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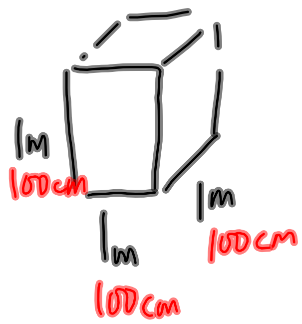
28.




$$\text{Volume} = (100\,\text{cm})^3$$

$$x\,\text{kg} = (100\,\text{cm})^3\left(\frac{1\,\text{mL}}{1\,\text{cm}^3}\right)\left(\frac{1\,\text{L}}{1000\,\text{mL}}\right)\left(\frac{1.00\,\text{kg}}{1\,\text{L}}\right)$$

$$\frac{1.00\,\text{kg}}{1\,\text{L}}$$

# Hooke's Law + Elastic Potential Energy

## Hooke's Law

The restoring force in an elastic (or spring) is directly proportional to the distance stretched (or compressed) from the equilibrium position.

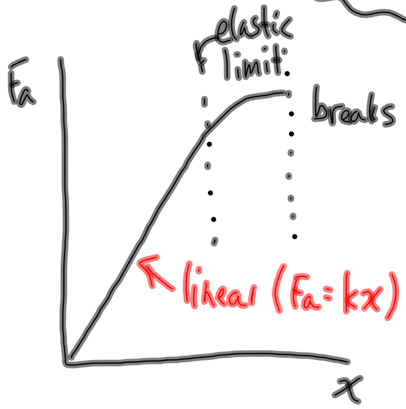
$$F = -kx$$

where $F$ is the restoring force (N)
$k$ is the spring constant ($\frac{N}{m}$)
$x$ is the distance stretched (+) / compressed (−) (m)

More practically, we will use:

$$F_a = kx$$

where $F_a$ is the applied




## mp/257

$F_a = 133 N$
$x = 71 cm$
$k = ??$

$F_a = kx$

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

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

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

## 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 distance stretched(+) / compressed(−) (m)

The work-energy theorem applies to ALL types of energy.

$$W = \Delta E_e$$

You must do work to change the elastic potential energy. The work done is equal to the change in elastic potential energy. If the energy increases, then positive work was done. If the energy decreases, then negative work was done.

The BIG IDEA: $\boxed{W = \Delta E}$
Work-Energy Theorem

**MP|260**

$k = 75\frac{N}{m}$

a) $x = -28cm$ ← compressed

$\Delta E_e = ?$

b) $F = ?$


← increasing the energy so positive work is done.

a) $\Delta E_e = E_{e2} - E_{e1}$ ($E_{e1}$ = 0)

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

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

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

b) Hooke's Law

$F_a = kx$

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

$\boxed{F_a = -21N}$ → Push with 21N

(− : compression)

**TO DO**
PP|258
PP|261

**Tomorrow**
- p276|23-28, 30-33 (Review)
- Assignment due tomorrow
- Quiz on Thursday
  - work
  - kinetic energy
  - work-energy theorem