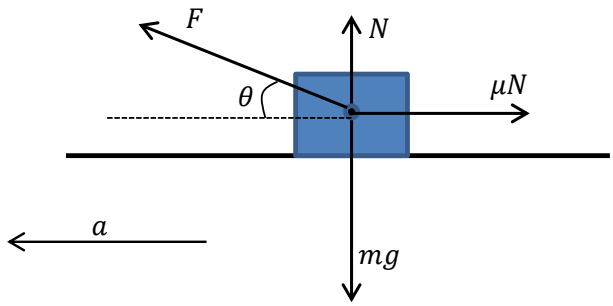
Problem:

A student attaches a rope to a 20.0 kg box of books. He pulls with a force of 90.0 N at anangle of 30.0° with the horizontal and walks to the left. The coefficient of kinetic friction between the box and the sidewalk is 0.500. Find the acceleration of the box.

Solution:



According to the figure above and second Newton's law:

$$\begin{cases} N + Fsin\theta = mg \\ Fcos\theta - \mu N = ma \end{cases}$$

Where $\theta = 30\ degrees$;

N – normal force;

mg – gravitational force;

$\mu = 0.5$ – friction coefficient;

a – acceleration;

F=90 N – pull force;

Thus,

$$a = \frac{F}{m}(cos\theta + \mu sin\theta) - \mu g = 0.12\ \frac{m}{s^2}$$

Answer: $a = 0.12\ \frac{m}{s^2}$.

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