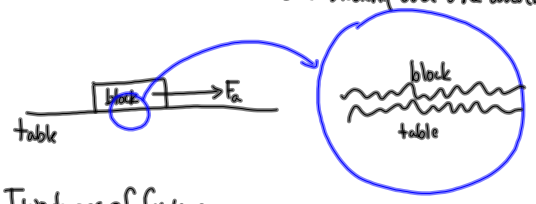
## Friction

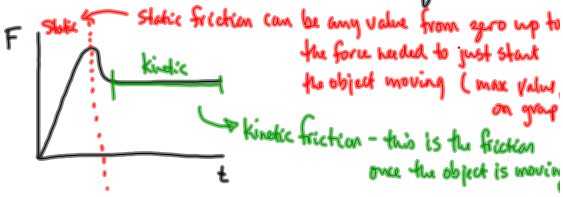
Consider two surfaces that are sliding over one another:




Two types of friction:

① Static friction - the friction that you need to overcome in order to just start an object moving.

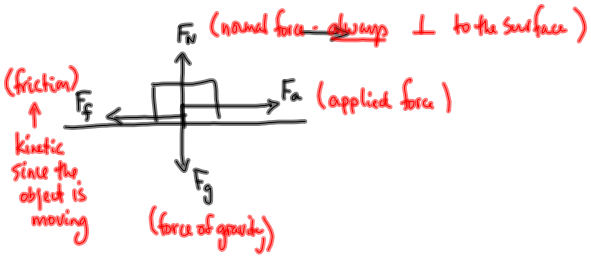
② Kinetic friction - the friction that you need to overcome once the object is moving.




## Free Body Diagram

A FBD shows all the forces acting on an object in the absence of its surroundings.

Consider pushing a crate along the floor:




$$F_f \propto F_N$$

$$\boxed{F_f = \mu F_N}$$

where $F_f$ is the frictional force (static or kinetic)

$F_N$ is the normal force (N)

($F_N = F_g$ if the surface is horizontal and $F_a$ is horizontal)

$\mu$ is the coefficient of friction (depends on the surfaces and whether static or kinetic)

Coefficient of friction is something that needs to be determined experimentally

To determine the coefficient

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$m = 2.00 \times 10^2\ kg$

$F_f(static) = ?$

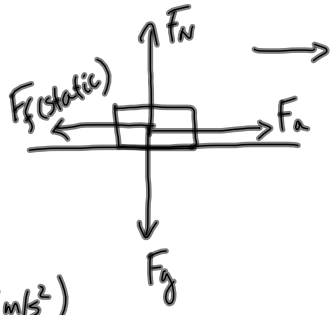
rubber + wet concrete

$\mu_s = 0.70$

$F_f = \mu F_N$

$F_f = \mu F_g$

$F_f = \mu mg$




$F_f = (0.70)(2.00 \times 10^3\ kg)(9.81\ m/s^2)$

$F_f = 1.4 \times 10^3\ N$

At the instant the truck starts to move $F_a = F_f(static)$

The static frictional force would be increased by:

$1.4 \times 10^3\ N$

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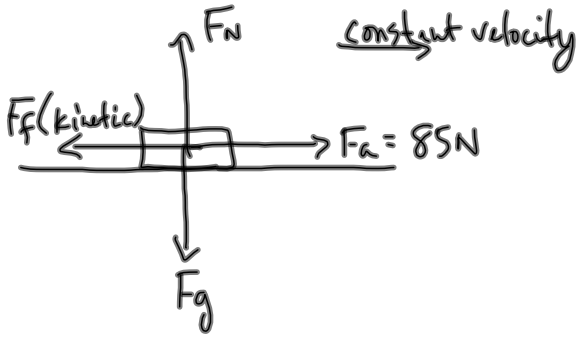
$F_a = 85N$

$m = 52kg$

$\mu_k = ?$

Constant velocity.




Since the child + sled are going at constant velocity, $F_f = F_a = 85N$

Also: $F_N = F_g = mg = (52kg)(9.8 m/s^2)$

$510.12\ N$

$F_f = \mu F_N$

$\mu = \frac{F_f}{F_N}$

$\mu = \frac{85N}{510.12N}$

$\mu = 0.17$

* Read p 137 - 141