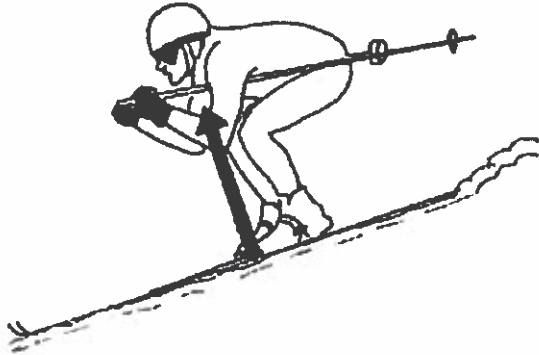# Normal Force

Normal Force is always perpendicular to the surface of contact.

If there is no any other force with a vector component perpendicular to the surface of contact, magnitude of the normal force is equal to mg

$$||F_N||=mg$$

Direction: perpendicularly away from the surface of contact.

Example 1: What is the normal force acting on a 1.5-kg book that lies on a stricly horizontal desk?

Example 2: Scenario $F_N>mg$

What is the normal force acting on a 2.0 kg objcet thar lies on a strictly horizontal ground and is acted on by a vertical force of push of 50N?

Example 3: Scenario $F_N<mg$

What is the normal force acting on a 2.0kg object that lies on a strictly horizontal ground and is being pulled vertically upwards by a froce of 5.6N?

Force of Friction
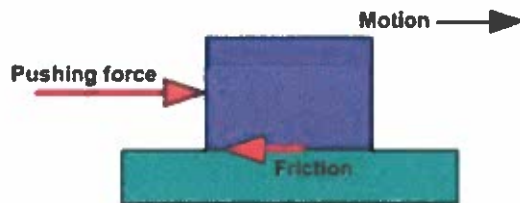
Kinetic Friction =
Static Friction =

➢ Force of friction always opposes the motion.
➢ Kinetic friction acts on moving objects – surfaces of contact exert the force of kinetic friction on one another when one or both surfaces of contact move
➢ Static friction acts on stationary objets s– surfaces of contact exert force of static friction on another when there is no motion between the two surfaces

Frictional force depends on:

- Material the surfaces of contact are made of = expressed by the coefficient of friction
- On the magnitude of the normal force (directly proportional)

$\mu_s =$

$\mu_k =$

$\mu_s > \mu_k$

Example 1: What is the force of friction between a moving object and the floor if the object's mass is 30.0 kg, the floor is horizontal, coefficient of static friction if 0.03 and the coefficient of kinetic friction is 0.025?

Example2: How much horizontal force and at what direction is needed to move a 50.0-kg stationary object that rests on a horizontal floor? The coefficient of static friction between the surfaces is 0.18 and the coefficient of kinetic friction is 0.10?

Bonus Question: Provided that frictional force exists between the surface of contact and an object, is it easier to push or pull the object at an angle 30° above horizontal? Explain?

Textbook: p 128 #17(note: constant speed implies that net force is zero) #18-20 and p130 #27, 28, 30