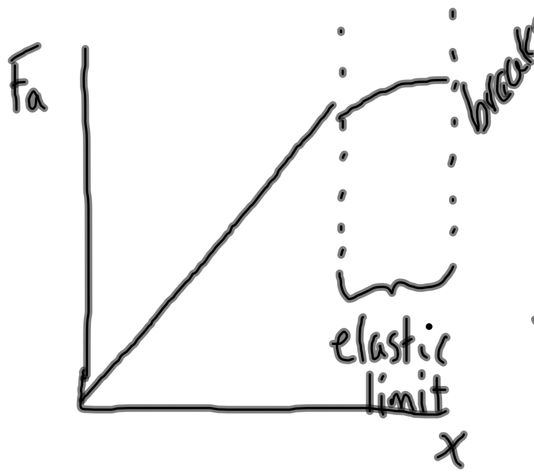
Elastic Potential Energy



Hooke's Law

The restoring force in a spring or elastic is directly proportional to the amount stretched/compressed

$$F = -kx$$

where F is the restoring force (N)
k is the spring constant ($\frac{N}{m}$)
x is the amount of stretch/compression (m)
\+ −

We are usually going to use this in terms of the applied force rather than the restoring force

$$F_a = kx$$

MP/257

$F_a = 133N$

$x = 71cm$

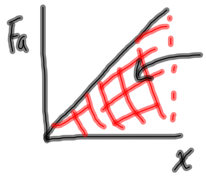
$k = ?$

$F_a = kx$

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

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

$k = 1.9 \times 10^2 N/m$



area = $W = \Delta E_e$ (WORK-ENERGY THEOREM)

Elastic Potential Energy

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

where E_e is elastic potential energy (J)

k is spring constant (N/m)

x is the amount of stretch (+) / compression (−) (m)

MP/260

$k = 75\ \text{N/m}$

$x = -28\ \text{cm}$

a) $\Delta E_e = ?$

b) $F_a = ?$

a) $\Delta E_e = E_{e_2} - \cancel{E_{e_1}}$ 0 (not streched/compressed to begin with)

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

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

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

There was an increase of 2.9 J in elastic potential energy (i.e. 2.9 J of work was done on the spring)

b) $F_a = kx$

$F_a = (75\ \text{N/m})(-0.28m)$

$F_a = -21\ N$

↑ (−) pushing on the spring

NOTE: You MUST find work using $W = \Delta E_e$

You cannot find work using $W = \cancel{F_{\parallel}}\Delta d$ because the force is not constant !!

(for a spring or elastic)

To Do

1. PP/250
2. PP/254
3. PP/258
4. PP/261