Mechanical Energy

Work

- Work is a change in energy applied to an object.

  This is the result of a force applied to an object moved through a distance.

- No work is done if:
  - ▷ Force is applied, but nothing moves (*e.g.*, pushing against a wall).
  - ▷ Something is moving, but there's no force (*e.g.*, coasting on ice)

Calculating Work

$W = Fd$

W - work, J; ***F*** - net force, N; ***d*** - distance, m

Work against gravity (movement up or down)

$W = mg\Delta h$

W - Work, ***J***; ***m*** - mass, kg; ***g*** - 9.8 m/s^2; ***Δh*** - vertical displacement, m

Weight

Weight is the force on a mass due to gravity. Thus, weight in Newtons (on earth) is

$weight = 9.8m$

where m is the mass in kg.

10 is often used as a convenient, close-enough value.

Mechanical Energy, ME (or Total Mechanical Energy, TME)

$ME = KE + PE$

ME - Mechanical energy; ***KE*** - Kinetic energy; ***PE*** - Potential energy

Kinetic Energy

$KE = \frac{1}{2}mv^2$

KE - Kinetic energy, J; ***m*** - mass, kg; ***v*** - velocity, m/s

Gravitational PE

$PE = mg\Delta h$

m - mass , kg; ***g*** - 9.8 m/s^2; ***Δh*** - vertical displacement, m

Spring PE

$PE = \frac{1}{2}kx^2$

k - spring constant; ***x*** - compression/stretch distance

Power (Rate of doing work)

$P = \frac{W}{t}$

P - power, W; ***W*** - Work, J; ***t*** - time, sec