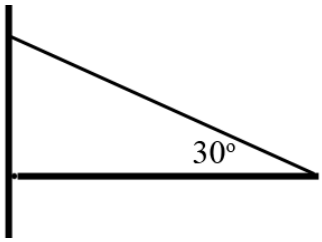
Question #72843, Physics / Mechanics | Relativity

A horizontal rod with a mass of 10 kg and length 12 m is hinged to a wall at one end and supported by a cable, which makes an angle of 30º with the rod at its other end. Calculate the tension in the cable and the force exerted by the hinge.

Solution



The net moment around the hinge is zero.

$$\sum M = 0;$$

$$-10 \times \frac{12}{2} \times g + T \sin 30° \times 10 = 0;$$

$$T = \frac{60g}{10 \times \sin 30°} = 12g = 117.72 \text{ N}$$

$$\sum F_x = 0;$$

$$R_x = T \cos 60°;$$

$$R_x = 117.72 \times \cos 60° = 58.86 \text{ N}$$

$$\sum F_y = 0;$$

$$R_y + T \sin 30° = mg;$$

$$R_y = mg - T \sin 30°;$$

$$R_y = 12 \times 9.81 - 117.72 \times \sin 30° = 58.86 \text{ N}$$

$$R = \sqrt{R_x^2 + R_y^2} = \sqrt{2 \times 58.86^2} = 83.24 \text{ N}$$

Answer: tension 117.72 N, the force exerted by the hinge 83.24 N.