Summary  Lecture 13

Energy <=> Work

\[ PE = mgh \]
\[ KE = \frac{m}{2} v^2 \]
\[ PE_E = \frac{k}{2} x^2 \]

Total work on an object

\[ W_{(total)} = F_{net} s \cos \theta \]

Work Energy Theorem

\[ W_{(total)} = \Delta KE \]
\[ W_{NC} + W_C = \Delta KE \]
\[ W_{NC} = \Delta KE + \Delta PE = E_f - E_i \]

If \( W_{NC} = 0 \)

\[ E_f = E_i \]

Energy Conservation
Power

Power is the rate at which work is done or energy is transformed

\[ P = \frac{W}{t} \quad \text{or} \quad \frac{\Delta E}{t} \]

Units: 1 J/s = 1 W [Watt]
**Definition of Impulse**

\[ \vec{J} = \vec{F} \Delta t \]

Useful in collisions with a time-varying force. \( \vec{F} \) is the average force during the collision, \( \Delta t \) is the duration of the collision. Vector

**Definition of Linear Momentum**

\[ \vec{p} = m \vec{v} \]

The momentum \( \vec{p} \) is a vector in the direction of the velocity. Vector

**Impulse-Momentum Theorem**

Impulse = Total momentum change

\[ \vec{J} = \vec{F} \Delta t = \Delta \vec{p} \ (= m \vec{v}_{\text{Final}} - m \vec{v}_{\text{Initial}}) \]