<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>3(a)</td><td>Record initial and final positions (of centre) of beam and subtract to give d (1)

Any TWO from:
Use a set square to ensure 15 cm ruler is vertical (1)

Clamp 15 cm ruler in position (vertically) (1)

Read perpendicular to the scale
Or
Ensure the ruler is close to the beam (1)</td><td>3</td></tr>
<tr><td>3(b)(i)</td><td>Values of log L correct to 3 d.p. [Accept 2 d.p.] (1)
Values of log d correct to 3 d.p. [Accept 2 d.p.] (1)
Axes labelled: y as log (d / m) and x as log (L / m) (1)
Appropriate scales chosen (1)
log values plotted accurately (1)
Best fit line drawn (1)

<table><tr><th>L / m</th><th>d / m</th><th>log (L / m)</th><th>log (d / m)</th></tr><tr><td>0.950</td><td>0.0160</td><td>–0.022</td><td>–1.796</td></tr><tr><td>0.850</td><td>0.0115</td><td>–0.071</td><td>–1.939</td></tr><tr><td>0.750</td><td>0.0080</td><td>–0.125</td><td>–2.097</td></tr><tr><td>0.650</td><td>0.0052</td><td>–0.187</td><td>–2.284</td></tr><tr><td>0.550</td><td>0.0032</td><td>–0.260</td><td>–2.495</td></tr><tr><td>0.450</td><td>0.0018</td><td>–0.347</td><td>–2.745</td></tr></table></td><td>6</td></tr>
</table>

3(b)(ii)	Uses large triangle to calculate gradient **(1)** Value of gradient in range 2.75 to 2.95 **(1)** Value of calculated gradient given to 2 or 3 s.f., positive, no unit **(1)** <u>Example of calculation</u> gradient $= \frac{-1.88- -2.60}{-0.050- -0.295} = \frac{0.72}{0.245} = 2.94$	**3**
3(b)(iii)	Correct value of log k from y intercept **Or** Correct value of log k from calculation using gradient and points from graph e.c.f. 3(b)(ii) **(1)** Conversion of log k to k **(1)** Values of r and k shown in mathematical relationship **(1)** <u>Example of calculation</u> $\log k = \log d - r \log L = -2.60 - (2.94 \times -0.295) = -1.73$ $k = 10^{-1.73} = 0.0186$ $d = 0.0186\ L^{2.95}$	**3**
	Total for question 3	**15**