Hello!!

- Solve the following: A 10kg box is being pushed to the right with a force of 35N. It accelerates at a rate of 3m/s^2. What is the force of friction?

This Week

- Monday: Friction
- Tuesday: Multi-body, friction and multiple tensions.
- Wednesday: Lab
- Thursday: Review for Quiz
- Friday: F=ma quiz

Friction and the Normal Force

- The force of friction is directly proportional to the normal force.
- There is a ratio of the force of friction and the normal force. Ff/Fn.
- This is the coefficient of friction.

μ: the coefficient of friction.

Kinetic and Static Friction

- Both are ratios to the normal force.
- μs: coefficient of static friction.
- μk: coefficient of kinetic friction.
- Static friction > kinetic friction.

TABLE 4–2 Coefficients of Friction[†]

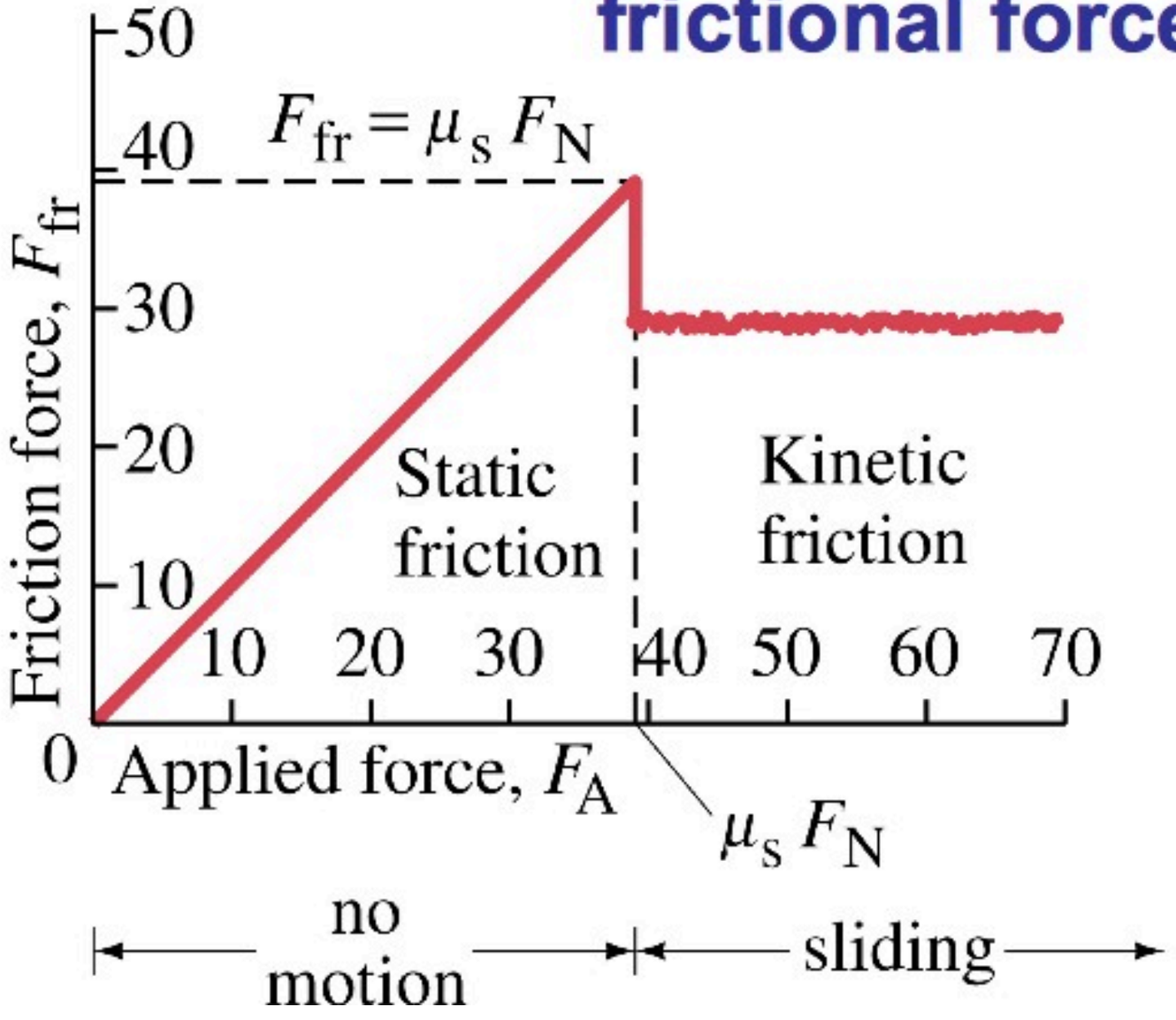
Surfaces	Coefficient of Static Friction, μ_s	Coefficient of Kinetic Friction, μ_k
Wood on wood	0.4	0.2
Ice on ice	0.1	0.03
Metal on metal (lubricated)	0.15	0.07
Steel on steel (unlubricated)	0.7	0.6
Rubber on dry concrete	1.0	0.8
Rubber on wet concrete	0.7	0.5
Rubber on other solid surfaces	1–4	1
Teflon® on Teflon in air	0.04	0.04
Teflon on steel in air	0.04	0.04
Lubricated ball bearings	<0.01	<0.01
Synovial joints (in human limbs)	0.01	0.01

[†] Values are approximate and intended only as a guide.

Variable Forces

- μs is determined by the maximum force applied until an objects begins to move.
- μk is constant.

The static frictional force increases as the applied force increases, until it reaches its maximum. Then the object starts to move, and the kinetic frictional force takes over.



Determining μ

- The acceleration of an object tells you the sum of the forces.
- The only two that you need are Ff and Fn.
- You may have to solve for multiple forces.

- A 10kg box is being pushed to the right with a force of 35N. It accelerates at a rate of 3m/s^2. What is the coefficient of kinetic friction?

A curler wants to stop a 20kg stone on a spot 30m away. If the coefficient of kinetic friction is 0.1, what is the initial speed of the stone?

Science of the Winter Olympics - Curling

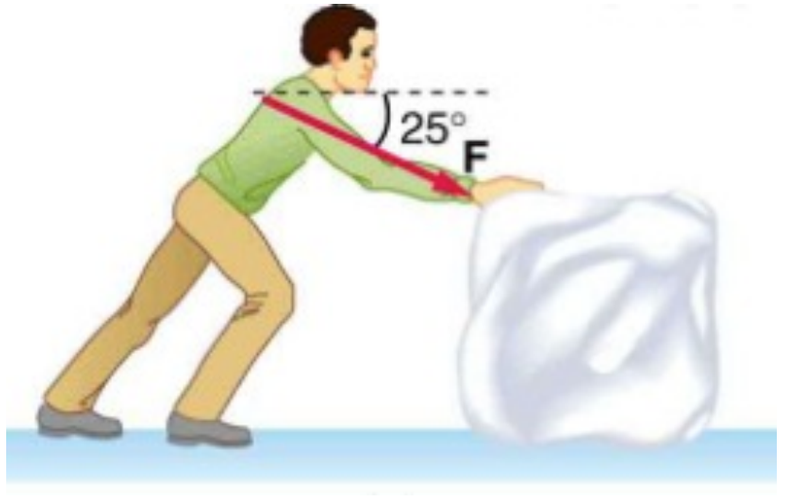
Physics of Curling

Forces at an Angle

- If there is a force that is not purely horizontal, the normal force is effected.
- Resolve the normal force **before** you calculate the force of friction.
- If an object is on an inclined plane, the formal force is not the same as Fg.

A football player drags two tires totaling 120kg. The rope is at an angle of 20°. If μk is 0.3 and the player applies 100N of force, what is the acceleration?

A man pushes a 50kg block of ice at an angle of 25° with a force of 75N. If μk=0.15, what is the acceleration of the block?



A 150kg panda accelerates down a 45° slide at 5m/s^2. Find the force of friction.

A 60kg hiker falls off of a trail and starts sliding down a 65° slope. If the hiker accelerates at 8m/s^2, what is the coefficient of friction?

Tonight

- Friction Worksheet
- The first three are at a constant velocity.
- The second half of the problems are accelerating.