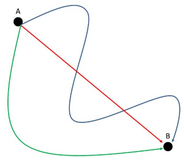
18.5 Conservation of Energy

A conservative force...

- does work independent of the path of the motion (depends only on initial and final locations)

U_{A-B} same for each path



- stores potential energy V (equal to the negative of the work done by the force)

$$\Delta V = -U$$

The potential energy depends only on position in space: $V(\vec{r})$

18.5 Conservation of Energy

Conservative forces:

- gravity $F = mg$ $V_g = Wy$
- elastic force $F = -ks$ $V_e = \frac{1}{2}ks^2$

Nonconservative forces:

- friction
- applied forces (person, motor, etc)

(no potential energy exists)

18.5 Conservation of Energy

- When work is done on a system in going from position 1 to 2:

$$U_{1-2} = \Delta T$$

- Separate the work done by conservative and nonconservative forces:

$$\underbrace{U_{\text{cons}}}_{-\Delta V} + U_{\text{noncons}} = \Delta T \qquad \underbrace{U_{\text{noncons}}}_{\text{how to change the total energy}} = \Delta T + \Delta V = \Delta \underbrace{(T + V)}_{\text{total energy}}$$

- In the absence of nonconservative forces (for example, free motion in a frictionless environment):

$$\Delta (T + V) = 0 \qquad \text{or} \qquad T_1 + V_1 = T_2 + V_2$$

Total energy is conserved.