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**PHYSICS**

**5054/31**

Paper 3 Practical Test

**May/June 2016**

MARK SCHEME

Maximum Mark: 30

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**Published**

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.

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- 1 (a) Mark to the left of 0.0 cm and to the right of 30.0 cm M0
- Both spaces sensible and determined to the nearest mm with unit seen somewhere. M1
- $2 \text{ mm} \leq d_{12} \leq 8 \text{ mm}$  (if OOR use SV  $\pm 2 \text{ mm}$ )
- $L$  found correctly with unit seen somewhere A1
- The unit must appear at least once in (a)
- (b)  $S_1$  in the range  $14.0 \text{ cm} \leq S_1 \leq 15.0 \text{ cm}$  to nearest mm with unit B1
- $S_2$  in the range  $27.5 \text{ cm} \leq S_2 \leq 29.5 \text{ cm}$  to nearest mm with unit and  $x$  and  $y$  determined correctly B1
- The unit must appear at least once in (b)*
- Penalise nearest mm mark only once in (b)*
- (c)  $M$  calculated correctly and in the region of 20 g B1  
(if OOR use in the region of SV)
- 2 (a)  $d_1$  in the range  $86.0 \text{ cm} \leq d_1 \leq 89.0 \text{ cm}$  to the nearest mm with unit B1
- (b) Sensible  $t_1$  with unit seen somewhere B1
- At least two values of  $t_1$  or two values of  $t_1$  within  $\pm 0.5 \text{ s}$  of each other with correct average. B1
- $T_1$  calculated correctly to 2/3 s.f. with unit seen somewhere and in the range 1.5 s to 2.0 s B1
- (c)  $t_2$  recorded M0
- $T_2$  calculated and  $T_2 < T_1$  B1
- The unit must appear at least once in (b) and (c)

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- 3 (a) sensible raw readings of  $h$  with at least one repeated measurement to the nearest mm with unit B1
- (c) Vertically above the line the pin and the line are in line M0  
 Head above A (left of line) the pin is to the right of the line A1  
 Head above B (right of line) the pin is to the left of the line A1
- (d) raw readings of  $d < h$ , found from at least 2 measurements to nearest mm with unit B1
- (e) Correct calculation of ratio in the range 1.20 to 1.45 with no unit B1

4 **Preliminary results**

- (a)  $V_0$  in the range 3.5 V to 5.5 V, to 0.1 V or better with unit B1
- (b)  $V$  in the range 1.00 V to 1.80 V to 0.1 V or better with unit B1  
 (penalise precision error once only and penalise unit error once only) .  
 Correct calculation of  $I$  with unit. B1

**Table**

- (c) Unit headings for  $R$ ,  $V$  and  $I$  and results from (b) included B1
- Three single resistances showing correct trend in  $V$  B1  
 ( $V$  increases as  $R$  increases)
- Three series arrangements showing correct trend in  $V$  B1
- Correct calculation of parallel resistance ( $= 6.9\Omega$ ) and correct calculation of two more values of  $R$  B1  
 (Condone any value rounding to 6.9)
- Parallel arrangement to give overall correct trend in  $V$ . B1  
 (Resistance values, 6.9, 10, 22, 32, 39, 49, 61 and 71)

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### Graph

- (d) Axes labelled with units and correct orientation B1  
 (Allow e.c.f. from wrong unit in table but not no units)
- Suitable scale, not based on 3, 6, 7 etc. with plotted data occupying  $\geq$  half the page in both directions (including the origin) B1
- Two points plotted correctly – check the two points furthest from the line. This mark can only be scored if the scale is easy to follow B1  
 (Points must be within  $\frac{1}{2}$  small square of the correct position)
- Best fit fine line and fine points or crosses B1  
 (Line thickness to be no greater than the thickest lines on the grid)

### Calculations

- (e) (i) Correct reading of sides of triangle M1
- Triangle uses more than half the drawn line and answer in the range 17.5 ( $\Omega$ ) to 26.5 ( $\Omega$ ) *ignore –ve sign* A1
- (ii)  $V$  in the range  $0.80 V_0$  to  $1.20 V_0$ . B1