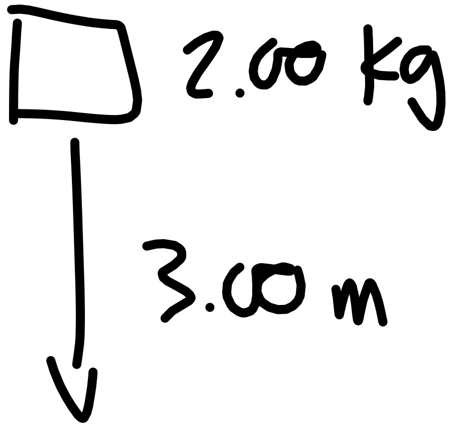
Recap: $K = \frac{1}{2}mv^2$

ex:

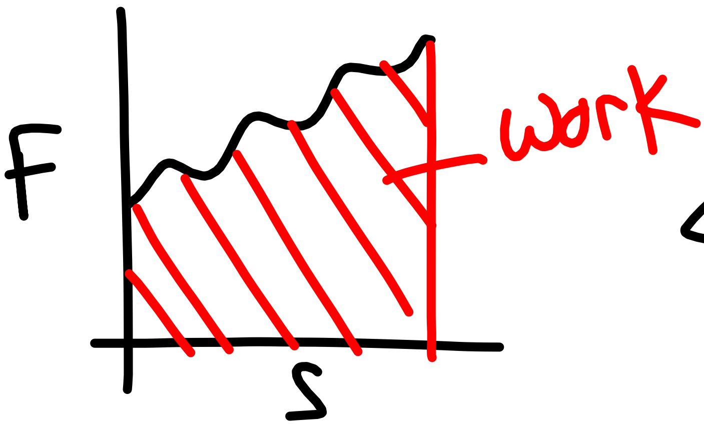


$W = \Delta E$

$W = \vec{F}\vec{s}$

$W = \vec{F} \cdot \vec{s}$

$W = |F||s|\cos\theta$



$W = \int F(s)\, ds$

Potential Energy -

Energy you Have by Virtue of your position

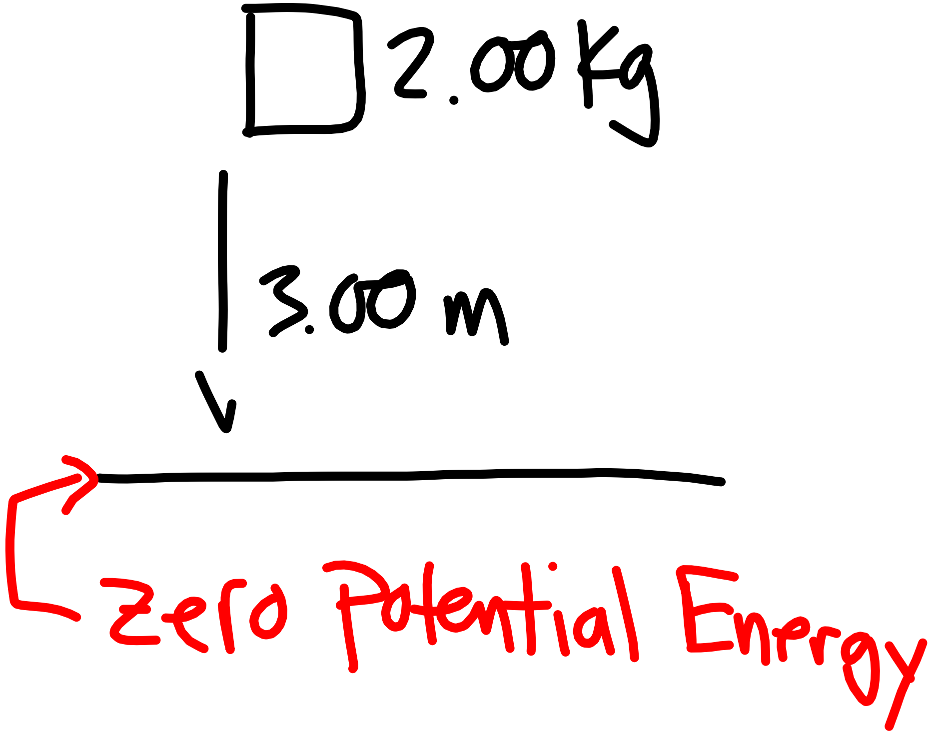
* Zero Can be <u>anywhere</u>!

$$W = \vec{F} \cdot \vec{s} \qquad F_g = mg$$

$$W_g = m\vec{g} \cdot \vec{s}$$

But: $W = \Delta E$

$$\boxed{U = mgh}$$



$$W = DE$$

$$W = E_f - E_i$$

$$W = mg\cancelto{0}{h_f} - mgh_i$$

$$W = -mgh_i$$

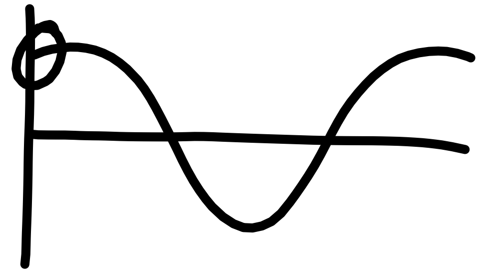
$$W = -(2)(9.81)(3) = -58.9 \ kg \cdot \frac{m}{s^2} \cdot m$$

$$(J)$$

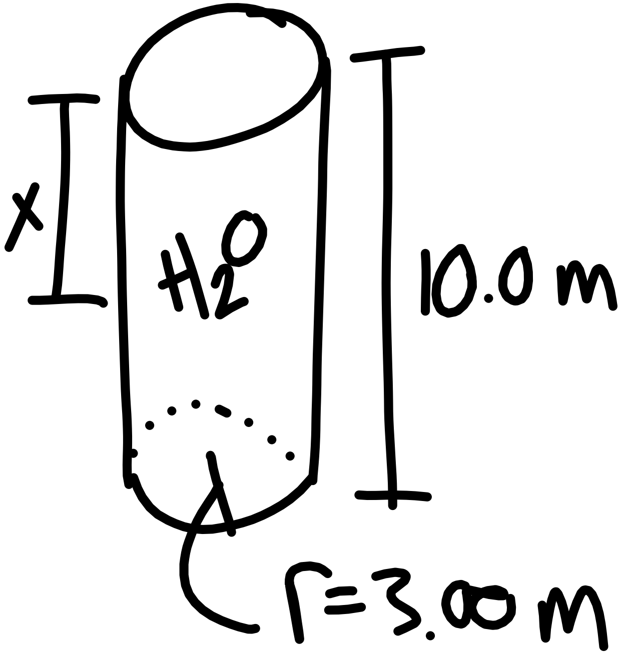
By Convention: $W_g = -\Delta U$

Proof: $W_g = \vec{F} \cdot \vec{s} = |F||s|\cos\phi$

Positive!



ex:



Empty tank from top.

$W = ?$

$W = \int F(s)\,ds$

$$W = F \cdot S$$

$$W = mg \cdot S$$

use density! $\longrightarrow$ $\rho = \frac{m}{V}$

$$\rho V = m$$

$$W = \rho V g \cdot S$$

$$W = \rho \pi r^2 dx g \cdot S \qquad V = Bh$$

$$W = \rho \pi r^2 dx g (10 - x) \qquad V = \pi r^2 h$$

$$V = \pi r^2 dx$$

$$W = \rho \pi r^2 g (10-x)\, dx$$

$$W = \rho \pi r^2 g \int 10-x \, dx$$

$$W = \rho \pi r^2 g \left(10x - \frac{x^2}{2}\right)\Bigg|_0^{10}$$

$$W = (1000)(3.14)(3)(9.81)\; 10x - \frac{1}{2}x^2$$

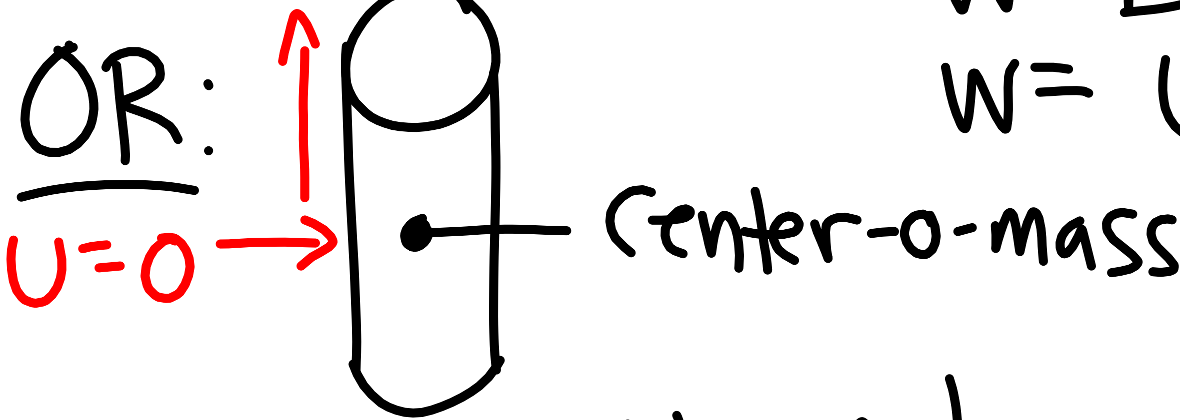
$$W = (277{,}371.22)\; 10x - \frac{1}{2}x^2$$

$W = 13{,}868{,}560.77 \text{ J}$ ✓

$W = \Delta E$

$W = U_f - U_i$

OR:



$U_f = mgh_f$

$U_f = \rho V g h_f$

$U_f = \rho B h g h_f$

$$U_f = \rho B h g h_f$$

$$U_f = \rho \pi r^2 h g h_f$$

$$U_f = (1000)(3.14)(3)^2(10)(9.81)(5)$$

$$U_p = 13,868,560.77 \text{ J}$$