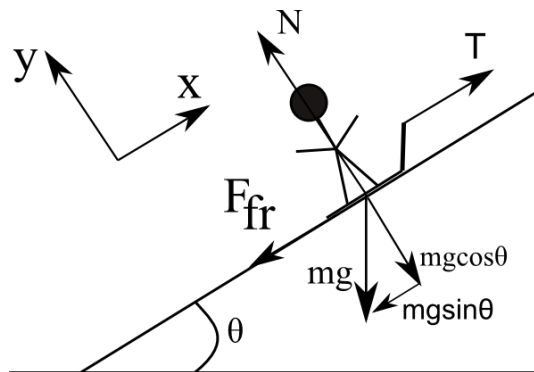


Answer on Question 78111, Physics, Mechanics, Relativity

Question:

A rope is used to pull a skier up a 10-degree slope. If the coefficient of kinetic friction is 0.18 and the mass of the skier is 80 kg what is the tension of the rope if the skier is accelerating at 0.5 m/s^2 ?

Solution:



Let's apply the Newton's Second Law of Motion in projections on axis x and y :

$$\sum F_x = ma_x,$$

$$T - mg\sin\theta - F_{fr} = ma,$$

$$\sum F_y = ma_y = 0,$$

$$N - mg\cos\theta = 0,$$

$$N = mg\cos\theta.$$

Since, $F_{fr} = \mu_k N$, we can write:

$$T - mg\sin\theta - \mu_k mg\cos\theta = ma.$$

From this equation we can find the tension in the rope:

$$\begin{aligned} T &= mg\sin\theta + \mu_k mg\cos\theta + ma = \\ &= 80 \text{ kg} \cdot 9.8 \frac{\text{m}}{\text{s}^2} \cdot \sin 10^\circ + 0.18 \cdot 80 \text{ kg} \cdot 9.8 \frac{\text{m}}{\text{s}^2} \cdot \cos 10^\circ + 80 \text{ kg} \\ &\quad \cdot 0.5 \frac{\text{m}}{\text{s}^2} = 315 \text{ N}. \end{aligned}$$

Answer:

$$T = 315 \text{ N}.$$