

Friction

Friction

- F_f is a force which always opposes the velocity or the attempted motion.
- The magnitude of friction from a surface is:
 1. Independent of the speed of the object or the area of contact.
 2. Proportional to the normal force, F_N . If we push the two objects together harder, F_N increases and thus F_f increases.
 3. Proportional to the coefficient of friction, μ . μ depends upon:
 - a) Type of motion: stationary, sliding, rolling
 - b) Type of materials
 - c) Lubrication

Types of Friction: Kinetic

1. Kinetic Friction: This applies to sliding or skidding motion. There is relative motion between the object and the surface.

$$F_f = \mu_k F_N \quad [N] = [\text{No Units}][N]$$

μ is a decimal number which indicates the stickiness of the surface.

If the surface is sticky, μ is large.

Ex: Melissa's 1500 kg BMW is zooming at 30 m/s. She hits the brakes and skids to a stop. The coefficient of friction between the tires and the road is 0.2. Find the distance to stop.

Types of Friction: Static

2. Static Friction: This applies to a stationary object

For a stationary object. The friction is very wise and adjusts itself to exactly match the pushing force. Therefore, F_f will cancel F_{PUSH} and the object will remain stationary.

$$F_f \leq \mu_S F_N$$

To explain the \leq sign for...

Given: $\mu_s = .8$ $m = 5 \text{ kg}$

1

2

3

4

Example: A 15 kg pumpkin is stationary on a frozen field where $\mu_s = 0.8$ and $\mu_k = 0.2$.

Find the force required to just start the squash moving.

Find the force required to accelerate the moving squash at 4 m/s^2 .