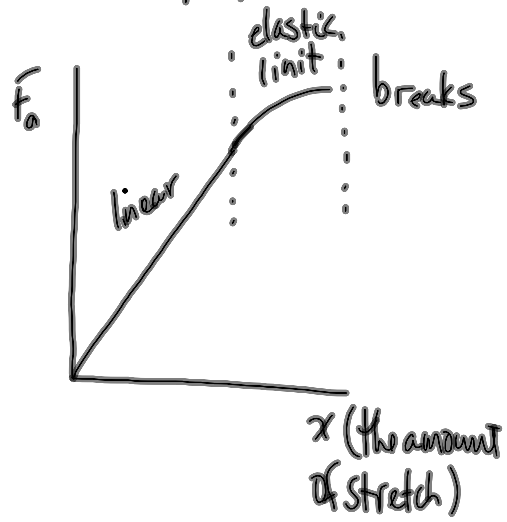
Hooke's Law

The more you stretch an elastic, the more force you need.



$$F_a = kx$$

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

Hooke's Law was originally written in terms of the "restoring force":

$$F = -kx$$

but we will use the form in terms of the applied force:

$$F_a = kx$$

MP | 257

$F_a = 133N$

$x = 71cm$

$k = ?$

$F_a = kx$

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

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

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

spring constant

Elastic Potential Energy

If an elastic is stretched then it has elastic potential energy.

Work was done on the elastic to give it 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 distance stretched (m)

The work energy theorem applies to elastic potential energy:

$$\boxed{W = \Delta E_e}$$

Note: The force is not constant while it is doing the work!

mp|260

$k = 75\,N/m$

a) $\Delta E_e = ?$ if $x = -28\,cm$ compressed

b) $F_a = ?$ (to hold at 28cm)

a) $\Delta E_e = E_{e2} - \cancel{E_{e1}}$ 0 (not stretched or compressed)

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

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

$\boxed{\Delta E_e = 2.9\,J}$

The increase in elastic potential energy.

b) use Hooke's Law to find F_a (DO NOT use $W = F_{\parallel}\Delta d$ since $F_{\parallel}$ is NOT CONSTANT)

$F_a = kx$

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

$F_a = -21\,N$

pushing to compress

$+x \Rightarrow$ stretching

$-x \Rightarrow$ compressing

TO DO

PP|258

PP|261