

Answer on Question #41986 – Physics – Other

Question: a rope requires 225 N of force in order to break. A 2.50 kg mass is tied to the rope and whirled in a vertical circle with a radius of 2.15 m. What is the maximum speed that mass can be whirled without snapping the rope?

Solution: on the mass that is tied to the rope and whirled acts the centrifugal force

$$F = \frac{mv^2}{r},$$

here r is the radius of the circle. From the other side on the mass acts the tension force that is equal to the centrifugal force. The rope will break, when the value of centrifugal force will be equal the value of maximal tension

$$T = \frac{mv_{max}^2}{r}$$

From last equation we find the value of the maximum speed:

$$v_{max} = \sqrt{T \cdot \frac{r}{m}} = \sqrt{225 \cdot \frac{2.5}{2.15}} = 16,18 \text{ N.}$$

Answer:

$$v_{max} = \sqrt{T \cdot \frac{r}{m}} = 16,18 \text{ N.}$$