§6.3 Potential Energy + The Work Energy Theorem

Gravitational Potential Energy

Gravitational Potential energy is the energy an object has due to its position above a certain reference level.

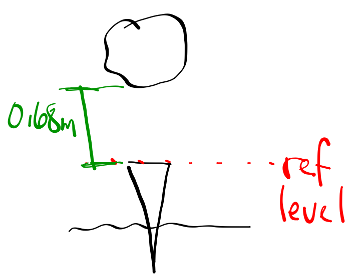
Gravitational Potential energy depends on the object's mass and its height above a certain reference level.

$$E_g = mgh$$

Where E_g is the gravitational potential energy (J)
m is the mass (kg)
h is the height above a certain referency level (m)
g is $9.81\ m/s^2$ (near the Earth's surface)

MP/249

$m = 3.0\ kg$
$h = 0.68\ m$
$E_g = ?$

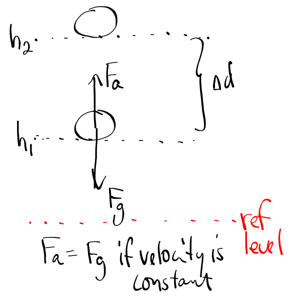


$E_g = mgh$
$E_g = (3.0\ kg)(9.81\ m/s^2)(0.68\ m)$
$E_g = 2.0 \times 10^1\ J$

When the rock has been lifted, it has 2.0×10^1 J of gravitational potential energy.

Work was done in giving the rock this energy.

Consider the work done when lifting an object:



$W = F_{\parallel} \Delta d$

$W = F_g \Delta d$

$W = mg(h_2 - h_1)$

$W = mgh_2 - mgh_1$

$W = E_{g2} - E_{g1}$

$W = \Delta E_g$

Work - Energy Theorem

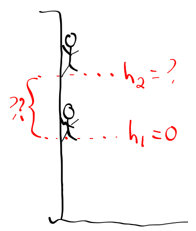
- Work is equal to the change in the object's gravitational potential energy
- Work is done in order to change an an object's gravitational potential energy
- It often convenient to use the lowest level as the reference level so that $E_{g1} = 0$.

MP/252

$m = 65.0\,kg$

$W = 1.60 \times 10^4\,J$

$h_2 = ?$ if $h_1 = 0$



$W = \Delta E_g$

$W = E_{g2} - \cancel{E_{g1}}$ 0

$W = mgh_2$

$h_2 = \frac{W}{mg}$

$h_2 = \frac{1.60 \times 10^4\,J}{(65.0\,kg)(9.81\,m/s^2)}$

$h_2 = 25.1\,m$

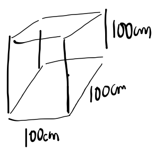
The rock climber ascended a height of 25.1 m.

(He's 25.1 m above where he started)

To DO

① PP/250 → #28 hint:

② PP/254



$1\,cm^3 = 1\,mL$