Newtons Second Law of Motion

Review of Newton's First Law

- Every object will remain at rest or will continue to move in a straight line with constant speed unless the object is acted on by a net force.

Newton's Second Law

$$F = ma$$

- the acceleration of an object is directly proportional to the net force acting on the object and inversely proportional to the mass of the object.

$$\text{Acceleration} = \frac{\text{net force}}{\text{mass}} \qquad a = \frac{F_{net}}{m}$$

SI

$$\text{Unit of Force} = 1 \text{ Newton} = 1 \text{ kg} \cdot \frac{m}{s^2}$$

(kg: m; $\frac{m}{s^2}$: a)

Eng

$$\text{Unit of Force} = 1 \text{ lb} = 1 \text{ slug} \cdot \frac{ft}{s^2}$$

(slug: m; $\frac{ft}{s^2}$: a)

Example 4.1 pg. 172

Calculating Weight and mass

For weight and mass of an object you can use Newton's 2nd Law

F_g = gravitation Force

g = gravitational acceleration

To calculate Weight(F_g) $F_g = mg$

Units of g

SI	English
$9.8 \frac{m}{s^2}$	$32.2 \frac{ft}{s^2}$

Ex. 4.2 pg. 173

Ex 4.3 pg 174

Friction Forces

* To accelerate an object that is standing still you must overcome the opposing force of friction.

- force of friction resists motion
- friction is a result of irregularities in the surface

To slide one ~~fo~~ surface over another, you must break the "bond" between the two surfaces. The force to accomplish this is the <u>static friction force</u>.

- Force to overcome to maintain constant speed is <u>Kinetic friction</u> force

Static friction is usually greater than kinetic

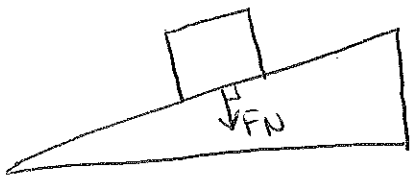
Linear Model of friction

1. Friction force depends on whether or not the surfaces are sliding.

2. Friction force depends on the materials of which the surfaces are made

3. Friction force depends on how hard the surfaces are pressed together. This is the <u>normal force</u>. Normal force acts perpendicular to the surfaces that are in contact

Coefficient of friction
μ (mu)



μ_s - coefficient of static friction

μ_K - coefficient of kinetic friction

$F_{static} = \mu_s N$

$F_{kinetic} = \mu_K N$

Maximum friction force = coefficient of friction × Normal force

Example 4.4 pg. 177.

Lubricants reduce friction

- reduces wear on surfaces

Rolling an object also reduces friction.