June 2004

GCE ADVANCED SUBSIDIARY LEVEL AND ADVANCED LEVEL

MARK SCHEME

MAXIMUM MARK: 25

SYLLABUS/COMPONENT: 9702/03

PHYSICS
Paper 3 (Practical (AS))

UNIVERSITY of CAMBRIDGE
International Examinations

(a) Pointer B reading to the nearest half millimetre or millimetre **1**
Extension correct and to nearest millimetre
Condone negative values (i.e. do not penalise 'upside down' rule)

(b) Calculation of spring constant to 2 or 3 sf **1**
$k = 0.98/x$ answer must be given in N m^{-1}.
Ignore any negative signs. Do not allow fractions

(c) (i) Diameter of one mass to at least 3 sf **1**
Accept value ± 0.2 mm of Supervisor's value

(ii) Percentage uncertainty in diameter **2**
One mark for Δd (either 0.1 mm or 0.2 mm).
One mark for correct ratio and multiplication by 100.

(iii) Cross-sectional area **2**
One mark for $A = \pi r^2$.
One mark for correct substitution into $A = \pi r^2$. ECF from **(c)(i)**.
Do not allow the second mark if diameter substituted into $A = \pi r^2$.
Wrong formula scores zero in this section.

(d) (iv) Measurements **2**
Expect to see six sets of results in the table (one mark).
l must be correct; check a value (one mark).
If correct, then tick. If incorrect, then do not award the second mark, and write in the correct value. If pointer reading not shown then this mark cannot be scored.
Minor help given by Supervisor, -1. Major help, then -2.

Column headings for d and l (one mark for each correct heading). **2**
Expect to see a quantity and a correct unit.
There must be a distinguishing feature between the quantity and the unit.

Consistency of d and l readings. **2**
Values should be given to the nearest mm.
One mark each.

(e) (iii) Gradient is negative. **1**
No ecf from misread rule if gradient is positive.

Gradient calculation. **1**
Δ used must be greater than half the length of the drawn line.
Check the read-offs (must be correct to half a small square).
Ratio must be correct (i.e. $\Delta y / \Delta x$ and not $\Delta x / \Delta y$).

Graph Axes **1**
Scales must be such that the plotted points occupy at least half the graph grid in both the x and y directions (i.e. at least 6 large squares on the longer side of the grid and at least 4 squares on the shorter side of the grid).
Scales must be labelled. Do not allow awkward scales (e.g. 3:10, 6:10 etc.).
Allow reversed axes (penalise in section **(f)**)

Plotting of points **1**
Count the number of plots and write as a ringed total on the graph grid.
All the observations must be plotted or this mark cannot be scored.
Check a suspect plot. Circle and tick if correct.
If incorrect, show correct position with arrow, and -1.
Work to half a small square.

Line of best fit **1**
There must be at least 5 trend plots for this mark to be scored.
There must be a reasonable balance of points about the line of best fit.

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Curved trend cannot score this mark.
Quality of results **1**
Judge by scatter of points about the line of best fit.
There must be at least 5 trend plots for this mark to be scored.
Incorrect trend (i.e. positive gradient) will not score this mark.

(f) Gradient equated with $\frac{-\rho_w Ag}{k}$. Condone misuse of negative sign. **1**

Value in range 800 – 1200 kg m^{-3} (or 0.80 to 1.20g cm^{-3}) **1**
This mark cannot be scored if the gradient has not been used.
This mark will not be scored if there is a Power Of Ten error in the working or reversed axes.

Unit correct (kg m^{-3}) **1**
If another unit has been given then it must be consistent with the value.

Significant figures in ρ_w **1**
Accept 2 or 3 sf only. Ignore trailing zeros (except ρ_w = 1000)

(g) Difficulty **1**
e.g. hard to see the water surface/surface tension problems/refraction effects/parallax errors. Do not allow vague 'human error'.

Improvement **1**
e.g. use calibrated beakers or masses/paper behind/mirror behind/travelling microscope
Do not allow 'use dye'/repeat readings.

25 marks in total

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