**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

GCE Advanced Subsidiary and Advanced Level

# MARK SCHEME for the June 2005 question paper

## 9702 PHYSICS

**9702/03** **Paper 3 (Practical Test), maximum raw mark 25**

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. This shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2005 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

**Grade thresholds** for Syllabus 9702 (Physics) in the June 2005 examination.

| | maximum mark available | minimum mark required for grade: | | |
|---|---|---|---|---|
| | | A | B | E |
| Component 3 | 25 | 22 | 20 | 15 |

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

June 2005

GCE A AND AS LEVEL

# MARK SCHEME

## MAXIMUM MARK: 25

**SYLLABUS/COMPONENT: 9702/03**

**PHYSICS**
**Paper 3 (Practical Test)**

UNIVERSITY of CAMBRIDGE
International Examinations

**(a) (iii)** Absolute uncertainty = $1^0$ - $5^0$, one mark. Can be credited from **(a) (ii)**. **[2]**
Percentage uncertainty in first value of $\theta$ (i.e. ratio correct and x 100), one mark.
A bald answer with no working scores zero. Check value if absolute uncertainty given but no ratio. Allow half range/av. value x 100.

**(b)** Two difficulties: one mark each **[2]**
Examples of creditworthy answers are as follows:

- Indicator on the newton-meter sticks
- Difficultly of too much compressive force to body of newton-meter when clamping
- Difficult to position centre of protractor on knot
- Protractor 'wobbles' when being held by hand/'wobbly hands'
- Parallax error when reading the scale on the protractor/newton-meter
- Hard to align newton-meter parallel to line of action of *F*
- Difficulty of ensuring AB is horizontal
- Difficulty with zero on scale of newton-meter
- Thick string makes measurement of angle hard
- The centre of the knot could not be accurately located
- 'The air-conditioning makes the string move'/reason for moving string

Candidate's answers must relate to <u>this</u> experiment, and the measurement of *F* and $\theta$.
Examples of vague answers which are not acceptable are as follows:

- 'The string was moving' or 'the mass was oscillating'
- 'I did not have any difficulties'
- 'The clamp is loose, so I tightened it'
- It was difficult to read the scale on the newton-meter/angle
- Unqualified 'adjusting the retort stand'
- The mass is not in equilibrium
- Unqualified 'parallax error'

**(c)** Readings **[5]**
6 sets of readings scores three marks; 5 sets, two marks; 4 sets, one mark.
Check a value for 1/sin $\theta$. Tick if correct and score one mark.
Ignore small rounding errors. Ignore POT errors in *F*.
If incorrect, write in correct value and do not award the mark.
All values of $\theta$ must lie between $90^0$ and $180^0$; one mark.
Help given by Supervisor, then -1. Excessive help then -2.

Quality of results **[2]**
Judge by scatter of points about the line of best fit.
6 trend points with little scatter scores two marks.
6 trend points with 'a fair amount of scatter' scores one mark.
5 trend points with little scatter scores one mark.
<u>Shallow</u> curve scores one mark. 4 trend points (or less) scores zero.
Considerable scatter scores zero. Wrong trend scores zero.
If wrong angle measured (i.e. values of $\theta$ < $90^0$) then cannot judge quality.
Score zero.

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Column headings **[1]**
Apply to *F* only. There must be some distinguishing feature between *F* and N.
Accept *F*/N, *F* (N), *F* in N, $\frac{F}{N}$. Allow the unit to be written in words.
Do not allow *F*, N. Do not allow *F*/n.

Consistency **[2]**
Apply to *F* and $\theta$ only. One mark each.
All the values of *F* should be given to one decimal place.
Do not accept 0.1 g if spring balance used.
Values of $\theta$ must be given to the nearest degree.

**(d)** 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 squares in the *y*-direction and 4 squares in the *x*-direction).
Scales must be labelled with the quantity plotted. Ignore units.
Do not allow awkward scales (e.g. 3:10, 6:10, 8:10 etc.)
Do not allow more than three large squares without a scale marking.

Plotting of points **[1]**
Count the number of plots on the grid and write this value by the line.
Do not allow plots in the margin area. Check a suspect plot.
The number of plots must correspond to the number of observations.
Score zero if the number of plots is less than the number of observations.
Circle and tick if correct. If incorrect, show correct position with arrow, and do not award the mark. Work to half a small square.

Line of best fit **[1]**
Expect to see a reasonable balance of points about the line of best fit.
Five trend plots are needed for this mark to be awarded.
There must be a straight line drawn through a linear trend of points.

**(e)** Determination of gradient **[2]**
$\Delta$ used must be greater than half the length of the drawn line; one mark
Read-offs and ratio correct (i.e. check that d*y*/d*x* has been found and not d*x*/d*y*); one mark. Ignore any unit given with the value.

*y*-intercept **[1]**
The value may be read directly or calculated using $y = mx + c$ and a point on the line. If a point on the line has been used, check that there is a valid substitution into $y = mx + c$. Do not look at final numerical answer if the method of working is correct. Tick the zero on the *x*-axis if present, or write FO if not.

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**(f)** Gradient equated with $mg$ **[1]**
If axes reversed on graph then do not award this mark.

Value of $m$ **[1]**
Working must be correct (i.e. gradient/$g$). Allow ecf from incorrect gradient.

Intercept equated with $k$ **[1]**
Value must agree with $y$-intercept on page 4.

Significant figures in $m$ and $k$. Accept 2 or 3 sf only. **[1]**

Units of $m$ and $k$ correct **[1]**
$m$ can be in kg or g (consistent with working). $k$ must be in N.

Note: a substitution method in **(f)** can only score SF and unit marks.

**[25 marks in total for this question]**

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