Impulse (J)

The symbol for impulse is 'J'
Impulse **causes** a change in momentum
Mathematically: $J = \Delta p$

$J = p_2 - p_1$ usually we are looking at one object and it changes speed.

J (impulse) is also a vector. So when solving problems, you need to establish the +/- directions

t =

Another Derivation

Fnet = ma This is the net force on one object causing it to accelerate Let's consider Fnet to be just 'F'.

We know $a = \Delta v/t$ Sub. this in.

$F = m\Delta v/t$

$Ft = m\Delta v$

Usually we are looking at one object that changes its velocity so mass (m) stays constant but the velocity changes (Δv). For example, a car would experience a force in a car crash causing it to come to rest (hopefully safely).

$\Delta p = p_2 - p_1$

$\Delta p = mv_2 - mv1$ The mass is constant (same object) and so can be factored out.

$\Delta p = m(v2 - v1)$

$\Delta p = m\Delta v$

So $m\Delta v$ is the Δp (change in momentum)

Impulse = change in moment **Note: Impulse is a vector!

Sample Problem

A skateboarder and his board have a mass of 75 kg and are travelling at 5 m/s [fwd]. He comes to rest by one of two ways: hitting a telephone pole (stops in 0.5 s) and coasting to a stop along some asphalt road (stops in 5 s).

a. Which situation creates the greater impulse?
b. Which situation creates the greater force? *remember large forces injure!

a)

$J = Ft$ This doesn't help because I don't know force.

$J = \Delta p$

$J = m\Delta v$

Stopping in 0.5 s $J = 75 (0 - 5)$ $J = -375$ N [forward]
or impulse is 375 N [back]

Stopping in 5 s J = 75 (0 - 5) J = -375 N [forward]
or impulse is 375 N [back]

So the impulse is the same for both methods of stopping.

b) F = ?
J = Ft
Stopping in 0.5 s 375 N [back] = F (0.5)
F = 750 N [back]

Stopping in 5 s 375 N [back] = F (5)
F = 75 N [back]

So...stopping by telephone pole in 0.5 s would require 750 N whereas stopping in 5 s by the friction of an asphalt road would require 75 N. Obviously more damage will be done by hitting the telephone pole!