Coefficient of Friction, μ

Friction results from uneven surfaces being in contact with each other. At a microscopic level, even smooth surfaces have rough edges that are in contact with each other. <u>Friction always opposes the direction of motion</u>.

Recall our free-body diagrams:

The normal force (F_N) will always be equal and opposite the weight of an object (F_g) on a <u>level</u> surface.

The friction between two surfaces can be given as a ratio of the frictional force to the normal force. This is called the coefficient of friction (μ).

where: μ = coefficient of friction
F_f = force of friction (N)
F_N = normal force (N)

Coefficient of friction, μ:

- a ratio of two forces, therefore has no units
- a decimal number between 0 and 1
- different for different surfaces in contact
- increases as the surfaces in contact become more rough

Static Friction vs. Kinetic Friction

Static friction is friction of stationary objects and kinetic friction is friction of moving objects. Static friction is slightly greater than kinetic friction because at rest more of the microscopic surfaces lock together.

$$\mu_s > \mu_k$$

The force of friction can be found by:

$$F_f = \mu F_N$$

ex.
What is the force of friction between a block and a surface if the coefficient of friction is 0.3 and the block is 10 kg?

ex.
What is the coefficient of friction if a 40 kg object has a 70 N frictional force acting on it?

<u>ex</u>.
What is the acceleration of a 25 kg block if a force of 75 N is applied to it? (μ = 0.21)