Work and Kinetic Energy

Starting with the 2nd Newton's Law:

$$F = ma$$

One can derive another important result:

"Change in kinetic energy is equal to the mechanical work done by all forces"

$$\Delta K = W$$

$K = \frac{mv^2}{2}$, is called Kinetic Energy of an object

$W = F\Delta x$, is called Mechanical Work

(Work = Force x Displacement)

Potential Energy

Work by done by gravity depends only on initial and finite height h

$$W_{gravity} = -mg\Delta h$$

therefore,

$$\Delta K = -\Delta mgh + W_{\text{not gravity}}$$

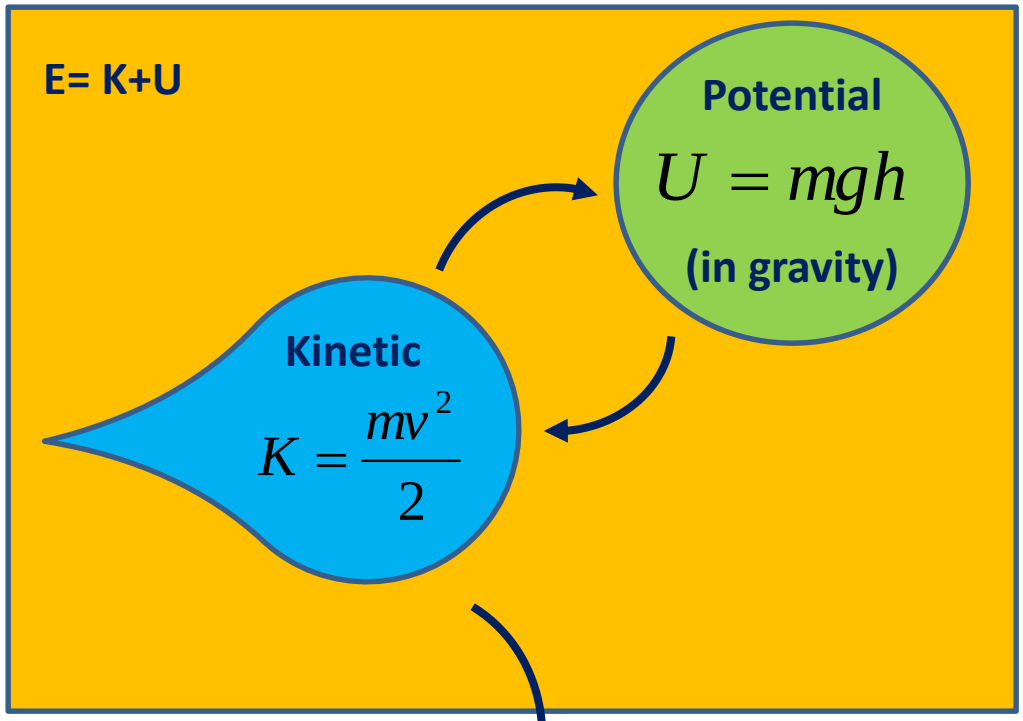
$U = mgh$ is called Potential Energy

$$\Delta\left(K + U\right) = W_{\text{not gravity}}$$

Therefore, if there is no forces other than gravity (no friction, engine or other external force), Total Energy (Kinetic + Potential) is conserved:

$$E = K + U = const \qquad \Delta E = W_{\text{not gravity}}$$

Energy Conservation and Change



Change in Energy= Work

$$W = F\Delta x$$

Unit of Energy & Work is called Joule (J)

$$1J = 1N \cdot m = 1\frac{kg \cdot m^2}{s^2}$$

Homework

Problem 1 A bobsleigh goes down the track whose initial point is at height ***h=150 m***. If there were no friction and no air resistance during the descend, find the distance ***d*** that bobsleigh had to travel after the finish line, before coming to a complete stop. Coefficient of kinetic friction on that horizontal part of the trip is μ***=0.5***.

Problem 2 A cart without any motor or other external source of energy is moving with a constant speed v=2m/s on a flat road. At some point, it climbs up a ramp of height h=15 cm (0.15 m), and continues moving on a flat road. What is its speed at that moment, if no energy is lost?