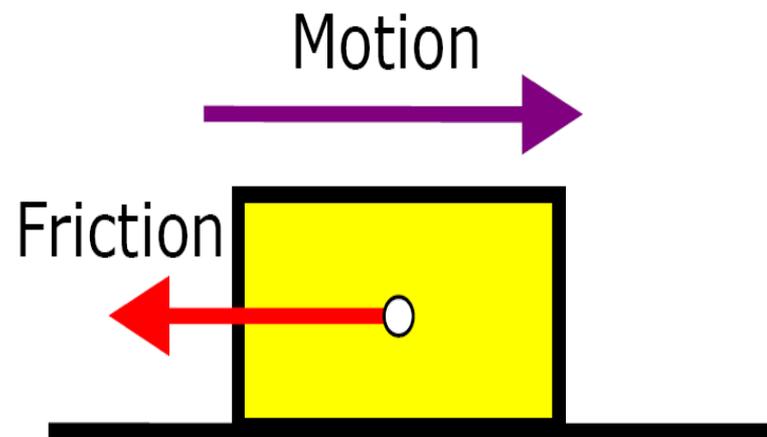


9.2 Friction



Friction

Coefficient of Friction

The magnitude of the frictional force is proportional to the magnitude of the normal force.

$$F_f = \mu \cdot F_N$$

μ = proportionality constant = coefficient of friction

μ is the Greek word for mu

Friction

Coefficient of Friction

The ratio of the force needed to overcome **friction to the normal force** pressing the surfaces together.

$$\mu = F_f / F_N$$

Friction

Angle of Uniform Slip

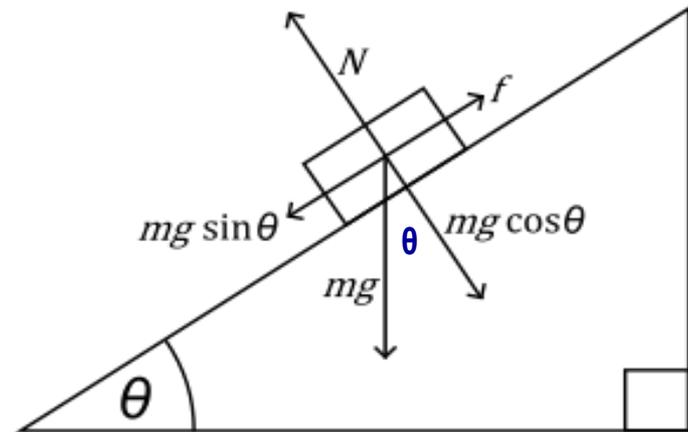
θ is the angle of incline which causes the block to slide at a **constant speed**; therefore $F_p = F_f$

We know:

- $\mu = F_f / F_N$
- $\tan \theta = F_p / F_N$
- $F_p = F_f$

Therefore by substitution:

$$\tan \theta = F_f / F_N = \mu$$



Friction

TYPICAL VALUES OF Coefficients of friction between two surfaces

(See page 81 in the book for more coefficients)

<u>Surfaces</u>	<u>Static</u>	<u>Kinetic</u>
Steel on Teflon	0.05	0.05
Wood on Wood	0.50	0.30
Smooth Tire, wet pavement	0.50	0.40
Smooth Tire, dry pavement	0.90	0.80
Grooved Tire, wet pavement	0.80	0.70

Friction

Example #1:

A box weighing 450 N is pulled along a level floor at constant speed by a rope that makes a 30° with the floor. If the force on the rope is 260 N, calculate:

- a. Horizontal component (F_p)
- b. The normal force (F_N)
- c. The coefficient of sliding friction (μ)

Friction

Example #2:

A block of wood of mass 5 kg rests on a flat table, and a horizontally applied force of 30 N is just enough to make it slide.

- a. What is the coefficient of static friction between the block and the table?

- b. If the applied force of 30 N is continued after the block starts to slide, and it accelerates at 2.5 m/s^2 , what is the coefficient of kinetic friction between the block and the table?

$$\mu_s = 0.612$$

$$\mu_k = 0.357$$

Friction

Example #3:

A block of 60 N slides down an incline at constant speed that is angled at 40° from horizontal.

- How large is the friction force that opposes it's motion?
- What is the coefficient of sliding (kinetic) friction between the block and the plane?

$$F_f = 38.57 \text{ N}$$

$$\mu_k = 0.839$$