CAMBRIDGE
INTERNATIONAL EXAMINATIONS

**June 2003**

GCE ADVANCED SUBSIDIARY LEVEL AND ADVANCED LEVEL

# MARK SCHEME

## MAXIMUM MARK: 30

SYLLABUS/COMPONENT: 9702/05

PHYSICS
Paper 5 (Practical (A2))

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

**1 (a) (v)** Measurements 3

**6 sets** of readings ($I \neq 0$) scores **1 mark**
Allow more than 6 sets without penalty
Write the number of readings as a ringed total by the table
Choose a row in the table
Check a **value for tan $\theta$**. Tick if correct and score **1 mark**
If incorrect, write in correct value and do not award the mark
Ignore small rounding errors
All values of $\theta < 90^\circ$ score **1 mark**
Minor help from the Supervisor -1. Major help, then -2
If help has been given then write SR at the top of the front page of the script, and give a brief explanation of the type of help that has been given by the table of results

**(a) (v)** Repeats 1

Expect to see at least two sets of readings for $\theta$, with an average calculated
Do not award this mark if all the results are the same

**(a) (v)** Quality of results 2/1/0

Judge by scatter of points about the line of best fit
6 trend points with little scatter scores 2 marks
5 trend points with little scatter scores 1 mark
Shallow curve can score 1 mark
4 trend points only scores zero
Wrong trend or 'impossible results' cannot score these marks

**(a) (v)** Column headings 1

Apply to the current column only
There must be some distinguishing mark between the quantity and the unit
Allow $I$/A, $I$ (A) or $I$ in A

**(a) (v)** Consistency 2/1/0

Apply to both $\theta$ and $I$
All values of $\theta$ must be given to the same number of d.p.
Allow $\theta$ to be given to the nearest half degree or nearest degree
All values of $I$ must be given to the same number of d.p. (0.1 A or 0.01 A)
Do not accept values to the nearest Ampere or milliampere

**(a) (vi)** Justification of sf in tan $\theta$ 2/1/0

Answer must relate the number of sf in $\theta$ to the number of sf in tan $\theta$
Do not allow answers in terms of decimal places
'Raw data' ideas can score 1 mark

**(b) (i)** Axes 1

The axes must be labelled with the quantities plotted
Ignore units on the axes
The plotted points must occupy at least half the graph grid in both the *x* and *y* directions (i.e. 4 large squares in the *x*-direction and 6 large squares in the *y*-direction)
Do not allow more than 3 large squares between the labels on an axis
Do not allow awkward scales (e.g. 3:10, 6:10, etc.)

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**(b) (i)** Plotting of points 1
All the observations must be plotted
Count the number of plots and ring this total on the grid
Do not allow plots in the margin area
Check one suspect plot. Circle this plot. Tick if correct. If incorrect, mark the correct position with a small cross and use an arrow to indicate where the plot should have been, and -1. Allow errors up to and including half a small square

**(b) (i)** Line of best fit 1
Only a drawn straight line through a linear trend is allowable for this mark
This mark can only be awarded for 5 or more plots on the grid
There must be a reasonable balance of points about the drawn line
Do not allow a line of thickness greater than half a small square

**(b) (ii)** Gradient 1
Ignore any units given with the value
Hypotenuse of Δ must be > half the length of line drawn
Check the read-offs. Work to half a small square. $\Delta x/\Delta y$ gets zero
Values taken from the table that lie on the line to within half a small square are acceptable
Do not award this mark if a curve has been drawn

**(c)** $k$ = candidate's gradient 1

**(c)** Unit of $k$ (i.e. $A^{-1}$) 1

**(c)** SF in $k$ 1
Allow 2 or 3 sf only

**(d) (i)** Value of $\theta$ when $I$ = 15 A 1
Method of working must be checked. Ignore unit and small rounding errors

**(d) (ii)** Reasons for not being able to verify experimentally 1
Heating problems with the wires
Fuse may blow on psu/max. output current on psu exceeded
Do not allow vague answers such as 'It is dangerous'

**20 marks in total**

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| | | | |
|---|---|---|---|
| 2 | **A1** | Sensible choice of equipment and procedure OK<br>(i.e. measure count rate and p.d.; change p.d. and measure new count rate)<br>Unworkable methods/inappropriate choice of apparatus cannot score this mark | 1 |
| | **A2** | Voltmeter shown in parallel with the GM tube or the supply | 1 |
| | **A3** | Ratemeter/scalar/datalogger connected to terminals A and B of GM tube | 1 |
| | **B1** | Radium or Cobalt source used | 1 |
| | **B2** | Reason for choice<br>Answer must relate to half-life. This mark cannot be scored if **B1 = 0** | 1 |
| | **B3** | Method of removing $\alpha$ or $\beta$ radiation (depending on source used)<br>Appropriate absorber is expected. Accept 'aluminium' or <u>thin</u> lead<br>Could be shown on the diagram. Allow electric or magnetic deflection | 1 |
| | **C1/2** | Any two safety precautions<br>e.g. use source handling tool<br>store source in lead lined box when not in use<br>do not point source at people/do not look directly at source<br>Do not allow 'protective clothing', 'lead suits', 'lead gloves', 'goggles', etc. | 2 |
| | **D1/2** | Any good/further detail<br>Examples of creditworthy points might be:<br>Repeat readings (to allow for randomness of activity) or scalar + long time<br>Sensible value of p.d. applied to GM tube (i.e. 50 V to 1000 V)<br>Keep distance from source to GM tube <u>constant</u>/<u>fixed</u>/<u>same</u>, etc.<br><u>Subtract</u> count rate due to background radiation<br>Aluminium sheets must be mm or cm thickness<br>Allow other valid points. Any two, one mark each | 2 |

**10 marks in total**

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