## **CAMBRIDGE INTERNATIONAL EXAMINATIONS**

GCE Advanced Subsidiary Level and GCE Advanced Level

## MARK SCHEME for the October/November 2013 series

## 9702 PHYSICS

9702/31

Paper 3 (Advanced Practical Skills 1), maximum raw mark 40

This mark scheme is published as an aid to teachers and candidates, 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, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.



| Pag   | je z        | wark Scheme  | Syllabus          | Paper                 |
|-------|-------------|--|-------------------|-----------------------|
|       |             | GCE AS/A LEVEL – October/November 2013   | 9702              | 31                    |
| (a)   | (i) V       | Value for $d$ in the range 0.15 mm ≤ $d$ ≤ 0.25 mm, with unit.   |                   | [1]                   |
| (c) ( | (ii) ∨      | Values of $V_1$ and $V_2$ , and $V_1 > V_2$ .  |                   | [1]                   |
|       |             | ets of readings of $l$ , $V_1$ and $V_2$ scores 5 marks, five sets sc r help from Supervisor –2. Minor help from Supervisor –1.  | ores 4 marks etc  | c. [5]                |
|       | Rang        | ge: $\Delta l \ge 30$ cm.  |                   | [1]                   |
|       | Each        | mn headings: column heading must contain a quantity and a unit where unit must conform to accepted scientific convention, e.g. $\it l$   | • • •             | [1]                   |
|       |             | sistency: alues of raw $\it l$ must be given to the nearest mm.  |                   | [1]                   |
|       | Signif      | ficant figures: ficant figures for every row of $V_1/V_2$ must be the same a per of significant figures used in $V_1$ and $V_2$ .  | s, or one more    | [1]<br>than the least |
|       |             | ulation: es of $V_1/V_2$ calculated correctly.   |                   | [1]                   |
| (e)   | S<br>S<br>b | Axes: Sensible scales must be used, no awkward scales (e.g. 3: Scales must be chosen so that the plotted points occupy both <i>x</i> and <i>y</i> directions. Scales must be labelled with the quantity that is being plotted.   | at least half the | [1]<br>graph grid in  |
|       | P<br>A<br>C | Scale markings should be no more than three large square Plotting of points: All observations in the table must be plotted. Diameter of plotted point must be ≤ half a small square (now Nork to an accuracy of half a small square.   | ·                 | [1]                   |
|       | Α           | Quality:<br>All points in the table must be plotted on the grid for this m<br>All points must be within 0.05 (to scale) on the <i>y</i> -axis $V_1/V_2$  |                   |                       |
| (     | `´J<br>T    | Line of best fit:  Judge by balance of all points on the grid about the candid  There must be an even distribution of points either side of a  Allow one anomalous point only if clearly indicated by the control and the standard by the control and the stan | he line along the |                       |

Mark Scheme

**Syllabus** 

**Paper** 

Page 2

1

Line must not be kinked or thicker than half a small square.

|   | Page 3  |  | Mark Scheme   |                  | Paper                  |
|---|---|--|---|------------------|------------------------|
|   |   |  | GCE AS/A LEVEL – October/November 2013  | 9702             | 31                     |
|   | (iii) Gradient:<br>The hypotenuse of the triangle must be at least half the length of the drawn line.<br>Both read-offs must be accurate to half a small square in both the x and y directions.<br>The method of calculation must be correct. |  |   |                  |                        |
|   |   | y-intercept:<br>Either:<br>Check correct read off from a point on the line and substituted into $y = mx + Read$ -off must be accurate to half a small square in both $x$ and $y$ directions. |   |                  |                        |
|   |   | Or:  | ck read-off of the intercept directly from the graph.   | ,                |                        |
|   | (f) (i)   | Value  | e of $P$ = candidate's gradient. Value of $Q$ = candidate's   | intercept.       | [1]                    |
|   | (ii)  | Value  | e of $ ho$ in range 1.0 – 20.0 × 10 <sup>-7</sup> $\Omega$ m  |                  | [1]                    |
|   |   |  |   |                  | [Total: 20]            |
| 2 | <b>(b)</b> Val  | lue of <i>i</i>  | m to the nearest 1g or better with consistent unit.   |                  | [1]                    |
|   | (c) (ii)  |  | surement of raw $\theta$ to nearest degree with unit. ence of repeat readings for $\theta$ .                          |                  | [1]<br>[1]             |
|   | (iii)   |  | entage uncertainty in $	heta$ based on absolute uncertainty ded this is not zero), and correct method of calculation. | of 2 to 5° (or   | half the range<br>[1]  |
|   | (iv)  | Corre  | ect calculation of tan ( $\theta$ /2).  |                  | [1]                    |
|   | (d) (i)   | Seco   | and value of <i>m</i> > first value of <i>m</i> .   |                  | [1]                    |
|   | (ii)  |  | and value of $\theta$ . ity: second value of $\theta$ .   |                  | [1]<br>[1]             |
|   | (e) Val   | lue of   | heta.   |                  | [1]                    |
|   | (f) (i)   | Two  | values of <i>k</i> calculated correctly.  |                  | [1]                    |
|   | (ii)  | Justif   | fication of s.f. in $k$ linked to significant figures in $m$ and $\epsilon$   | 9.               | [1]                    |
|   | (iii)   |  | sible comment relating to the calculated values of <i>k</i> ified by the candidate.                                   | r, testing agair | nst a criterion<br>[1] |

| Page 4 Mark Scheme |  | Syllabus | Paper |
|--------------------|--|----------|-------|
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| (g) | (i) Limitations (4 max)   | (ii) Improvements (4 max)   | Do not credit   |
|-----|---|---|---|
| A   | Two readings not enough (to draw a conclusion                                       | Take more readings <u>and</u> plot a graph / take more readings and calculate more <i>k</i> values and compare  | repeat readings / 'few readings' / 'take more readings and calculate average' / 'only one reading' / 'repeat readings' on its own |
| В   | Difficult to measure $\theta$ because hook of mass (hanger) in the way / thick band | Tie thread to centre of bottom of rubber band and hang mass from it   |   |
| С   | Difficult to hold the protractor steady / parallax error reading angle / protractor | Improved method to measure $\theta$ e.g. project image of stretched rubber band onto a screen / mark on board / measure lengths and calculate $\theta$ clamp protractor / take picture or video and measure angle |   |
| D   | Rubber band stretches over time   | Take readings quickly / remove mass from rubber band between readings   |   |
| E   | Stands moved / rods twist when loads attached to rubber band                        | Method of preventing movement of stands / clamp stands to bench / use nails in board  |   |
| F   | Difficult to locate centre of band  | Method of locating <u>and mark</u> centre e.g. measure and mark centre  |   |
| G   | Change in $	heta$ small   | Larger range of masses  |   |

[Total: 20]