Work Energy Power

Work

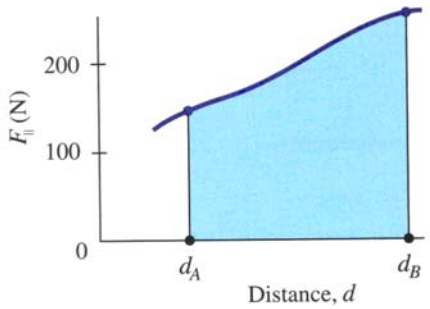
$$W = F_{\parallel} d = F d \cos\theta$$

Done by a force through a distance (constant force)

Done **by** one object **on** another object

Free body diagram very important

When work is done by a varying force, it is equal to the area under the force/distance graph



Energy

The ability to do work

There are many forms of energy. Energy cannot be created or destroyed. It only changes form. (First Law of Thermodynamics – Law of Conservation of Energy)

Mechanical Energy – most mechanical energy can be grouped into potential energy and kinetic energy

- Kinetic Energy – the ability to do work due to the motion of an object $1/2mv^2$
- Potential Energy – the ability to do work based on position or condition
  - Gravitational Potential Energy – mgh – h as measured from a reference point
  - Elastic Potential Energy – $1/2kx^2$

Work-Energy

Conservative Forces – Work done is independent of path
Nonconservative Forces – Work done is dependent on path
Potential Energy can only be defined for a Conservative Force
Extending the W-E Principle to include PE

W_{net} = ∑W by conservative and nonconservative forces
= $W_c + W_n$
= ΔKE

$W_c + W_n = \Delta KE$
$W_n = \Delta KE - W_c$
$W_c = -\Delta PE$
Finally: $W_n = \Delta KE + \Delta PE$

Other Forms of Energy

Chemical,

Work Done with Dissipative Forces

When we consider heat to be a form of energy, then energy is conserved. (closed system)

Power

Power is the rate at which work is done

$$\text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{1J}{1s} = Watts$$

Kilowatt-Hours are actually a unit of ENERGY not Power.

$$1kW \bullet hr = 1000Watts \bullet 1.0hrs = 1000\frac{J}{s} \bullet 3600s = 3.6x10^6\ J$$