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 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.
1 (a) (i) and (ii) \( l_o \) and \( l_1 \) clearly in cm/mm and \( l_1 > l_o \) 

(iii) Correct value for \( e_1 \) from 1(a)(i) & 1(a)(ii) 

(iv) Correct calculation for \( k \) (allow ecf) 
    Unit g/cm or g/mm consistent with \( e_1 \) 

(b) (i) Appropriate method (can be written and/or in diagram) 
    e.g. measure half width of mass either side of 40 cm/mark centre of mass 

(ii), (iii) and (iv) \( l_2 > l_3 \) and \( e_2 \) calculated 

(v) \( M \) within range (180 – 220 g) (no ecf) 
    2 or 3 significant figures 

(c) Any two from: 
    rule bends 
    mass not exactly at 40 cm 
    mass may slip 
    end of rule may slip 
    hook not directly above 0 cm 
    spring extension not uniform/owtte 
    proportional limit exceeded 
    mass irregular/C of G not at centre/owtte 
    any other valid cause of inaccuracy 

[Total: 10]

2 (a) Units all correct (symbols or words) 
    \( t \) values inserted (0, 60,120,180, 240) 
    \( \theta \) for white card increasing 
    \( \theta \) for black card increasing at greater rate than \( \theta \) for white card 

(b) (i) Both temperature changes correct 

(ii) Statement matching temperature changes (expect ‘black’) 
    with supporting comparative comment 

(iii) Statement matching results (expect ‘Yes’ but allow ecf) 
    Figures from table supporting correct statement 
    and time interval mentioned
(c) Any one from:
- same (type of) lamp/same brightness
- same distance/same height
- same (type of) thermometer
- same area of card
- same thickness of card
- good contact between card and thermometer (owtte)
- same start temperature/allow thermometer to cool
- allow lamp to cool

Appropriate matching explanation:
- power output may not be the same (owtte)
- different intensity of radiation (owtte)
- respond differently/different heat capacity
- different surface area to absorb radiant heat (owtte)
- different rate of conduction (owtte)
- rate of rise different at different temperatures
- heating starts at different times

[Total: 10]

3 (a) Correct symbol for voltmeter
   Connected in parallel with lamp
   [1]

(b) and (c) Units all correct (symbols or words)
   All p.d.s < 7.0 V and to at least 1 d.p.
   currents all < 1.00 A and to at least 2 d.p.
   R calculations correct
   Consistent 2 or 3 significant figures in R column
   [1]

(d) Statement matches results (expect ‘No’)
   R figures quoted appropriately and matching statement
   Mention of brightness related to temperature
   [1]

[Total: 10]
<table>
<thead>
<tr>
<th></th>
<th>Mark Scheme</th>
<th>Syllabus</th>
<th>Paper</th>
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<tbody>
<tr>
<td>4</td>
<td>(a) and (b) Values of ( v ) in metres</td>
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<tr>
<td></td>
<td>To 3 significant figures</td>
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<td>Correct values for 1 (consistent with ( v ) values in table)</td>
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<td>(c) Axes labelled (including units) and appropriate scales</td>
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<td></td>
<td>Plots correct</td>
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<td>Well judged straight line</td>
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<td>Thin line and fine plots</td>
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<td>(d) (i) and (ii) ( p ) and ( q ) values recorded and matching graph</td>
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<td>(e) (i) and (ii) ( f ) within range 13.0 to 17.0 (or equivalent m/mm)</td>
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<td>2 or 3 significant figures and appropriate unit</td>
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