Momentum and Impulse

Momentum & Impulse

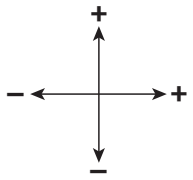
Momentum, *p*

Think of momentum, *p*, as a measure of how hard it is to change an object's velocity or bring it to rest.

- $p = mv$

Vector Quantities

Momentum and Impulse are vector quantities; direction matters! By convention, up and right are positive, down and left are negative.



Impulse, *J*

Impulse is change in momentum

- $J = m(v_f - v_i)$
- $J = Ft$
- $Ft = m(v_f - v_i)$

Note that $m(v_f - v_i)$ is the same as $m\Delta v$

Collisions and Projectiles

Momentum is conserved; in a collision or the firing of a projectile, the total momentum before the event is the same as the total momentum afterward.

Elastic Collisions (Objects bounce; kinetic energy is conserved)

$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$

Inelastic Collisions (Objects bounce; kinetic energy is not conserved)

$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$ (same as elastic collisions)

Perfectly Inelastic Collisions (Objects stick together; kinetic energy is not conserved)

$m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)v_f$

Projectiles (Guns, thrown objects, etc.)

$0 = m_1v_{1f} + m_2v_{2f}$

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