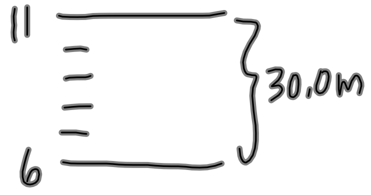
Gravitational Potential Energy

$$E_g = mgh$$

$$W = \Delta E_g$$

PP/254

34. $m = 1.35 \times 10^4\,kg$



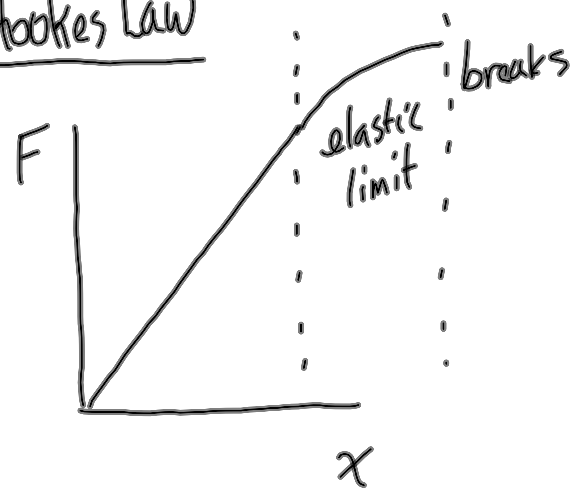
one floor = 6.0m

a) $E_g = mgh$

$E_g = (1.35 \times 10^4\,kg)(9.81\,m/s^2)(12\,m)$

b) $E_g = (1.35 \times 10^4\,kg)(9.81\,m/s^2)(18\,m)$

Hooke's Law



$F \propto x$

$$\boxed{F_a = kx}$$

where F_a is the applied force (N)
k is the spring constant $\left(\frac{N}{m}\right)$
x is the distance stretched (m)

As you stretch an elastic, you need more force.

* Hooke's Law was originally written in terms of the restoring force. $(F = -kx)$

mp/257

$F_a = 133\,N$

$x = 71\,cm$

$k = ??$

$F_a = kx$

$k = \frac{F_a}{x}$

$k = \frac{133N}{0.71m}$

$$\boxed{k \doteq 1.9 \times 10^2 \frac{N}{m}}$$

Work and Elastic Potential Energy

If your stretch an elastic or spring then you do work + transfer energy to the elastic. The work done is equal to the change in elastic potential energy.

$$E_e = \frac{1}{2}kx^2$$

Where E_e is the elastic potential energy (J)
k is the spring constant $\left(\frac{N}{m}\right)$
x is the amount of stretch (+) / compression (−) (m)

Also: $W = \Delta E_e$ (work-energy theorem) mp/260

$k = 75 N/m$

$x = -28 cm$

↑ compression

a) $\Delta E_e = ??$

b) $F_a = ?$

a) $\Delta E_e = E_{e_2} - \cancel{E_{e_1}}^{0}$

$\Delta E_e = \frac{1}{2}kx^2$

$\Delta E_e = \frac{1}{2}\left(75\frac{N}{m}\right)(-0.28m)^2$

$\Delta E_e \doteq 2.9 J$

$\frac{N}{\cancel{m}} \cdot m \cdot \cancel{m}$

$N \cdot m$

J

b) $F_a = kx$

$F_a = \left(75\frac{N}{m}\right)(-0.28m)$

$F_a = -21N$

↑ compression

NOTE: Do not use $W = F_{\parallel}\Delta d$ to find the work done to stretch an elastic or spring!! The force is not constant!

Use $W = \Delta E_e$ instead!!

Do: pp/258

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