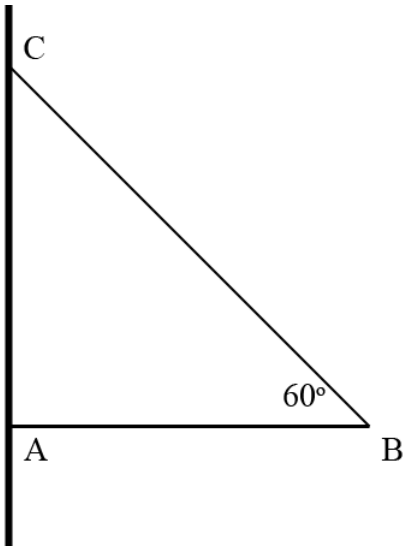
Question #74184, Physics / Mechanics | Relativity

The end A of a uniform rod AB of weight W is hinged a fixed point. The rod is held in equilibrium in a horizontal position by means of a string attached to B and to a point C vertically above A. The string is inclined at 60 degrees to the rod. Find the tension in the string and the reaction of the hinge.

Solution



$\sum M_A = 0;$

$T\sin 60° \times \left(AB\right) - W \times \frac{AB}{2} = 0;$

$T = \frac{W}{2\sin 60°}$

$\sum F_x = 0;$

$R_{Ax} - T\cos 60° = 0;$

$R_{Ax} = T\cos 60° = \frac{W\cos 60°}{2\sin 60°} = \frac{W}{2\tan 60°}$

$\sum F_y = 0;$

$R_{Ay} + T\sin 60° - W = 0;$

$$R_{Ay} = W - T\sin 60° = W - \frac{W\sin 60°}{2} = \frac{W}{2};$$

$$R_A = \sqrt{R_{Ax}^2 + R_{Ay}^2} = \sqrt{\frac{W^2}{4\tan^2 60°} + \frac{W^2}{4}} = \sqrt{\frac{W^2\cot^2 60°}{4} + \frac{W^2}{4}} = \frac{W}{2\sin 60°}$$

Answer: $T = \frac{W}{2\sin 60°}$; $R_A = \frac{W}{2\sin 60°}$