**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

GCE Advanced Level

# MARK SCHEME for the June 2005 question paper

## 9702 PHYSICS

**9702/05** **Paper 5 (Practical Test), maximum raw mark 30**

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 5 | 30 | 24 | 22 | 14 |

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 LEVEL

# MARK SCHEME

## MAXIMUM MARK: 30

**SYLLABUS/COMPONENT: 9702/05**

**PHYSICS**
**Paper 5 (Practical Test)**

UNIVERSITY of CAMBRIDGE
International Examinations

**1 (b) (ii)** Repeats of raw time **[1]**

**(c)** Readings **[3]**

Write the number of readings as a ringed total by the results table.
6 sets of readings scores 1 mark. Do not award this mark if wrong trend or no trend.
Check a value for lg(*T*/s) and a value for lg(*d*/m). Underline checked values.
Ignore small rounding errors. Allow *d* in cm. Tick if correct; 1 mark each.
If incorrect then write in correct value. Ln loses one mark only.
If no value for *N* then the mark for lg(*T*/s) cannot be scored.
If minor help is given, then -1. If excessive help is given then -2. Please indicate when help has been given to a candidate by writing **SR** at the top of the front page of the candidate's script. Also, please indicate the type of help that has been given by writing a brief comment by the table of results.

At least two readings > 10 s **[1]**

Column headings **[1]**

There must be some distinguishing mark between the quantity and its unit.
Please ✓ each correct column heading to show that it has been seen.
Ignore the column headings for lg(*T*/s) and lg(*d*/m)

Consistency of raw readings in the table of results **[1]**

Apply to *d* and raw times only.
Expect to see raw times to either 0.01 s or 0.1 s.
Expect to see all the values of *d* given to the nearest millimetre.
Indicate using $\checkmark_C$ at the foot of each column of raw readings if correct.

**(d) (i)** Axes **[1]**

Each axis must be labelled with a quantity.
Scales must be such that the plotted points occupy at least half the graph grid in both the *x* and *y* directions. Do not allow more than 3 large squares between scale markings. Do not allow awkward scales (e.g. 3:10, 6:10, 7:10, etc.).
Do not award this mark if the axes are inverted (i.e. lg(*d*/cm) vs lg(*T*/s)), but ecf.

Plotting of points **[1]**

Count the number of plots on the grid and write this value by the line and ring it.
Do not allow plots in the margin area.
The number of plots must correspond to the number of observations.
Do not award this mark if the number of plots is less than the number of observations.
Check one suspect plot. Circle this plot. Tick if correct. If incorrect then mark the correct position with a small cross and use an arrow to indicate where the plot should have been. Allow errors up to and including half a small square.

**(ii)** Line of best fit **[1]**
There must be a reasonable balance of points about the line of best fit.
If one of the plots is a long way from the trend of the other plots then allow this plot to be ignored when the line is drawn.

**(iii)** Measurement of gradient **[1]**
The hypotenuse of the triangle must be greater than half the length of the drawn line.
Read-offs must be accurate to half a small square and ratio must be correct.
Please indicate the vertices of the triangle used by labelling with Δ.

*y*-intercept **[1]**
Check the read-off.
Accept correct substitution from a point on the line into $y = mx + c$.

**(e)** $\lg T = n \lg d + \lg k$ **[1]**
This can be implied from the working.

Value for *n* (from gradient) **[1]**

Value for *k* (only from $10^{\text{y-intercept}}$) **[1]**

**(f)** **(i)** Value of *t* ($\pm 0.05$ mm of SV) or $\pm$ 0.05 mm of extremes if range given **[1]**
If POTE do not award this mark.

**(ii)** Micrometer screw gauge/micrometer/screw gauge **[1]**

**(iii)** Percentage uncertainty in $t^3$ **[1]**
$\Delta t$ ratio, x100 and 'x 3' must be correct.
$\Delta t$ can be 0.005 mm, 0.01 mm, 0.02 mm or half the range.

**(g)** Value of *E* **[1]**
Check the substitution, working and consistency of units.
Must be in range from $5.0 \times 10^{10}$ to $5.0 \times 10^{11}$ Pa.
Allow $M = 0.05$ kg or 0.10 kg.
Bald answer for *E* scores zero.

Unit of *E* (Pa or N $m^{-2}$) **[1]**

**[Total: 20 marks]**

**2 A1** Use of alpha emitter as source (one mark), with a reason (strongly ionising) (one mark). These are independent marks. **[2]**
Do not award these marks if the source is not sensible (e.g. smoke producing alpha particles)

**A2** Correct circuit showing milliammeter/microammeter/galvanometer **[1]**
Do not allow ammeter. Accept 'sensitive ammeter'.
A power supply must be shown.

**A3** Use of Bourdon gauge/pressure gauge/manometer/barometer **[1]**
Accept pressure sensor + datalogger.
Do not allow vague 'pressure metre'.
Could be shown on the diagram.

**B1** Change air pressure using pump (could be shown on diagram) **[1]**

**B2** Diagram showing 'closed box' surrounding the equipment. **[1]**
do not award this mark if the gauge is not measuring the pressure in the box.

**B3** Procedure **[1]**
Measure ionisation current and *P*; change air pressure (and measure new pressure and ionisation current).
This mark can be scored even if the design is unworkable.
Accept a table.

**C1/C2** 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
use safety goggles when dealing with low/high pressures
Do not allow vague 'safety goggles' without clarification
container must be strong enough to withstand high/low pressure
use safety screens in case of implosion/explosion
Do not allow lead suits/lead lined rooms/lead gloves/lead lined expt. etc.
One mark for safety relating to radiation.
One mark for safety relating to pressure.

**D** Any good/further detail **[1]**
Examples of creditworthy points might be:
Use high voltage as current is small
Use GM tube and scalar/ratemeter to monitor activity to ensure that it does not change
Use of source of long half-life
Place source close to plates (as range of alpha in air is small)
Tap gauge when taking readings (in case needle sticks)
Fix position of source relative to plates
Separation of plates constant
Allow other valid points.

**[Total: 10 marks]**