Elastic Energy: Energy stored in a substance that is compressed or stretched (like a spring).

An object is said to be **elastic** if it can be deformed by a force in order to store energy, and then transfer its energy to another form when it returns to its normal state.

Consider the example of an elastic band.

Work is done on it to deform it, storing energy in the elastic.

When the elastic returns to its normal state it converts this stored energy into another form, in this case kinetic energy.

We can consider a spring to be in**equilibrium** when it is in its normal, unwound state.

Examples of elastic energy include springs in watches, springs and shocks in cars, slingshots, and bungee cords.

Hooke's Law

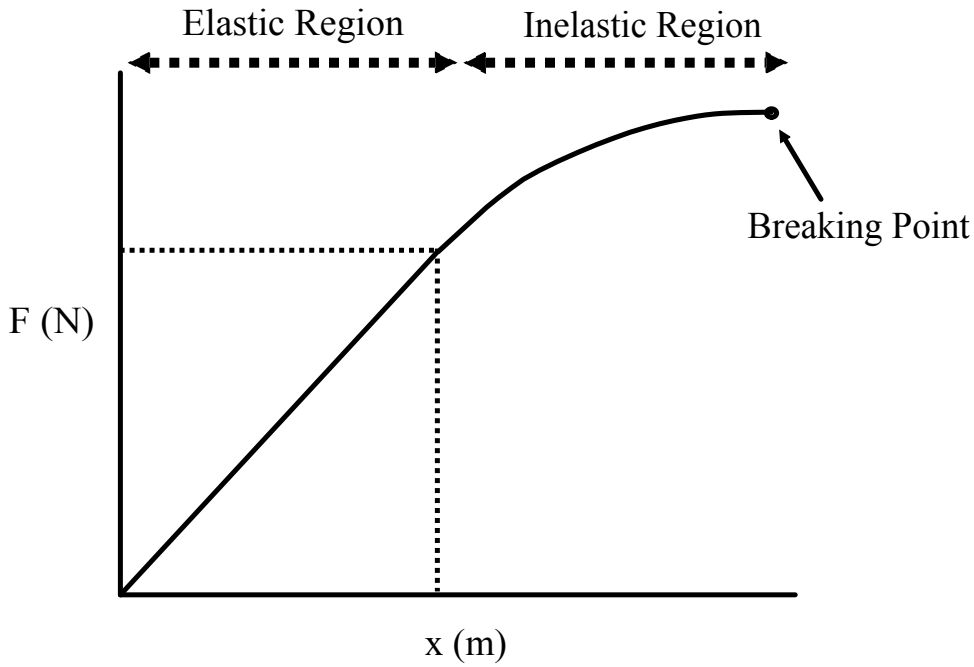
"The deformation of an elastic object is proportional to the force applied to deform it."

Mathematically: $\boxed{F = kx}$

Where: F = applied force to stretch or compress the spring (N)
k = spring constant of the object (N/m)
x = amount of deformation (m)

Activity...Find k for 2 springs

If too much force is applied, the spring may become permanently deformed, or it may break.
When this happens we say the spring becomes inelastic.

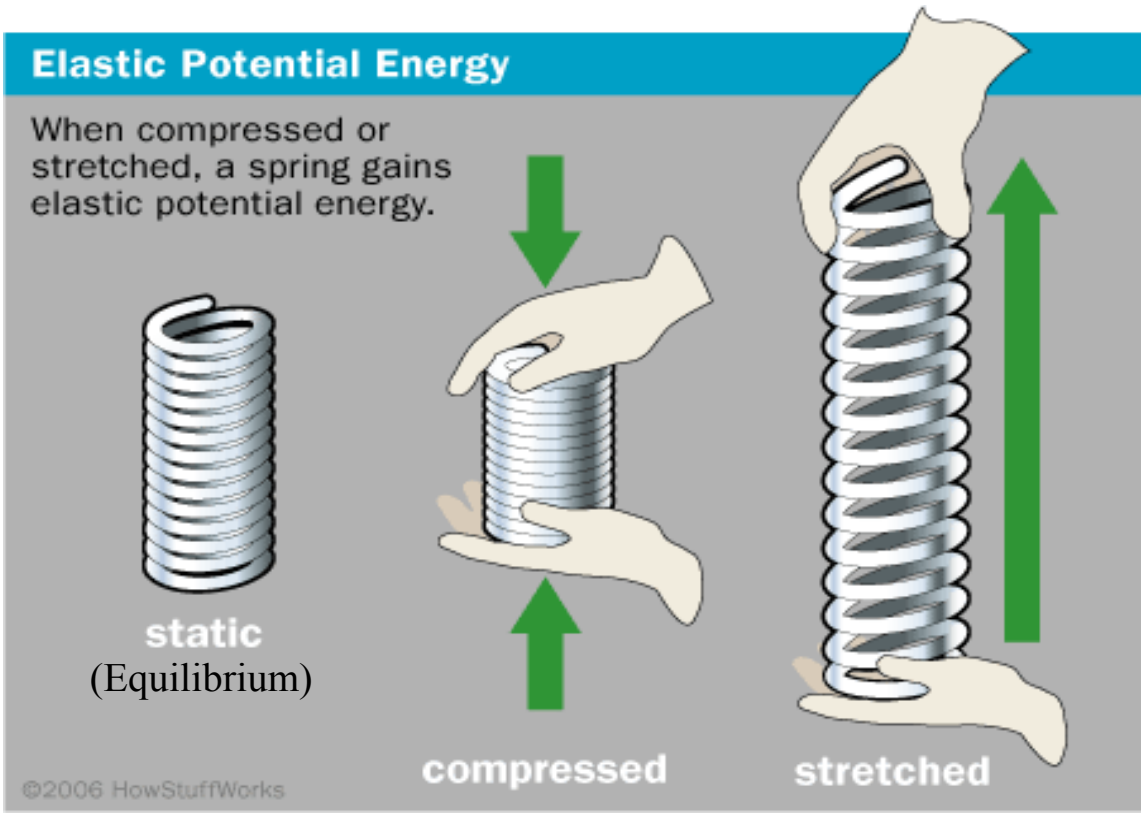


Elastic Potential Energy (E_e): The stored energy in a spring.

A spring that has E_e has the potential to do work.

Mathematically: $\boxed{E_e = \frac{1}{2} kx^2}$

Where: E_e = Elastic potential energy (J)
k = spring constant (N/m)
x = amount of deformation (m)


Elastic Potential Energy
When compressed or stretched, a spring gains elastic potential energy.
static
(Equilibrium)
compressed
stretched
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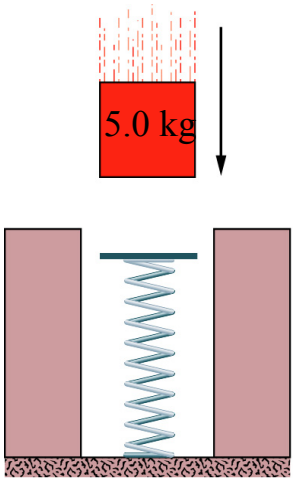
Ex: A 1.2 kg mass is suspended from a spring which has a force constant of 220 N/m. Find:

a) How far the spring is stretched.
b) The potential energy of the spring once the mass is suspended.

Energy Transformations

Elastic energy is stored in a spring and then changed into some other forms.

Ex 1. (Potential Energy and Elastic Energy)
A 5.0 kg mass is released from a height of 250 cm onto a spring with k = 1200 N/m. How much will the spring deform?



Ex 2: (Kinetic Energy and Elastic Energy)

A 800 kg truck has a bumper with a spring constant of 1.50×10^5 N/m and can safely deflect 12 cm before damaging the truck. With what maximum speed can the truck hit a wall and still not damage itself?

Ex 3: A 2.5 kg mass block of ice is held against a horizontal spring with a spring constant of 225 N/m. The spring is compressed 8.0 cm and then released. If the coefficient of kinetic friction is 0.12 between the ice and the floor, how far does the ice go before stopping?