Conservative Forces

* Conservative forces produce <u>path-independent</u> work.
  Non-conservative forces produce <u>path-dependent</u> work.

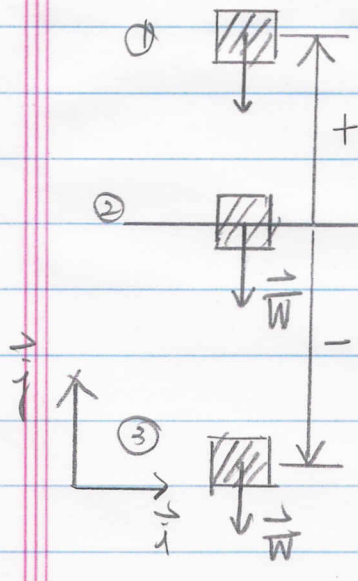
* Conservative forces : Weight, spring forces, etc.
  Non-conservative forces : Frictional forces, fracture forces.

Potential Energy

* Gravitational Potential Energy ⇒ by weight
  ⇒ $V_g = W \cdot y$
  Elastic potential energy ⇒ by spring forces
  ⇒ $V_e = \frac{1}{2} k s^2$

Work and Energy

* <u>Gravitational forces</u>



< Work of a weight >

$U_{2-1} = -W \cdot y$

$U_{2-2} = 0$

$U_{2-3} = +W \cdot y$

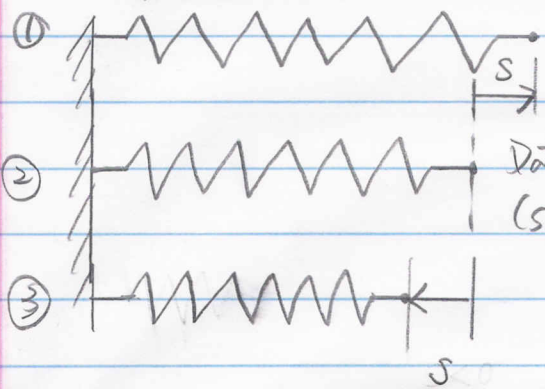
< Gravitational Potential Energy >

$V_{g_1} = W \cdot y$

$V_{g_2} = 0$

$V_{g_3} = -W \cdot y$

* Spring forces



< Work done by a spring force >

$U_{2-1} = -\frac{1}{2}ks^2$

$U_{2-2} = 0$

$U_{2-3} = -\frac{1}{2}ks^2$

< Elastic Potential Energy >

$V_{e_1} = \frac{1}{2}ks^2$

$V_{e_2} = 0$

$V_{e_3} = \frac{1}{2}ks^2$

* Potential function

$$V = V_g + V_e \Rightarrow U_{1-2} = V_1 - V_2$$

$$= (V_{g_1} + V_{e_1}) - (V_{g_2} + V_{e_2})$$

$$\text{or } U_{2-1} = V_2 - V_1$$

$$= (V_{g_2} + V_{e_2}) - (V_{g_1} + V_{e_1})$$

⇒ For conservative forces ONLY *

Conservation of Energy

$$T_1 + V_1 + (\Sigma U_{1-2})_{\text{noncons.}} = T_2 + V_2$$

$$\Rightarrow T_1 + (V_{g_1} + V_{e_1}) + (\Sigma U_{1-2})_{\text{noncons.}} = T_2 + (V_{g_2} + V_{e_2})$$

When $(\Sigma U_{1-2})_{\text{noncon.}} = 0$ if NO nonconservative forces

$$\Rightarrow \boxed{T_1 + V_1 = T_2 + V_2} \Rightarrow \text{Conservation of mechanical energy}$$

$$\text{or } \Sigma T_1 + \Sigma V_1 = \Sigma T_2 + \Sigma V_2$$