Friction

Note Title 9/27/2011

Friction is a contact force that resists motion.

F_f ⇒ Friction Force in Newtons

Always Parallel to Surface

$$F_f = \mu \cdot N$$

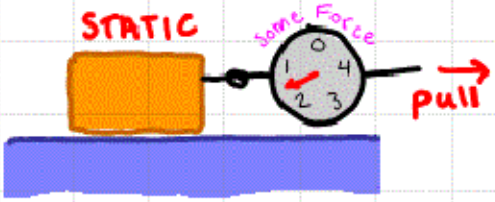
N ⇒ Normal Force in Newtons

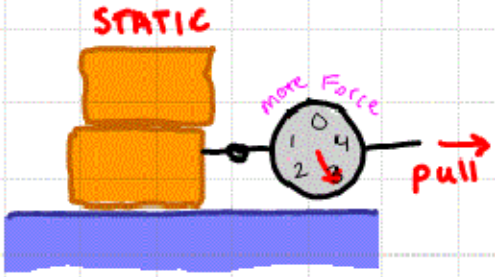
Always Perpindicular to surface

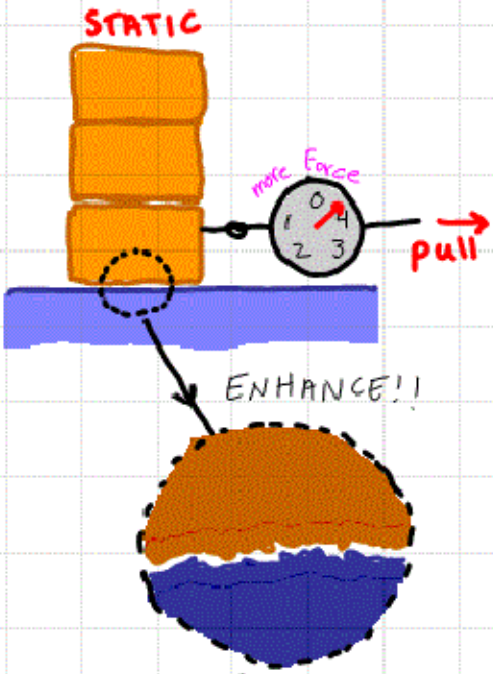
coefficient of friction
No units

According to our equation, the greater the normal force, the greater the Frictional Force.

↳ In other words, when two objects are pressed together more strongly, it will be harder to slide them against eachother.







μ or "mu" is a rating of how well two surfaces will slide together

Generally: slides well ↔ $0 < \mu < 4$ ↔ slides poorly

μ_s → static friction (not moving)

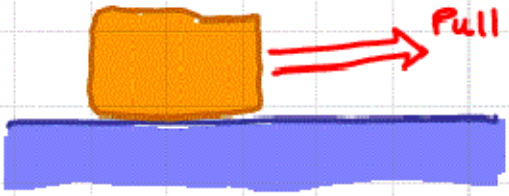
μ_K → Kinetic friction (moving)

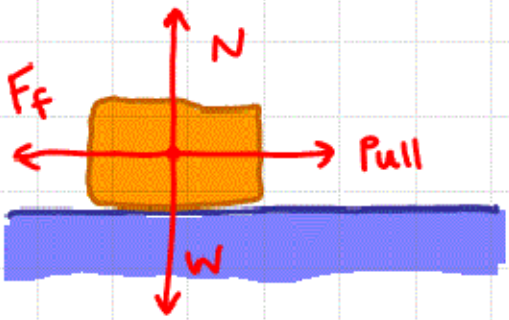
For any object $\mu_s > \mu_K$

by changing these to be smoother, less friction will result

LET'S CALCULATE! (HOORAY!)

a Force of 22 N pulls a 2 kg block at a constant speed. What is the frictional force? What is μ_K?





X: $F_f + Pull = F_{net} = 0$ ← constant speed means $a = 0$

$F_f - Pull = 0$

(with direction)

Y: $N + W = F_{net} = 0$

$N - W = 0$

(with direction)

$F_f - pull = 0$

$F_f = pull = 22N$

$F_f = pull$

$\mu N = pull$

$N - W = 0 \rightarrow N = W$ CAUTION! N is not always the same as W!

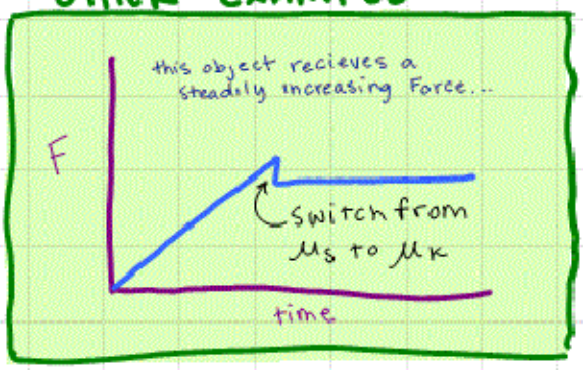
$\mu \cdot W = pull$

$\mu \cdot m \cdot g = 22$

$\mu = \frac{22}{2 \cdot 9.8}$

$\mu_K = 1.12$ (No units)

OTHER EXAMPLE



What is the frictional force on a 4kg object that has $\mu_S = .5$ with another surface?

$N - W = 0$

$N = W = m \cdot g$

$F_f = \mu N = .5 \cdot (m \cdot g)$

up to 19.6 N ← in other words, if pull = 5N F_f = 5N; if pull = 19.6N F_f = 19.6

Be careful with μ_S. It can never cause a net force, it is only able to resist force