PP|245

24.

$m = 500 g$

$V_1 = 0$

$V_2 = 1.2 m/s$

$\Delta d = 0.1 m$

$F = ??$

$W = \Delta E_k$

$F_{\parallel} \Delta d = E_{k_2} - \cancel{E_{k_1}}^{0}$

$F_{\parallel} \Delta d = \frac{1}{2} m v_2^2$

$F_{\parallel} = \frac{m v_2^2}{2 \Delta d}$ → a when $v_1 = 0$ $(v_2^2 = v_1^2 + 2a\Delta d)$

$F_{\parallel} = \frac{(0.500 kg)(1.2 m/s)^2}{2(0.1 m)}$

$F_{\parallel} = 3.6 N$

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

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

$E_{k_2} = 0.36 J$

→ $W = \Delta E_k$

$W = 0.36 J - 0$

$F_{\parallel} \Delta d = 0.36 J$

$F_{\parallel} = \frac{0.36 J}{0.10 m}$

$F_{\parallel} = 3.6 N$

26.

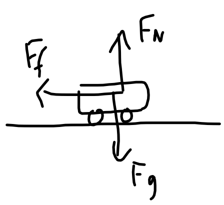
$m = 1250 kg$

$V_1 = 25 km/h$

$V_2 = 0$

$\Delta d = 10 m$

$F_f = ??$



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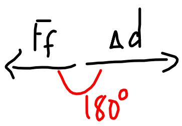


$W = \Delta E_k$

$F \Delta d \cos\theta = \cancel{E_{k_2}}^{0} - E_{k_1}$

$F \Delta d \cos\theta = -\frac{1}{2} m v_1^2$

§6-3 Potential Energy + the Work-Energy Theorem

Gravitational Potential Energy

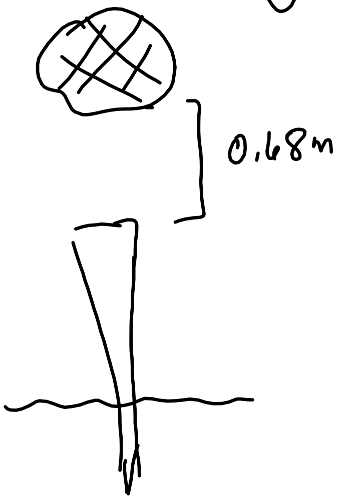
Gravitational potential energy is related to an object's mass and its height above a certain reference level.

$$E_g = mgh$$

where E_g is the gravitational potential energy (J)
m is the mass (kg)
g is 9.81 m/s^2 near the Earth's Surface.
h is the height above a certain reference level (m)

mp/249

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



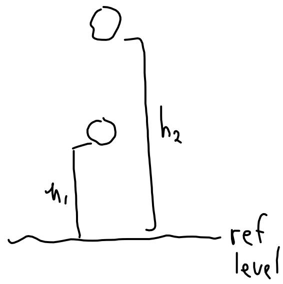
$E_g = mgh$

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

$E_g = 2.0 \times 10^1\,J$

What is the relationship between work and gravitational potential energy?

Consider an object being lifted from h_1 to h_2



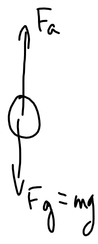
$W = F_{\parallel} \Delta d$

$W = mg(h_2 - h_1)$

$W = mgh_2 - mgh_1$

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

$W = \Delta E_g$



Work-Energy Theorem

In order to change an object's gravitational potential energy, work must be done. The work done is equal to the change in gravitational PE.

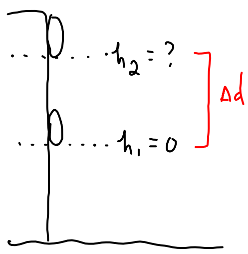
MP|252

$m = 65.0\,kg$

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

$h_2 = ?$

$h_1 = 0$



$W = \Delta E_g$

$W = E_{g2} - E_{g1}$ (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 25.1 m

OR

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

$W = mg\Delta d$

$\Delta d = \frac{W}{mg} = 25.1\,m$

TO DO: PP|250 (gravitational PE)

PP|254 (work-energy theorem)