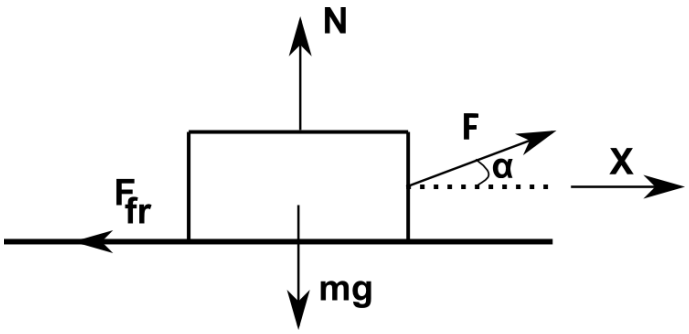
Answer on Question 57046, Physics, Mechanics, Relativity

Question:

There is an unknown container on a horizontal surface that you need to move. The coefficient of friction for the floor is 0.54 and the box weighs $250kg$. If you apply a force of $350N$ at an angle of 50 degrees the box will accelerate at a rate what rate?

Solution:

Let's draw a free-body diagram and write all forces that act on a container:



$$m\vec{g} + \vec{N} + \overrightarrow{F_{fr}} + \vec{F} = m\vec{a}$$

Then projected the forces on axis x we get ($F_x = Fcos\alpha$):

$$Fcos\alpha - F_{fr} = ma, (1)$$

And projected the forces on axis y we get ($F_y = Fsin\alpha$):

$$N + Fsin\alpha - mg = 0,$$

$$N = mg - Fsin\alpha.$$

Then we can find the friction force:

$$F_{fr} = \mu N = \mu(mg - Fsin\alpha)$$

Substituting F_{fr} into the equation (1) we can find the acceleration of the container:

$$Fcos\alpha - \mu(mg - Fsin\alpha) = ma,$$

$$a = \frac{Fcos\alpha - \mu(mg - Fsin\alpha)}{m}. (2)$$

Unfortunately, under such conditions of the question, an unknown container will not move, because the applied force less then the friction force needed to move object:

$$F_x = Fcos\alpha = 350N \cdot cos50^\circ = 225N.$$

$$F_{fr} = \mu N = \mu(mg - Fsin\alpha) = 0.54 \cdot \left(250kg \cdot 9.8\frac{m}{s^2} - 350N \cdot sin50^\circ\right) = 1178N.$$

$$F_x < F_{fr}.$$

So, maybe you mistake when enter the data for this question. If you substitute the correct data into the equation (2) , you find the acceleration of an unknown container.

Answer:

$$a = \frac{Fcos\alpha - \mu(mg - Fsin\alpha)}{m}.$$