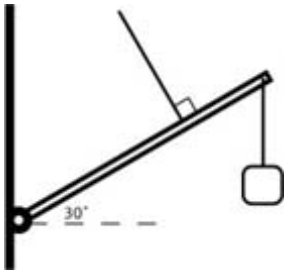
Answer on Question #75862-Physics-Mechanics-Relativity

In the figure above, a 34 kg boom of length 5 m is supported by a cable that has a breaking tension of 1200 N. The cable is perpendicular to the boom and is attached 3.75 m from the pivot.

Find: a) the maximum load that can be suspended from the end of the boom;

b) The magnitude of the horizontal force exerted by the pivot at maximum load?

c) The magnitude of the vertical force exerted by the pivot at maximum load?



Solution

a) Sum up all the perpendicular components of torques using the actual pivot point as pivot point.

$$\left(\frac{5}{2}\right)(34 \cdot 9.8)\, cos(30) - 3.75 \cdot 1200 + 5F\, cos(30) = 0$$

$$F = 873\ N$$

b) Sum up all the perpendicular components of torques using the end point of the boom as pivot point.

$$(5 - 3.75)\ 1200 - \left(\frac{5}{2}\right)(34 \cdot 9.8)\, cos(30) - 5R_y = 0$$

$$R_y = 155.7\ N$$

Sum up all the parallel components of the forces.

$$873\, sin(30) + (34 \cdot 9.8)\, sin(30) - R_x = 0$$

$$R_x = 603.1\ N.$$

Find the magnitude of the reaction force by the wall.

$$R = \sqrt{155.7^2 + 603.1^2} = 623\ N$$

Find the angle of the reaction force by the wall.

$$\theta = 30° - arctan\left(\frac{155.7}{603.1}\right) = 15.5°$$

Find the vertical component of the reaction force by the wall.

$$R_v = 623\, sin(15.5°) = 166\ N.$$

c) Find the horizontal component of the reaction force by the wall.

$$R_h = 623\, cos(15.5°) = 600\, N.$$