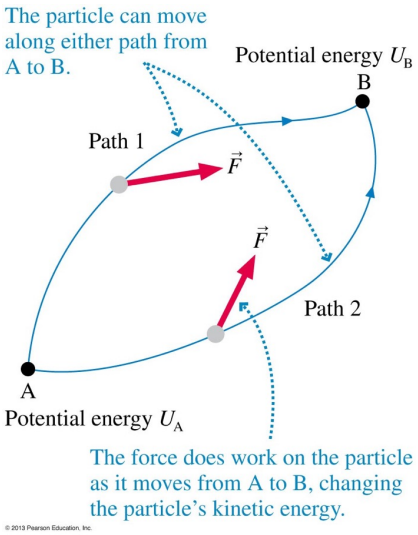
Conservative and Non-conservative Forces



A force for which the work done on a particle is independent of the path is called a **conservative force**.
(Mechanical energy is conserved.)

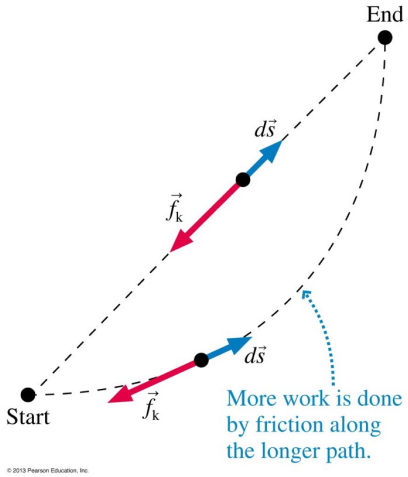
There is a **potential energy** associated with the force. (Stored energy; we may retrieve it later.)

The potential energy is transformed into **kinetic energy**.

$$\Delta K = -\Delta U$$

Ex. gravitational force, springs.

Conservative and Non-conservative Forces



A force for which the work done on a particle is **not** independent of the path is called a **nonconservative force**.

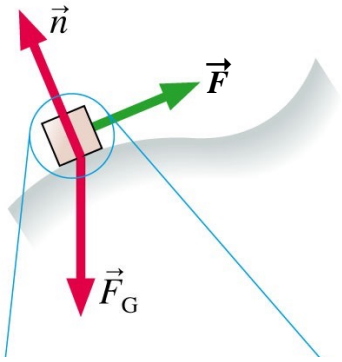
For example: friction does negative work:

$$W_{\text{fric}} = \mathbf{f} \cdot \Delta \boldsymbol{s} = -f_k \, \Delta s$$

The work done by friction depends on Δs, the distance traveled.

The work done by friction is usually dissipated as heat; it is not possible to define a potential energy for a nonconservative force.

Conservative and Non-conservative Forces



Work-Energy Theorem

$$W_{\text{net}} = \Delta K$$

$$W_{\text{net}} = W_{\text{cons}} + W_{\text{other}}$$

gravitational W_{grav}
elastic (spring) W_{sp}

$$W_{\text{cons}} = -\Delta U$$

nonconservative, e.g. friction, external forces

$$W_{\text{other}} = \int \vec{F}_{\text{other}} \cdot d\vec{s}$$

Considering conservative and nonconservative forces, we get:

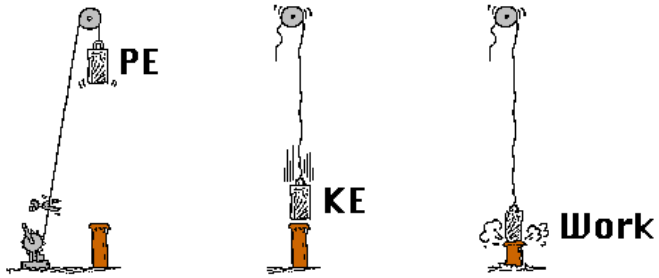
$$W_{\text{net}} = \Delta K$$
$$-\Delta U + W_{\text{other}} = \Delta K$$
$$\boxed{K_i + U_i + W_{\text{other}} = K_f + U_f}$$

Conservation of Energy

Law of Conservation of Energy: Energy cannot be created or destroyed; it may be transformed from one form into another through interactions, but the total amount of energy never changes.

$$\boxed{K_i + U_i + W_{\text{other}} = K_f + U_f}$$

where $U = U_{\text{grav}} + U_{\text{sp}} = mgy + \frac{1}{2}k(\Delta s)^2$



Do work → lift ram → giving it PE

Release ram, PE → KE

This KE transfer to the piling.

(force of impact x distance piling penetrates into ground = work done)