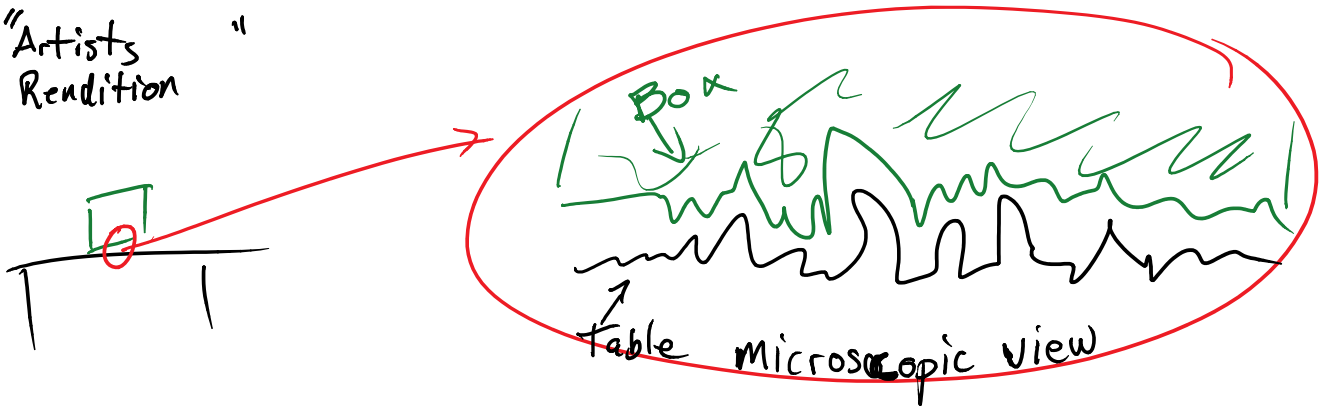
Friction

December-02-15 8:30 AM

Friction is a reaction force that resists movement. Its direction is always opposite of the direction of movement, or attempted movement.

Friction is caused by uneven surfaces bumping into each other.

"Artists Rendition"



Friction can be calculated with.

$$F_F = \mu F_N$$

Coefficient of Friction

F_N ← Normal Force

μ ← Coefficient of friction

μ is an experimentally determined value that is based on the quality of the surface.

↑ smooth vs rough.

Every surface has 2 coefficients of friction

1) coefficient of 1) coefficient of

Every surface has 2 coefficients of ...

μ_s - coefficient of Static Friction

→ Not moving friction

→ higher than μ_k harder to move.

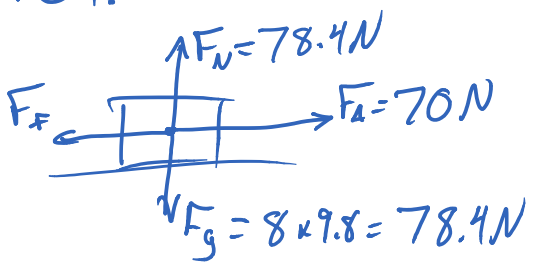
μ_k - coefficient of kinetic Friction

→ moving friction

→ lower than μ_s easier move

8kg Box on the ground It is being shoved to the right with a force of 70N. The coefficent kinetic of Friction is $\mu_k = 0.34$.

a) Draw a FBD.



b) Find the force of Friction.

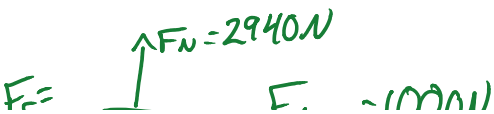
$$F_F = \mu_k F_N$$

$$F_F = (0.34)(78.4)$$

$$F_F = 26.7N$$

A 300kg bear is sitting on the ground. The ground has a $\mu_s = 0.42$. Stupid Steve pushes the bear with 1000N of force.

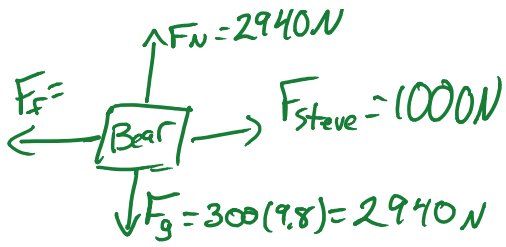
a) Does the bear move? Draw a FBD



$F_{F_s} = \mu_s F_N$

$F_{F_s} = (0.42)(2940)$

$F_{F_s} = 1234.8\,N$



No the bear does not move.

Maximum Force that can be applied before it moves

b) What is the Force of Friction actually applied in this situation?

Forces are balanced → 1000 N

On ice the coefficients of Friction are $\mu_s = 0.23$ and $\mu_k = 0.15$. A 500 g novelty puck is put on the ice.

500 g → 0.5 kg

a) What is maximum Force that can be applied before the puck moves?

$F_N = F_g$

$F_f = 0.23(9.8 \times 0.5)$

$F_{F_s} = 1.127\,N$

b) What is the Force required to keep it moving at a constant velocity? ← applied Force = Friction Force.

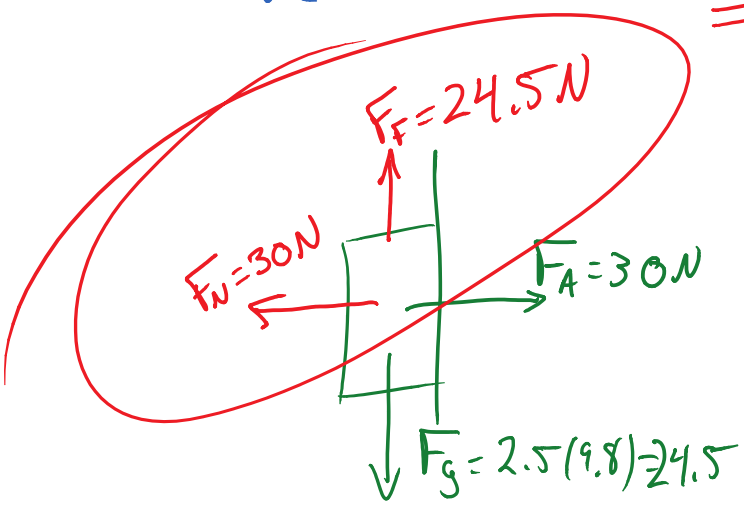
$F_{F_k} = 0.15(9.8 \times 0.5)$

$F_{F_k} = 0.735\,N$

$\mu_k = 0.\ldots\ldots$

A book is being pushed into a wall with a force 30 N. The book masses at 2.5 kg. what does the coeffient of static friction of the wall have to be to keep it in place?

Balanced Forces



$F_F = \mu F_N$

$\frac{24.5}{30} = \mu \frac{(30)}{30}$

$\mu = 0.82$

Wks Package p. 4-5