


CHAPTER 11

Energy and Its Conservation

BIG IDEA Within a closed, isolated system, energy can change form, but the total energy is constant.

SECTIONS

- 1 The Many Forms of Energy
- 2 Conservation of Energy



Forces that do not store energy are called **nonconservative** or dissipative forces.

Conservative: Gravitational Force, Elastic Force, Magnetic Force, Electrostatic Force.

Nonconservative: Friction Force, Applied or External Force, Tension, Normal

Theorem: Work and Kinetic Energy

$$W = F \cdot \Delta X$$

$$F = m \cdot a$$

$$W = m \cdot a \cdot \Delta X$$

$$v^2 = v_0^2 + 2a \Delta X$$

$$W = m \cdot a \cdot \left(\frac{v^2 - v_0^2}{2a} \right)$$

$$\frac{v^2 - v_0^2}{2a} = \Delta X$$

$$W = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$$

$$\frac{1}{2}mv^2 = K \text{ (Kinetic Energy)}$$

$$W = K - K_0$$

$$W = \Delta K$$

work done by $\begin{cases} \text{Conservatives} \\ \text{None Conservative FORCES} \end{cases}$

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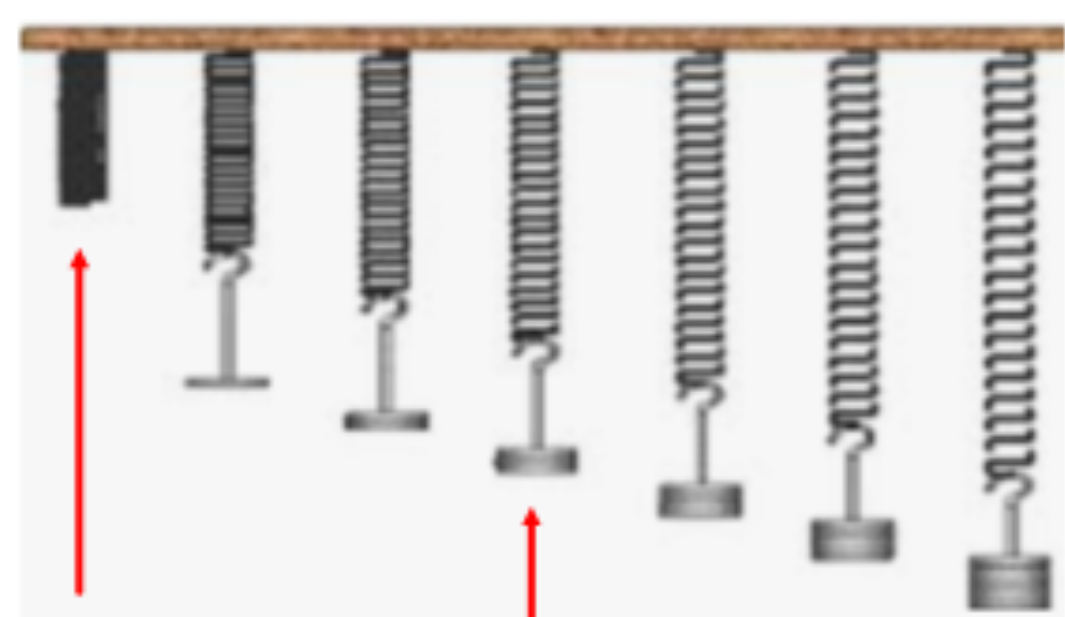
$$\frac{1}{2}mv^2 = K \text{ (Kinetic Energy)}$$

$$W = K - K_0$$

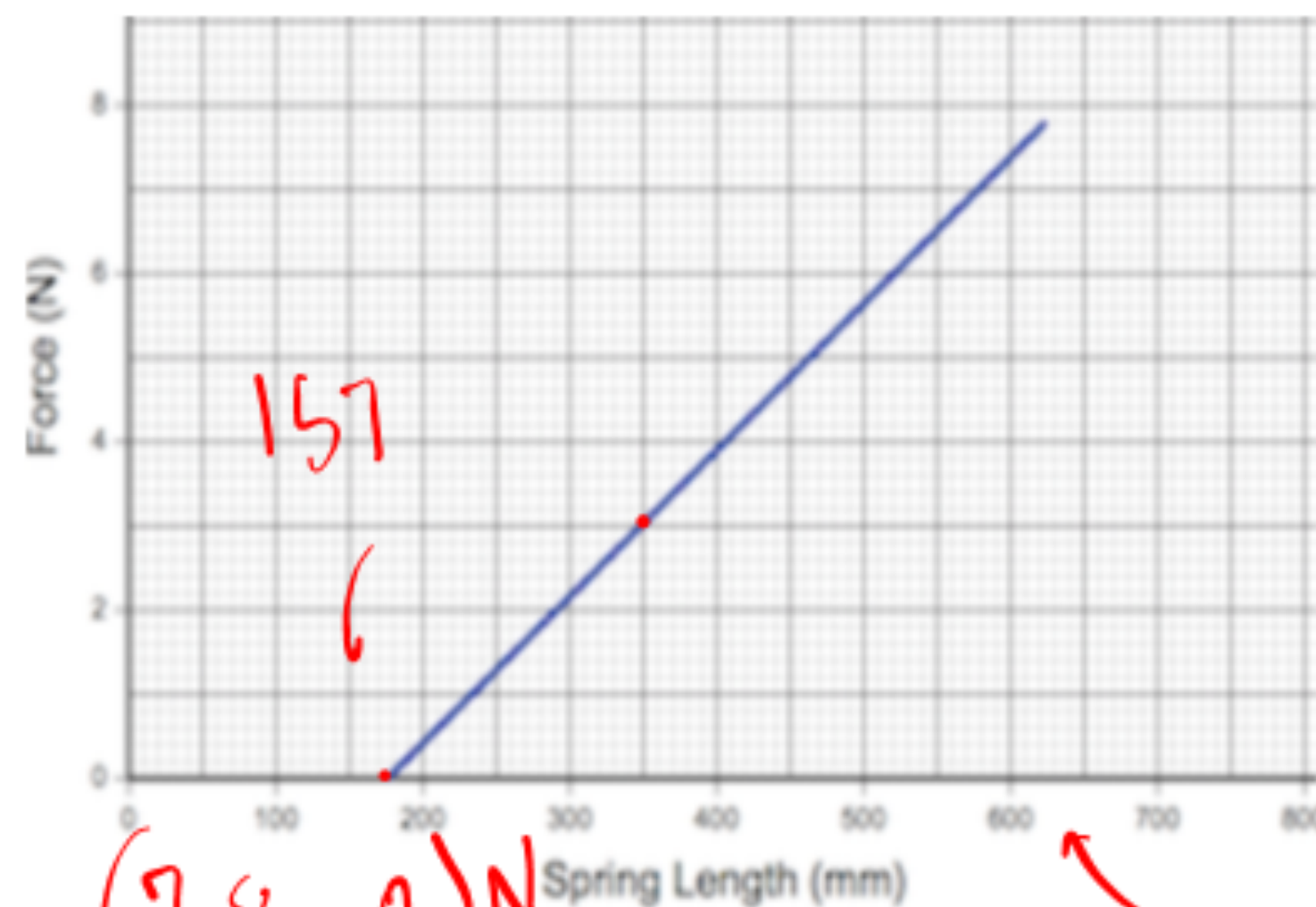
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Work and Elastic Potential Energy



Spring Constant From Graph



$$F_s = -kx$$

$$k = \frac{\Delta F}{\Delta x} = \frac{(7.8 - 0) \text{ N}}{(0.620 - 0.157) \text{ m}}$$

$$k = 16.8 \frac{\text{N}}{\text{m}}$$

spring (or Elastic Force)

spring constant

Work and Elastic Potential Energy

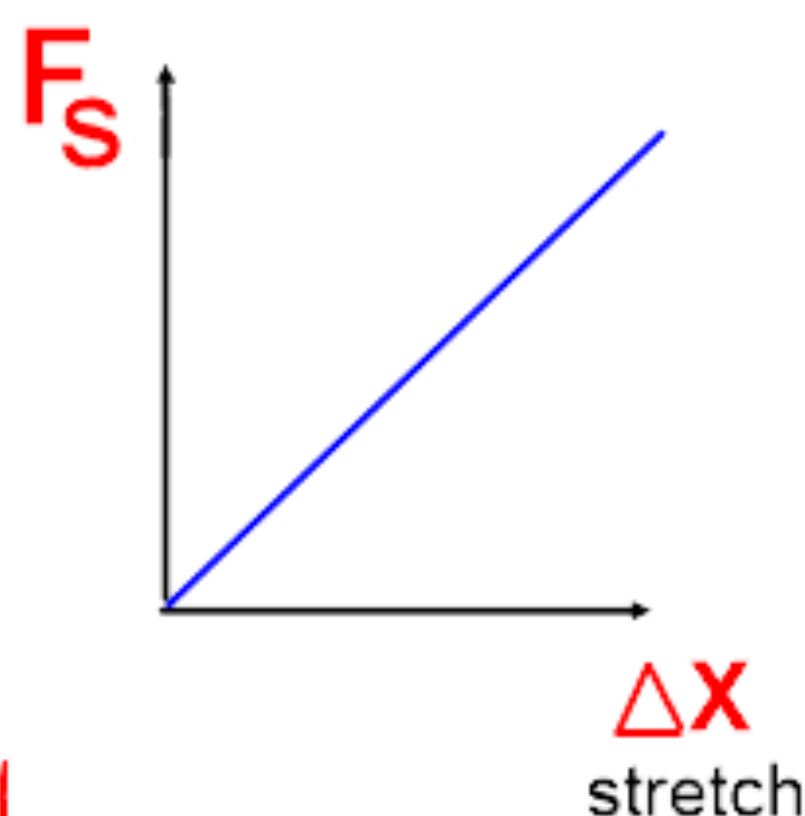
$$W = F \cdot \Delta x \cdot \cos \theta$$

$$W_{F_s} = F_s \cdot \Delta x \cdot \cos(180^\circ)$$

$$W_{F_s} = -k \cdot \Delta x \cdot \Delta x$$

$$W_{F_s} = -\frac{k \Delta x^2}{2}$$

$$W_{F_s} = -\Delta U_s$$



Hooke's Law Lab

$$F_s = k \Delta x$$

F_s elastic force

$$\text{the factor } \frac{kx^2}{2} = U_s$$

Elastic Potential Energy !!

$$W_{\text{net}} = W_c + W_{\text{nc}} = K \quad \longleftrightarrow \quad -\Delta U + W_{\text{nc}} = \Delta K$$

$$\left. \begin{array}{l} W_{F_g} = -\Delta U_g \\ W_{F_s} = -\Delta U_s \end{array} \right\} W_c = -\Delta U$$

$$W_{\text{nc}} = \Delta K + \Delta U$$

$$E = K + U$$

$$W_{\text{nc}} = \Delta E$$