**Impulse- Momentum Theorem**

The unit for impulse is the same as the unit for momentum.

Unit for impulse is Ns. This equals kg(m/s2)(s). The seconds cancel out to equal kgm/s. Which is the same unit for momentum.

**Deriving the Impulse- Momentum Theorem**

F = ma Newton’s 2nd law

F = m(Δv/t) Definition of a

Ft = mΔv Multiply both sides by t

Ft = m (vf – vi) Definition of Δv

**Ft = mvf – mvi** Distributed the m into (vf – vi)

Ft = pf - pi Where p = momentum = mv

**Ft = Δp** Δp = change in momentum

Impulse equals change in momentum.

**Example #1**

100 N of force is applied to an object for 8 seconds. What is the change in the object’s momentum?

**Ft = Δp**

100N(8s) = Δp

800 Ns = Δp

800 kgm/s = Δp

**Example #2**

A 50kg object is at rest and after a force is applied to the object for 3 seconds, the object reaches a velocity of 3.8 m/s. What is the magnitude of the applied force?

**Ft = mvf – mvi**

F (3s) = (50kg)(3.8m/s) – (50kg)(0m/s)

F (3s) = (190kgm/s) – (0kgm/s)

Solve for force. Divide both sides by 3 seconds.

F = 63.3 N

**Example #3**

80 Ns of impulse is applied to an object at rest with unknown mass. After the impulse, the object travels at 2 m/s. What is the mass of the object?

**Ft = m (vf – vi)**

800Ns = m(2m/s – 0m/s)

800Ns = m(2m/s)

Solve for m. Divide both sides by 2m/s

40 kg = m