**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Advanced Subsidiary Level and GCE Advanced Level**

# MARK SCHEME for the May/June 2010 question paper

# for the guidance of teachers

## 9702 PHYSICS

**9702/34** Paper 32 (Advanced Practical Skills), 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 (a)** Apparatus set up without help from Supervisor. [1]
Value of $L$ to nearest mm. [1]

**(d)** Table –
Six sets of readings of $d$ and $h$ scores 5 marks, five sets scores 4 marks, etc.
Incorrect trend –1. [5]

Range –
Range of values of $d \geqslant 15$ cm. [1]

Column headings –
Each column heading must contain a quantity and a unit. Ignore units in the body of the table.
There must be some distinguishing mark between the quantity and the unit e.g. $1/d$ / $m^{-1}$ or $1/d$ ($m^{-1}$). [1]

Consistency –
All raw values of $h$ must be given to the nearest mm. [1]

Significant figures –
S.f. for $1/d$ must be the same as, or one more than, the s.f. given for raw $d$. Check each row. [1]

Calculated values –
Check the specified value of $1/d$. If wrong, write in the correct value. [1]

**(e) (i) Graph**
Axes –
Sensible scales must be used. Awkward scales (e.g. 3:10) are not allowed.
Scales must be chosen so that the plotted points occupy at least half the graph grid in both $x$ and $y$ directions. Indicate a false origin with FO.
Scales must be labelled with the quantity that is being plotted. Ignore units.
Allow inverted axes but do not allow the wrong graph.
Scale markings should not be more than three large squares apart. [1]

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

**(ii)** Line of best fit –
Judge by the 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 whole length.
Indicate best line if candidate's line is not the best line.
Line must not be kinked or thicker than 1 mm. [1]

Quality –
Judge by scatter of all points about a best line. All plots from table (minimum 5) must be within 0.1 $m^{-1}$ of a straight line (in $1/d$ direction).
Do not credit if it is the wrong graph or if the trend is wrong. [1]

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**(iii)** Gradient –
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 – if wrong write in the correct value(s).
Check for $\Delta y/\Delta x$ (i.e. do not allow $\Delta x/\Delta y$). [1]

*y*-intercept –
Value must be read from graph to nearest half small square (after checking for false origin) or calculated using ratios or $y = mx + c$. [1]

**(f)** Correct calculation of *z* (gradient value must be used).
Ignore sign. [1]
Value of *z* given with unit of length (gradient value must be used). [1]

**[Total: 20]**

**2** **(a)** Measurement of $I$ in range 1.5 A–2.5 A and to 0.1A or better. [1]

**(c)** Measurement of *x* to the nearest mm. [1]

**(d)** Measurement of $\theta$ (less than 45°). Raw values to no more than nearest degree or half degree. [1]

**(e)** Percentage uncertainty in $\theta$: Correct method, using $\Delta\theta$ = half the range, or $\Delta\theta$ = 2° to 10°. [1]

**(f)** **(i)** Evidence of repeated measurements either here or in **(d)**. [1]

**(ii)** Correct average value of $\theta$. [1]

**(g)** Second measurement of *x*. [1]
Second measurement of $I$. [1]
Quality: $I$ decreases as *x* decreases. [1]

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

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

**(iii)** Statement that the s.f. for *k* depend on the s.f. for $I$ and *x*. Ignore any reference to d.p. [1]

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**(i)** Identifying limitations and suggesting improvements

| | Limitations (4) | Improvements (4) | Ignore |
|---|---|---|---|
| **A** | Two readings (of $x$ and $I$) are not enough (to draw a valid conclusion). | Take more readings and plot a graph. | Repeat readings. |
| **B** | Difficult to measure $x$ / difficult to keep $x$ constant / difficult to keep distance between wire and magnet constant / difficult to keep distance between wire and stick constant. | Use a clamped ruler / method of fixing the string | Parallax error in measuring $x$. |
| **C** | Magnet does not come to rest. | Practical method of damping / shield from draughts / turn off fans. | Magnet swings too fast. |
| **D** | Measured angles are very small | Use larger currents / use bigger protractor | Use stronger / larger magnet. |
| **E** | Parallax error in measuring $\theta$ / reading protractor / reading deflection. | Method of bringing protractor closer to wire / shine light from above | Increase $x$ / use mirror. |
| **F** | Difficult to alter rheostat while holding string. | Method of fixing the string (unless already credited in B) / method of fixing rheostat to bench / use assistant. | |
| **G** | ($\theta$ affected by) magnetic materials nearby / stray magnetic fields. | Use wooden / non-magnetic stands. | Move object further away. |
| **H** | Fluctuating current. | Method of improving contact with wire (e.g. cleaning contacts, soldered connections). | |

Do NOT credit: Use sensors / use lightgates / use video.

**[Total: 20]**

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