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Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2014 series

9702 PHYSICS

9702/34 Paper 3 (Advanced Practical Skills 2), maximum raw mark 40

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1 (b) (ii) Value for p in range 4.0 to 5.0 cm. [1]

(c) (iii) Value for q greater than p. [1]

(d) Six sets of values for p and q scores 5 marks, five sets scores 4 marks etc. [5]
Incorrect trend –1. Help from Supervisor –1.

Range: [1]
p values must include 3.0 cm or less and 5.0 cm or more.

Column headings: [1]
Each column heading must contain a quantity and a unit where appropriate.
Units should be shown using accepted scientific convention e.g. $1/p/\text{cm}^{-1}$ or $1/p$ (1/cm), and q/p must have no unit.

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

Significant figures: [1]
Every value of $1/p$ must be given to the same s.f. as (or one more than) the s.f. in the corresponding p.

Calculation: [1]
$1/p$ 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 must be no more than three large squares apart.

Plotting: [1]
All observations in the table must be plotted on the grid.
Diameter of plotted points must be $\leq$ half a small square (no "blobs").
Plotted points must be accurate to within half a small square.

(ii) Line of best fit: [1]
Judge by the 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 plot only if clearly indicated by the candidate (i.e. circled or labelled).
Line must not be kinked or thicker than half a small square.

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(iii) Gradient: [1]
The hypotenuse must be greater than half the length of the drawn line.
Both read-offs must be accurate to half a small square in both *x* and *y* directions.

y-intercept: [1]
Either:
Read-off from a point on the line 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.

(f) a = gradient / (1 – intercept) and b = intercept. [1]

Correct and consistent units for a (e.g. cm) and no unit for b. [1]

Quality: Value for b in range 1.40 to 1.55. [1]

[Total: 20]

2 (a) (i) Raw value(s) for d to nearest 0.01 cm or 0.001 cm and in range 0.5 to 1.5 cm. [1]

(ii) Value for x in range 2.2 to 2.8 cm. [1]

(iii) Raw value(s) of l to nearest mm or better. [1]

(b) Estimate of percentage uncertainty based on an absolute uncertainty of 2 to 5 mm and method of calculation correct. [1]
If repeated readings have been taken, then uncertainty can be half the range (but not zero) if the working is clearly shown.

(c) Correct calculation of A with consistent unit. [1]

(d) (v) Value for n. [1]
Evidence of repeat measurements of n. [1]

(e) Second values of x and l. [1]

Quality: n increases as l increases. [1]

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

(ii) Justification based on the s.f. in x, d and l. Ignore any reference to n or A. [1]

(iii) Valid comment consistent with the calculated values of k, testing against a stated criterion e.g. “The calculated percentage difference between k values is less than the percentage uncertainty in **(b)**, so the relationship is valid”. [1]

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(g)	Limitations (4 max.)	Improvements (4 max.)	Do not credit
A	Two readings are not enough to draw a valid conclusion	Take many *A* values and plot a graph / take more readings and compare *k* values / repeat readings and plot graph	Repeat / too few readings
B	Difficult to measure because hard to judge where parallel section of pencil starts / to judge where to measure from	Use a flat-ended rod	
C	Pencil not vertical	Use guides	
D	Difficult to keep drop height constant / drop height not constant	Use a stop with detail / use a fixed ruler behind strip / use pointer with detail e.g. pointer mounted in a stand	Difficult to release strip without a force / use fiducial marker
E	Difficult to judge when mark reaches surface because rice surface uneven	Use ring of card resting on rice around pencil / measure change in height of pencil	Rice spills out of container during experiment
F	Difficult to judge if strip is horizontal / strip may not be horizontal / strip is not horizontal	Measure (or compare) height at each end / use spirit level	
G	Conical section of pencil not taken into account		

[Total: 20]

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