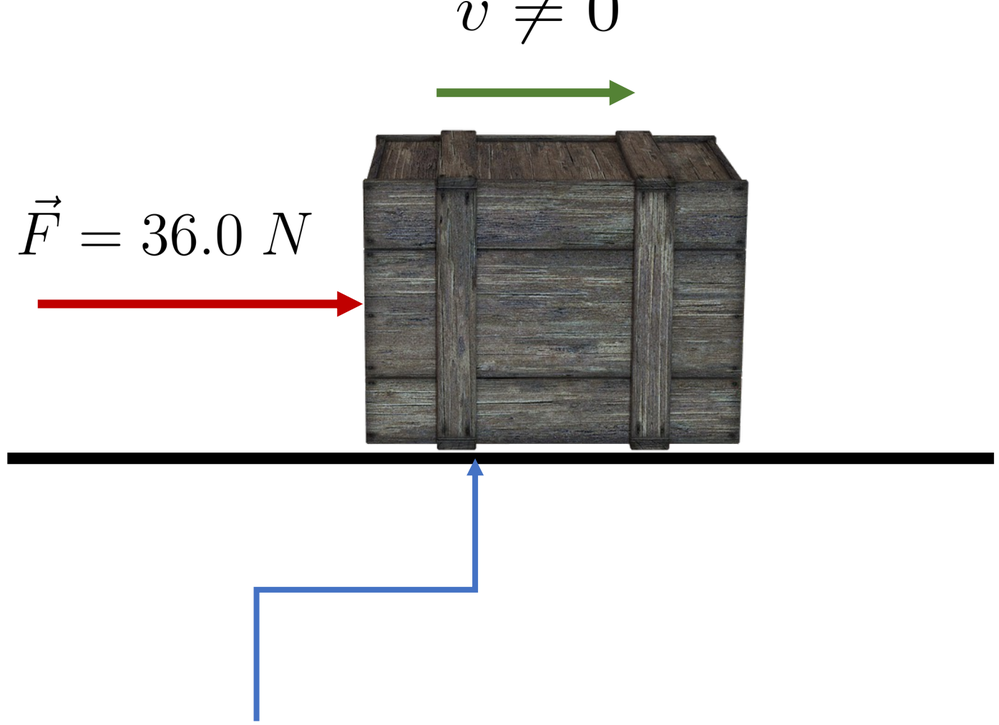
Raul Barrea
@PhysicsSensei

Object Moving on a Floor with friction

A wooden crate, mass 6.00 kg, is being pushed by a force of 36.0 N magnitude as shown below, on a floor with friction coefficient $\mu_k = 0.25$.
The force acts horizontally as indicated, and the crate is already moving.
Find the crate's acceleration.

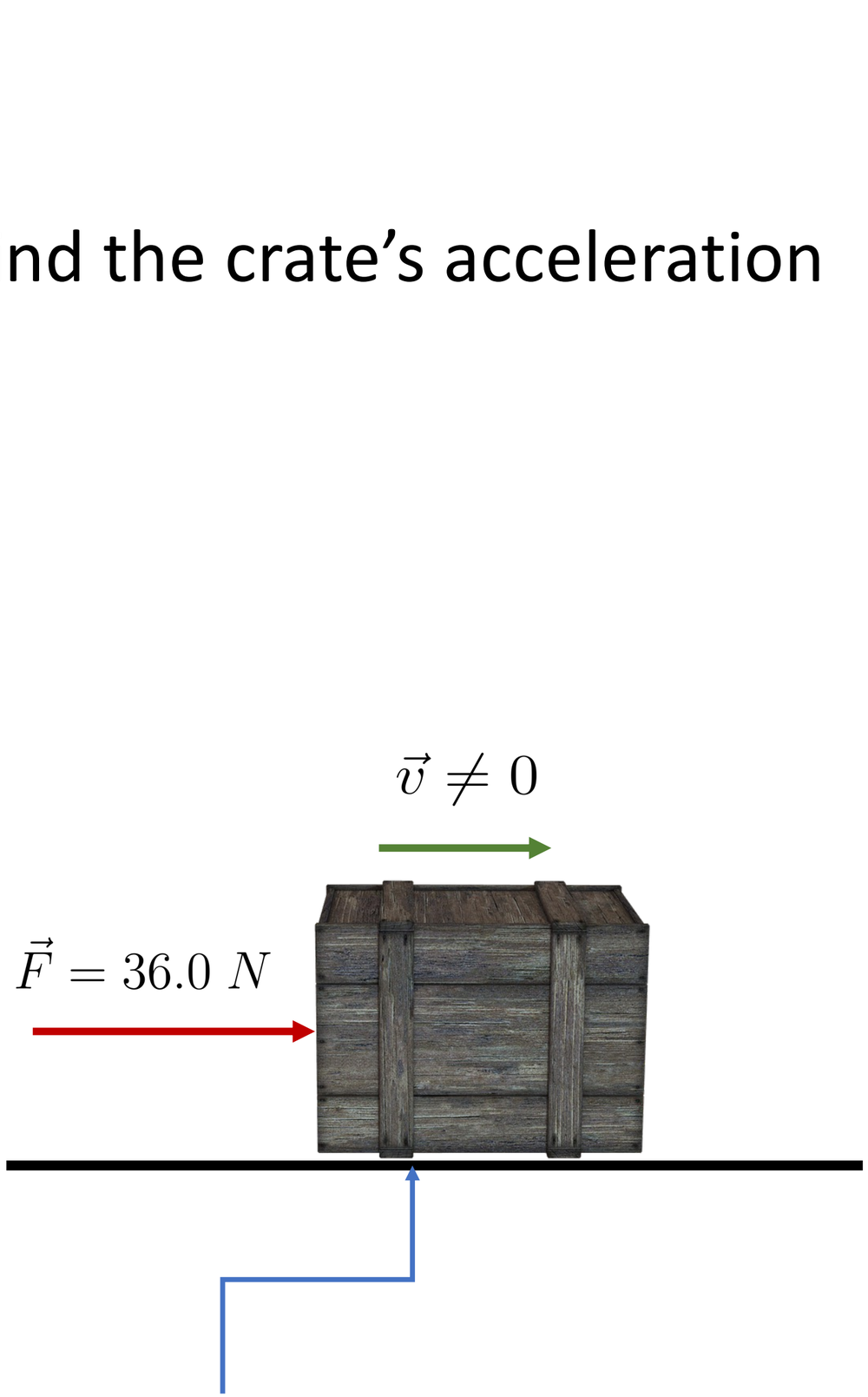


Raul Barrea
@PhysicsSensei

Find the crate's acceleration

$$m_{crate} = 6.00\ kg$$

$$\vec{F} = 36.0\ N$$



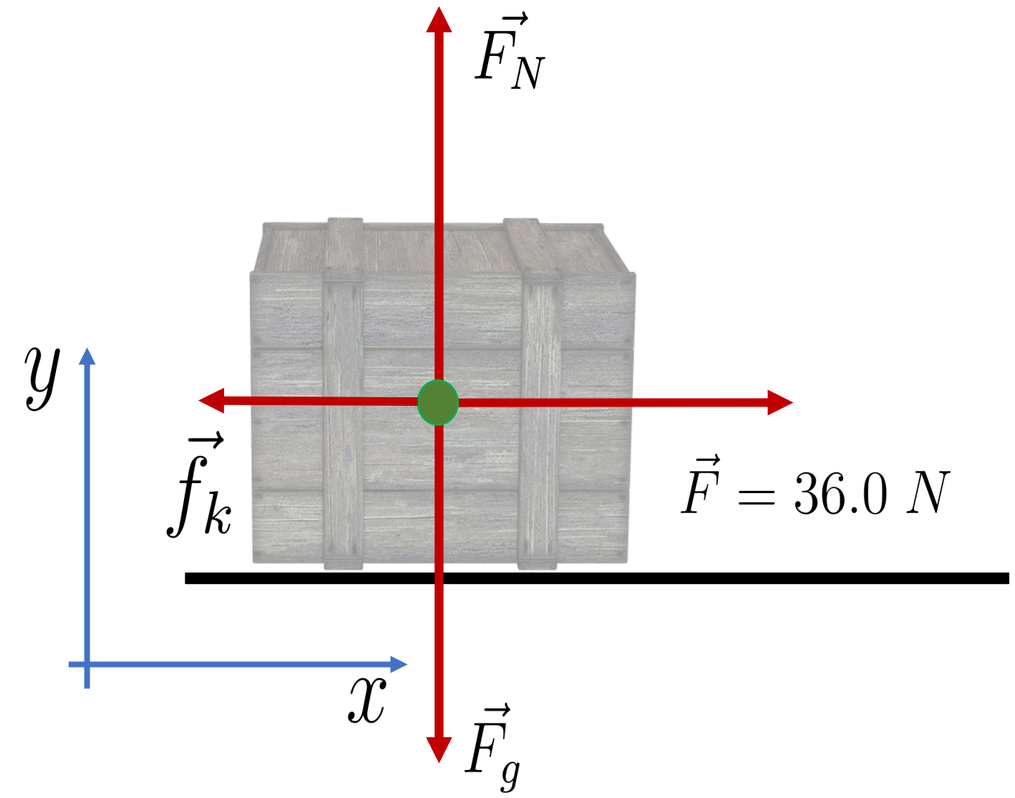
$$\mu_k = 0.25$$

Raul Barrea
@PhysicsSensei

Free Body Diagram (FBD)

$$m_{crate} = 6.00\ kg$$

$$\vec{F} = 36.0\ N$$

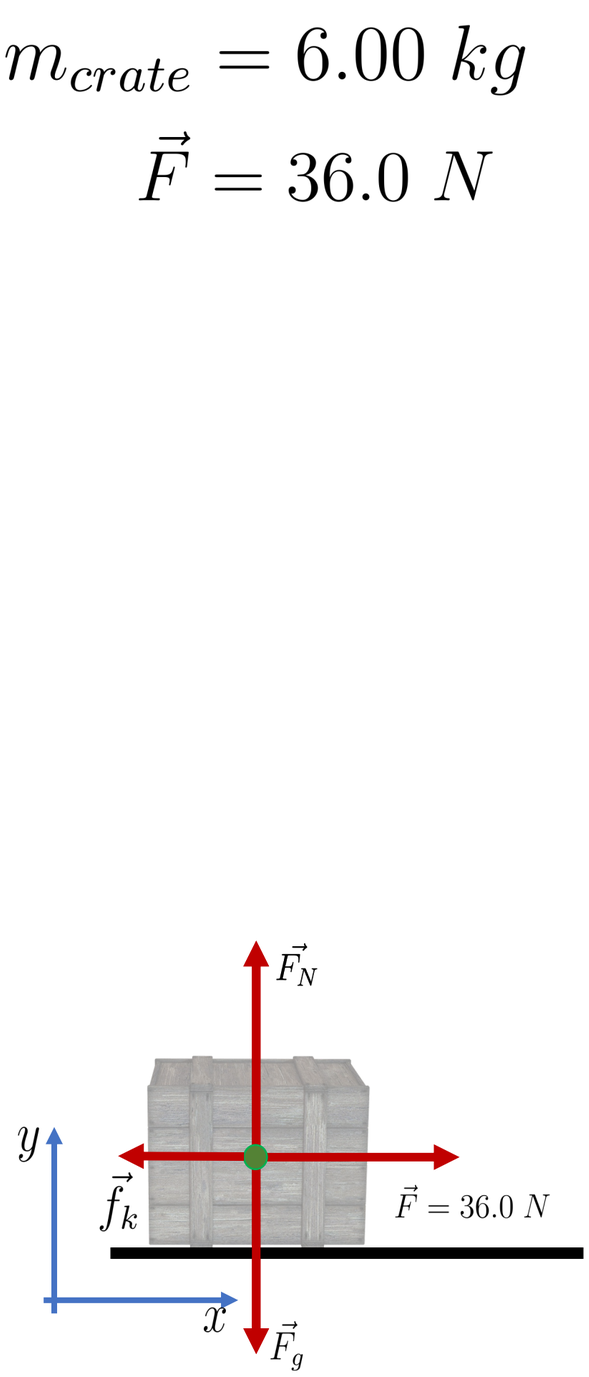


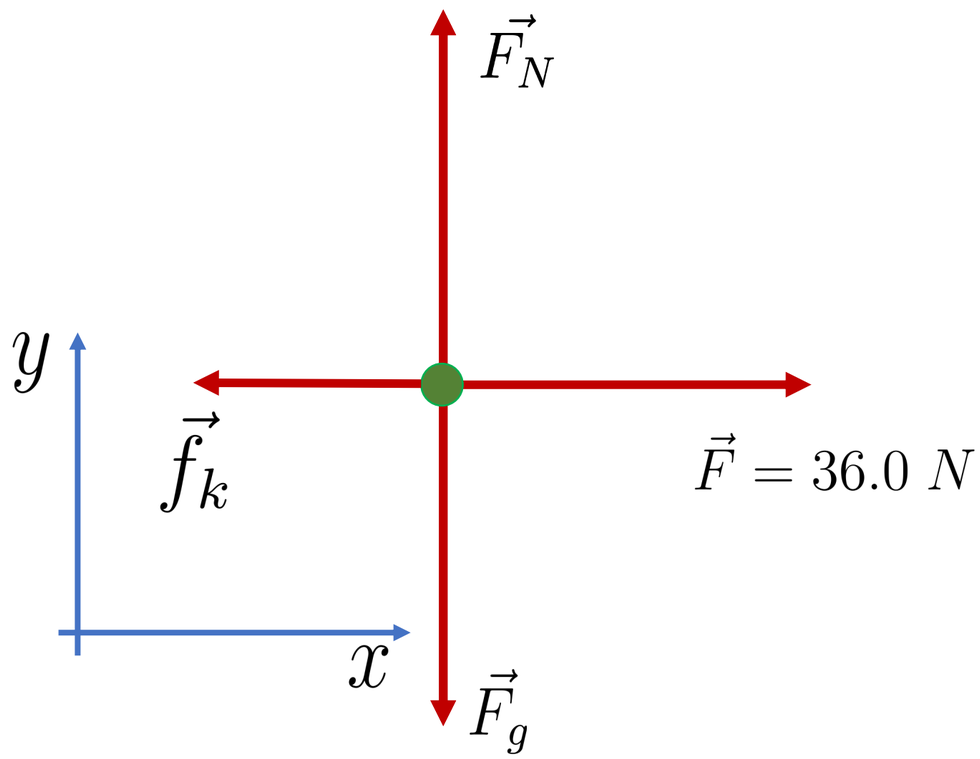
Raul Barrea
@PhysicsSensei

Free Body Diagram (FBD)

$$m_{crate} = 6.00\ kg$$

$$\vec{F} = 36.0\ N$$





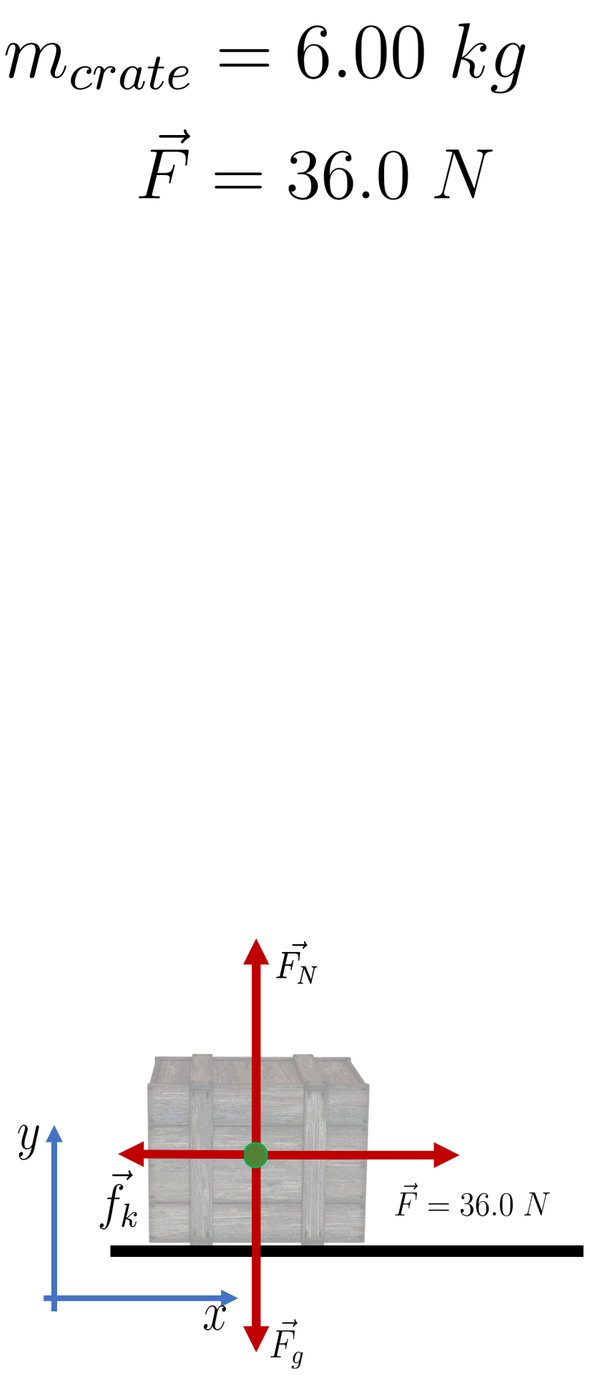
Raul Barrea
@PhysicsSensei

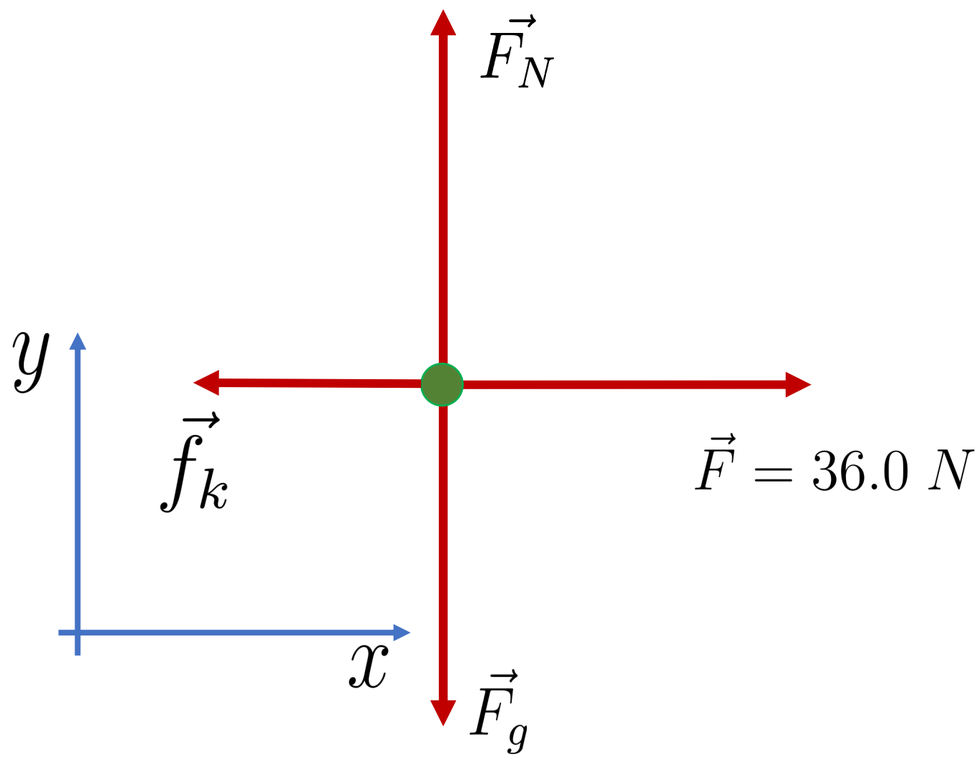
Newton's 2nd law

$$\sum \vec{F} = m\ \vec{a}$$

$$m_{crate} = 6.00\ kg$$

$$\vec{F} = 36.0\ N$$

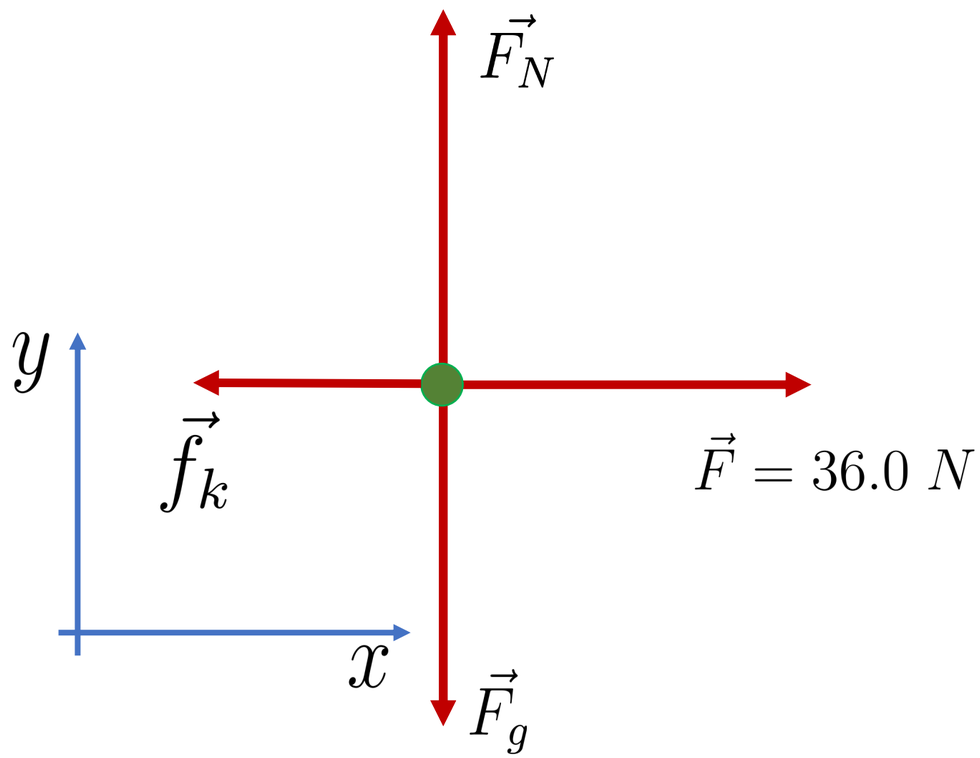


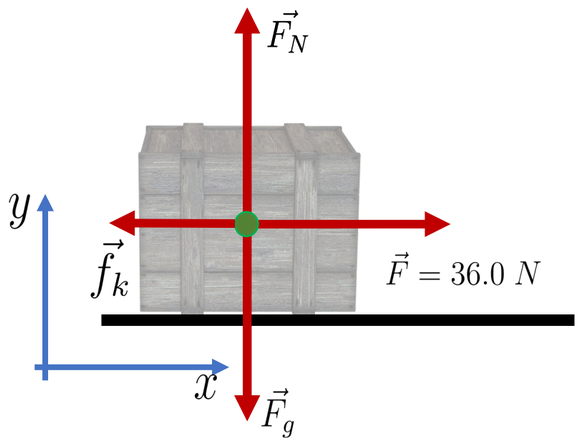


Raul Barrea
@PhysicsSensei

Newton's 2nd Law
Y axis

$$\sum F_y = 0$$





Raul Barrea
@PhysicsSensei

Solve for Normal Force

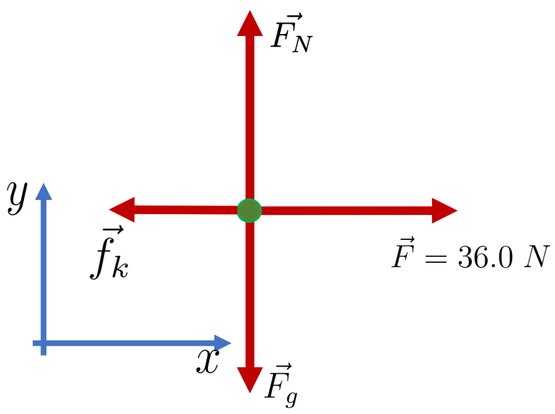
$$\sum F_y = 0$$

$$F_N - F_g = 0$$

$$F_N = F_g$$

$$F_N = (6.00)\ kg * 9.81 \frac{m}{s^2}$$

$$\boxed{F_N = 58.9\ N}$$



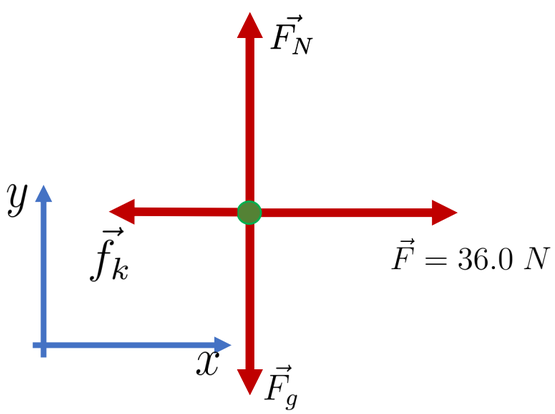
Raul Barrea
@PhysicsSensei

Find the kinetic friction force

$$f_k = \mu_k \, F_N$$

$$f_k = (0.25) \cdot (58.9 \; N)$$

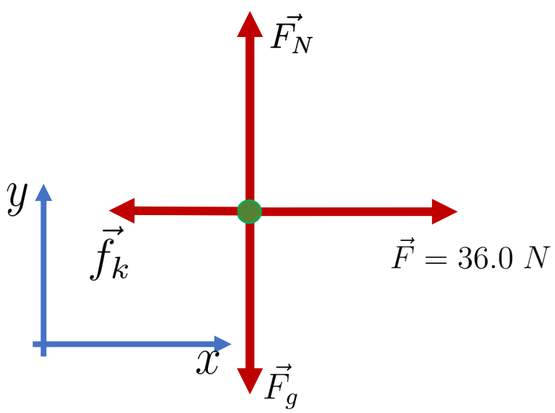
$$\boxed{f_k = 14.7 \; N}$$



Raul Barrea
@PhysicsSensei

Newton's 2nd Law
X axis

$$\sum F_x = m\ a_x$$



Raul Barrea
@PhysicsSensei

Physics 先生 Sensei

Newton's 2nd Law

X axis

$$\sum F_x = m\ a_x$$

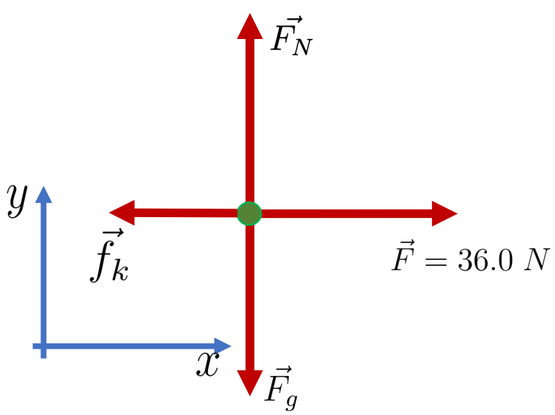
Solve for acceleration

$$F - f_k = m \cdot a$$

$$36.0\ N - 14.7\ N = (6.00\ kg) \cdot a_x$$

$$21.3\ N = 6.00\ kg \cdot a_x$$

$$a_x = 3.55\ \frac{m}{s^2}$$



Raul Barrea
@PhysicsSensei

If you liked this simple explanation, and you want to know how to get better grades in physics using less study time, you'll love my FREE eBook

Go to
www.PhysicsSensei.com/eBooks/howtoeBooks/
and grab your free copy today.