June 2004

GCE ADVANCED SUBSIDIARY LEVEL AND ADVANCED LEVEL

MARK SCHEME

MAXIMUM MARK: 30

SYLLABUS/COMPONENT: 9702/05

PHYSICS
Paper 5 (Practical (A2))

UNIVERSITY of CAMBRIDGE
International Examinations

Question 1

(a) (v) Sensible use of fiducial marker placed at centre of oscillation/mean position/ equilibrium position **1**

(a) (vi) Measurements **3**
6 sets scores one 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 values for T^2d & d^2. Tick if correct.
One mark each. If incorrect, write in correct values. Ignore small rounding errors.
Impossible values of d or t, -1. Misread stopwatch –1.
Minor help from the Supervisor, -1. Major help, then -2.

Repeats **1**
Expect to see at least two sets of readings of raw times.

At least half the raw times > 20 s **1**

Column heading for T^2d **1**
The column heading must contain a quantity and a unit (e.g. s^2 m or s^2 cm).
There must be some distinguishing mark between the quantity and the unit.

Consistency **1**
Apply to d (all values of d must be given to the nearest millimetre).

SF in d^2 **1**
Check by row in the table; compare with raw values of d.
The number of significant figures in d^2 must be the same as, or one better than, the number of significant figures in d.

(a) (vii) Justification of sf in d^2 **1**
Answer must relate the number of sf in d.
Do not allow answers in terms of decimal places.

(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, 8:10 etc.).
If axes reversed (i.e. d^2 against T^2d) then zero and ecf.

Plotting of points **1**

All the observations must be plotted.
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 score zero. Allow errors up to and including half a small square.

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.

Quality of results **1**

Judge by scatter of points about the line of best fit.
5 trend plots can score this mark. Curved trend scores zero.
This mark can only be scored if a graph of d^2 against T^2d or T^2d against d^2 has been plotted.

(b) (iii) 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.

y-intercept **1**

The value must be read to the nearest half square.
Allow calculation from $y = mx + c$

(c) k = gradient of line of best fit **1**

A numerical value is expected. Substitution method scores zero.

A = candidate's value for the *y*-intercept **1**

A numerical value is expected. Substitution method scores zero.

Unit of A correct and consistent with value (e.g. s^2 m or s^2 cm) **1**

If incorrect allow ecf from column heading in table.

(d) Value of T when d = 1.0 cm **1**

Must be in range 3 – 8 s.
A power of ten error anywhere in the working will result in this mark not being scored.
Working must be checked. Bald answer scores zero.

20 marks in total

Question 2

A1 Sensible choice of equipment and basic idea OK **1**
Source/magnetic field/detector
Inappropriate choice of apparatus cannot score this mark.
Ignore lead or aluminium plates at this stage.

A2 Method of measuring angle of deflection **1**
(e.g. detector at edge of large protractor/lengths & trig ratio used)
Do not allow vague 'use a protractor'.
This mark can be awarded even if the detector has not been specified.

A3 Use Hall probe/search coil/current balance to measure field strength **1**
Allow Helmholtz coils expression if Helmholtz coils used.
Allow a current or voltage measurement as indication of field strength (as $I \propto B$)

B1 Method of removing α radiation or statement that α radiation almost undeflected **1**
Use paper or distance to detector > few cm/air to absorb alpha
Could be shown on the diagram. Do not allow lead/aluminium plate.
Allow α to be shown deflecting in the opposite direction to β on the diagram.

B2 γ -radiation undeflected/deflect beta particles using electric field **1**
Can be shown on diagram. Do not allow 'absorb gamma with lead plate'.

B3 Workable procedure for uniform fields **1**
Measure deflection and field strength; change current in coils and repeat.

C1/2 Any two safety precautions **2**
e.g. use source handling tool
store source in lead lined box when not in use
do not point source at people/do not look directly at source
place lead sheet at 'end of experiment' to absorb unwanted rays

D1/2 Any good/further detail. Examples of creditworthy points might be: **2**
Type of detector (GM tube/film/screen/scintillation counter). N/a cloud chamber/CRO
Repeat readings to allow for randomness of activity
Correct deflection of beta on diagram/left hand rule ideas (diagram or written)
Separation of coils = radius of coils for uniform field
Discussion of count rate (and not just count)
Plane of semiconductor slice is perpendicular to field lines
Calibrate Hall probe
Detail of calibration
Collimation ideas
Allow other valid points. Any two, one mark each.
B1 = B2 = B3 = 0 if lead or aluminium plate is placed in front of the source. Allow thin (less than 1 mm) sheet or foil

10 marks in total.