Work + Energy

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

$W = F \Delta d \cos\theta$

W = area under a F-d graph

$E_k = \frac{1}{2} m v^2$

$W = \Delta E_k$

PP 245

24. $m = 500\,g$

$V_1 = 0$

$V_2 = 1.2\,m/s$

a) $E_{k_2} = ?$

b) $F = ?$, if $\Delta d = 0.1\,m$

a) $E_{k_2} = \frac{1}{2} m v_2^2$

$E_{k_2} = \frac{1}{2}(0.500\,kg)(1.2\,m/s)^2$

$\boxed{E_{k_2} = 0.36\,J}$

b) $W = \Delta E_k$

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

$F_{\parallel} \Delta d = E_{k_2} - E_{k_1}$ ($E_{k_1} = 0$)

$F_{\parallel}(0.1\,m) = 0.36\,J$

$\boxed{F_{\parallel} = 3.6\,N}$

Gravitational Potential Energy (near the earth's surface)

- an object has gravitational potential energy due to its height above a given reference level.

$$E_g = mgh$$

Where E_g is the gravitational potential energy (J)

m is the mass (kg)

g is the acceleration due to gravity ($9.81 m/s^2$)

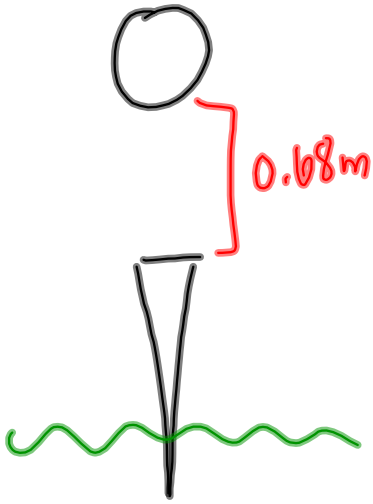
h is the the height with respect to the reference level (m)

MP/249

$m = 3.0 kg$

$h = 0.68 m$

$E_g = ?$



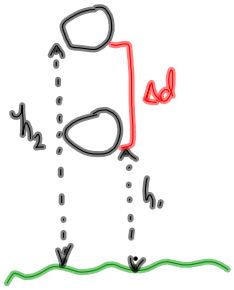
$E_g = mgh$

$E_g = (3.0kg)(9.81 m/s^2)(0.68 m)$

$E_g = 2.0 \times 10^1 J$

Work & Gravitational Potential Energy

Consider lifting a rock from h_1 to h_2.



$W = F_{||}\Delta d$ but $F_{||} = F_g$

$W = F_g \Delta d$

$W = mg(h_2 - h_1)$

$W = mgh_2 - mgh_1$

$W = E_{g_2} - E_{g_1}$

$\boxed{W = \Delta E_g}$

Work-Energy Theorem

The change in an objects gravitational potential energy is equal to the work done.

If there is an increase in gravitational potential energy then positive work is done

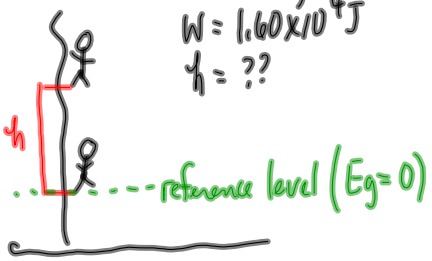
If there is a decrease in gravitational potential energy then negative work is done

MP/252

$m = 65.0\,kg$

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

$h = ??$



$W = \Delta E_g$ ($E_{g_1} = 0$)

$W = E_{g_2} - E_{g_1}$

$W = E_{g_2}$

$W = mgh$

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

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

$\boxed{h = 25.1\,m}$

The rock climber climber 25.1 m

TO DO: ① PP/250

② PP/254