball/ syringe	Use e.g. sellotape/small cork to seal hole	
D	Difficult to judge lowest depth with reason e.g. parallax error/difficult to move head	Line up both sides of rubber band with ball Use mirror behind ball	Parallax measuring *x* Take measurements at eye level
E	Difficult to judge lowest depth because ball at <u>maximum depth</u> for a short time	Video experiment with <u>scale</u>	Moves too fast/too quickly Use motion sensor/high-speed cameras/slow-motion cameras Use light sensors
F	Large uncertainty in value of *V*/scale <u>divisions</u> on syringe too large	Use a smaller syringe/ measure mass/weight of ball and water	
G	Difficult to release ball without applying force/difficult to hold the ball on the surface of the water	Method of releasing ball e.g. cut string attached to ball	Clamp ball Use card/plastic gate

Do not allow 'use a computer to improve the experiment'.

[Total: 20]

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