

Work done on Spring
Elastic potential energy

Hooke's law $F_s = -kx$

Elastic potential energy

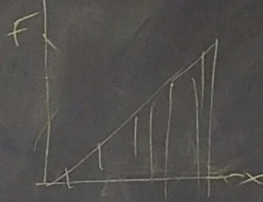
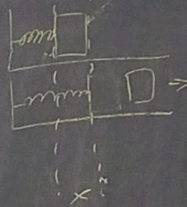
$$PE_e = \frac{1}{2} kx^2$$

Elastic potential energy = $\frac{1}{2}$ (Spring constant) (Displacement)²

Derivation

Work done on Spring

$$F = -kx$$

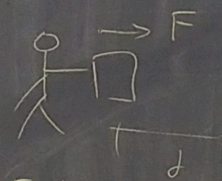


$W = F \cdot d$ $F = kx$
Area under curve = work done

Variable force

$$\frac{1}{2} Fx$$

$$\frac{1}{2} (kx)x = \frac{1}{2} kx^2$$

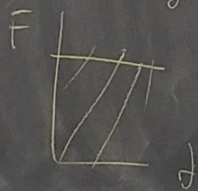


ex) Spring, with $k = 200 \text{ N/m}$.

How much energy does the Spring have when it is stretched by 0.05 m ?

$$PE_s = \frac{1}{2} kx^2 = \frac{1}{2} (200 \text{ N/m}) (0.05 \text{ m})^2$$

$$PE_s = 0.25 \text{ J}$$



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100 points participation

ex) A 2.0 kg box is sliding with a velocity of 1.6 m/s and strikes a bumper attached to a spring with spring constant $k = 15 \text{ N/m}$.

- a) What is the energy in the spring after being compressed?
b) How much was it compressed?

$\square \rightarrow \text{mm}$ $\left[\begin{array}{c} \text{E} \text{ (J)} \\ \downarrow \\ \text{X} \end{array} \right]$

$$KE = \frac{1}{2}mv^2 = \frac{1}{2}(2.0\text{kg})(1.6\text{m/s})^2$$

$$KE = 2.56 \text{ J} \quad PE_c = 2.56 \text{ J}$$

$$PE_c = \frac{1}{2}kx^2 \quad x = \sqrt{\frac{2PE_c}{k}}$$

$$x = \sqrt{\frac{2(2.56\text{J})}{15\text{N/m}}} = 0.584 \text{ m}$$

Classwork 4-7

1. A spring with spring constant $k = 100 \text{ N/m}$ is compressed 0.05 m . How much elastic potential energy does the spring have when compressed?
2. If 17 J of work is done on stretching a spring 0.03 m , what is the spring constant of the spring?

