1 Friction

Friction is the force that opposes relative motion between surfaces in contact. It is parallel to the contact surface between surfaces and always in the direction *opposite* motion or attempted motion of systems relative to eachother.

$$F_f = \mu F_N$$

Kinetic Friction - If two surfaces are in contact and moving relative to one another.

Static Friction - If two surfaces are in contact and ***NOT*** moving relative to one another. Static friction is usually greator than kinetic friction between the surfaces.

The magnitude of Static friction f_s is

$$f_s \leq \mu_s N$$

with μ_s is the coefficient of static friction and N being the magnitide of normal force. Also represented as $F_f \leq \mu_s F_N$

once the applied force exceeds $f_{s(max)}$ then the object moves, giving us

$$F_{s(max)} = \mu_s F_N$$

Once moving, the magnitude of Kinetic friction F_k is given

$$F_k = \mu_k F_N$$

2 Drag

Drag force always moves in the opposite direction of an objects motion (like friction)

Drag force F_D is proportional to the square of the speed of an object. $F_D \propto v^2$

$$F_D = \frac{1}{2} C \rho A v^2$$

With C as the drag coefficiant, A being the area of the object facing the fluid and ρ being the density of the fluid. More generalized equation is $F_D = bv^2$ where b is a constant equivalent to $0.5C\rho A$.

EX: At Terminal Velocity:

$$F_{net} = mg - F_D = ma = 0$$

so

$$mg - F_D = 0 - - - > mg = F_D$$

using the equation for drag force, we get:

$$mg = \frac{1}{2} \rho C A v^2$$

solving for velocity:

$$v = \sqrt{\frac{2mg}{\rho C A}}$$