Flipping Physics Lecture Notes:
AP Physics 1 Review of *Linear Momentum and Impulse*

- Momentum: $\vec{p} = m\vec{v}$ (remember, momentum is a vector)
    - Dimensions for momentum have no special name: $\vec{p} = m\vec{v} \Rightarrow \frac{kg \cdot m}{s}$
- Conservation of momentum: $\sum \vec{p}_i = \sum \vec{p}_f$ (during all collisions and explosions)
    - Collisions in two dimensions: 2 different equations; $\sum \vec{p}_{xi} = \sum \vec{p}_{xf}$ & $\sum \vec{p}_{yi} = \sum \vec{p}_{yf}$
- Types of collisions:

Type of Collision	Is Momentum Conserved?	Is Kinetic Energy Conserved?
Elastic (bounce)	Yes	Yes
Perfectly Inelastic (stick)	Yes	No

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    - Many collisions are in between Elastic and Perfectly Inelastic. They are called Inelastic collisions. During inelastic collisions the objects bounce off of one another, momentum is conserved however Kinetic Energy is not conserved. Elastic and Perfectly Inelastic collisions are the two ideal extremes.
- Rearranging Newton's Second Law in terms of momentum:
    - $$\sum \vec{F} = m\vec{a} = m\left(\frac{\Delta \vec{v}}{\Delta t}\right) = m\left(\frac{\vec{v}_f - \vec{v}_i}{\Delta t}\right) = \frac{m\vec{v}_f - m\vec{v}_i}{\Delta t} = \frac{\vec{p}_f - \vec{p}_i}{\Delta t} = \frac{\Delta \vec{p}}{\Delta t} \Rightarrow \sum \vec{F} = \frac{\Delta \vec{p}}{\Delta t}$$
    - Gives us the equation for impulse: $\Delta \vec{p} = \sum \vec{F} \Delta t = \vec{J} = Impulse$
    - The Impulse Approximation gives us the equation on the equation sheet: $\sum \vec{F} \approx \vec{F}_{impact} \Rightarrow \Delta \vec{p} = \vec{F}_{impact} \Delta t = \vec{J} = Impulse$
    - On a Force of Impact vs. time graph, the area between the curve & the time axis is impulse.
    - Dimensions for impulse: $\Delta \vec{p} = \vec{F}_{impact} \Delta t \Rightarrow N \cdot s = \frac{kg \cdot m}{s}$