UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9702 PHYSICS

9702/34 Paper 32 (Advanced Practical Skills 2), maximum raw mark 40

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1 (c) Measurements for h_1 and h_2 to nearest mm [1]
Check raw values if readings are repeated.

The difference between h_1 and h_2 is < 2 mm. [1]

(d) (iii) Six sets of readings of n, h_1 and h_2 scores 5 marks, five sets scores 4 marks etc. [5]
Incorrect trend then –1.
Help from supervisor then –1.

Range – [1]
n values must include 10 or greater.

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. h_1/cm or h_1(cm) but not 1/((h_1 – h_1)/cm).

Consistency of presentation of raw readings – [1]
All values of h_1 and h_2 must be given to the same precision.

Significant figures – [1]
S.f. for 1/(h_1 – h_2) must be the same as, or one more than, the s.f. in the difference (h_1 – h_2).

Calculation – [1]
1/(h_1 – h_2) calculated correctly.

(Graph) 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. Ignore units.
Scale markings must be no more than 3 large squares apart.

Plotting of points – [1]
All observations must be plotted.
Do not accept blobs (points with diameter > half a small square).
Ring and check a suspect plot. Tick if correct. Re-plot if incorrect.
Work to an accuracy of half a small square.

Line of best fit – [1]
Judge by balance of at least 5 trend points about the candidate's line. There must be an even distribution of points either side of the line along the full length.
Line must not be kinked.

Quality – [1]
Scatter of points must be less than ±0.02 on the 1/n axis about the examiner's line.
All points must be plotted (at least 5) for this mark to be scored.

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

Intercept [1]
Check that the read-off or the method of calculation is correct.

(f) Value of a = value of gradient and value of b = value of intercept. [1]
Do not allow a value presented as a fraction.

Units for a and b are correct. [1]
E.g. cm^{-1} or m^{-1} but must be consistent with the values.
Allow no unit for b if $b = 0$.

[Total: 20]

2 (a) (i) Value of d in range 5 cm to 15 cm. [1]
Help from supervisor then –1.

Evidence of repeated measurements of d. [1]

(ii) Correct calculation of A. [1]
Do not allow a value in terms of π.

(b) (i) Measurement for x in range $0.8\,cm < x < 1.0\,cm$ to nearest mm. [1]

(ii) Absolute uncertainty 1 or 2 mm (or half the range of repeats), and correct method of calculation. [1]

(c) (ii) Measurement for h to nearest mm. [1]

(d) (iii) Value for $t > 1$ s and given to 0.1 s or 0.01 s. [1]
Check raw data if there are repeats.

(iv) Correct calculation of R, with consistent unit (e.g. $cm^3\,s^{-1}$). [1]

(e) (i) Values for x, V and h. [1]

(ii) Correct trend (R increases with h). [1]

(f) (i) Values of k calculated correctly. [1]

(ii) Valid conclusion based on the calculated values of k. Candidate must test against a stated criterion. [1]

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(g)

	(i) Problems **4 max**	**(ii)** Improvements **4 max**	No credit/not enough
A	Two readings are not enough (to draw a conclusion).	Take more readings, and plot a graph/calculate more *k* values.	More readings and calculate the average/ only one reading.
B	Bottle not circular/ diameter at P different to that at Q.	Collect water and measure volume/remeasure diameter at P.	
C	Bottle deforms when measuring *d*.	Use vernier callipers to measure *d*.	Use string to measure *d*.
D	Difficult to see water level/meniscus problems/refraction problems.	Use coloured water/liquid.	Use oil.
E	Labels get wet/ink runs	Use waterproof labels/ink	
F	Difficult to judge when to start/stop timing.	Use video, with timing method.	Human reaction time error.
G	Large uncertainty in *x*.	Use travelling microscope to measure *x*.	
X	Another valid point E.g. Flowrate calculated is not the flowrate at *h*.	E.g. Measure *h* to point midway between marks.	Move marks closer together.

Ignore 'parallax problems' unless there is a convincing diagram.
Ignore 'use assistant'.
Ignore 'use distance sensor' unless there is a convincing diagram.
Ignore 'use a computer/datalogger/light gates'.
Ignore 'bottle not vertical'.

[Total: 20]

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