**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Advanced Subsidiary Level and GCE Advanced Level**

# MARK SCHEME for the October/November 2006 question paper

## 9702 PHYSICS

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

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

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.

The grade thresholds for various grades are published in the report on the examination for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses.

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**Question 1**

**(b) (iii)** Resistance of LDR calculated <u>correctly</u> and greater than 1 kΩ and less than 100 kΩ. 1

**(b) (iv)** Justification of sf in *R* (in text or value in (iii)). Relate to V <u>and</u> I. Do not allow just one unless valid reason given. Do not allow 'raw' data. Ignore dp if SF correct. 1

**(c)** Readings. Wrong trend in I (or R) −1. 2
6 sets scores two marks. 5 sets one mark.
Allow more than 6 sets without penalty.
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.

**(c)** lg *R* and lg *N* correct; one mark each. Values must be checked. 2

**(c)** Column headings consistent. Ignore POT. 1
V, I, R and lgR column heading must contain a quantity and any valid unit. e.g. lg(R/Ω).

**(c)** Consistency of raw readings. I and V only. 1

**(d) (i)** Axes inverted or wrong graph loses this mark. 1
The axes must be labelled with the quantities plotted. (ignore units)
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.).

**(d) (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.

**(d) (ii)** Line of best fit. Too much scatter loses this mark. 1
A linear trend is expected for this mark.
At least 5 or more trend plots on the grid.
There must be a reasonable balance of points about the drawn line.

**(d) (iii)** Gradient. Expect negative gradient. Allow ecf. 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.

**(d) (iii)** $y$-intercept
Accept substitution into $y = mx + c$ using a point on the line. 1

**(e)** $a = 10^{y\text{-intercept}}$ 1
Check value from candidate's y-intercept. Allow ecf. from graph

**(e)** *b* = gradient. Allow ecf from graph. 1

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**(f) (i)** Value of diameter of pin. Check value between 0.60 – 0.70 mm. Must have 2dp. 1
(If out of range check Supervisor's value $\pm$ 0.05 mm)

**(f) (ii)** Check substitution for area of check value if no substitution. Ignore POT. 1
Expect A = 0.33 $mm^2$. allow ecf from (f) (i).

**(f) (iii)** Repeat readings of diameter (and check area). 1

**(g)** Value of R in range 200 – 2000 $\Omega$. 1

**(g)** 2/3 S.F. only. 1

**20 marks in total.**

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**Question 2**

**A1** (Measure) p.d. and find a force (could be in a table or graph). Change p.d. and repeat. 1
i.e. correct procedure. Do not give for only identifying the variables.
This mark can be scored if the method is unworkable.

**A2** Measurement of p.d. – voltmeter connected in parallel with capacitor or power supply on diagram or voltage read from power supply in text. Wrong diag loses this mark. 1

**A3** Workable electrical arrangement: d.c. power supply on diag or in text. 1
Ignore Voltmeter in series. Ammeter in parallel loses this mark.
Do not allow discharge of circuit while measuring force.
If diagram wrong this loses this mark.

**A4** Method of changing the p.d. (diag or text). 1
Variable power supply or potential divider circuit. Do no allow variable resistor in series.
Do not allow changing distance.

**B1** Measure the force/(mass) with tpb or force with newtonmeter. 1
Or measure force from a mass/lever/pulley system.

**B2** Workable mechanical arrangement to measure force on diag. 1
Allow workable loading/lever/pulley system.

**B3** **Plates** close together/large surface area or HT/EHT/hight voltage to 1
make force large/measurable.

**C** Any one safety precaution with reason. 1
e.g. wear insulating/rubber gloves: earth/insulate one plate wrt top pan balance or newtonmeter; discharge before touching plates to avoid/prevent shock/short circuit.
Do not allow not touching plates (precaution needed).

**D1/2** Any further good design features. 2
Some of these might be:
Two fixed points shown on the diagram (appropriate clamps or supports).
Distance between the plates should be kept constant.
Method of achieving constant separation of plates (spacers or measurement; no insulators or dielectrics)/adjust newtonmeter position to give same separation.
Force = mg
Force is the change in readings.
Calibrate springs to give force reading.
Approx. p.d (greater than 100 V)/distance (less than 1 cm)/Area (greater than 400 cm2)

**10 marks in total.**

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