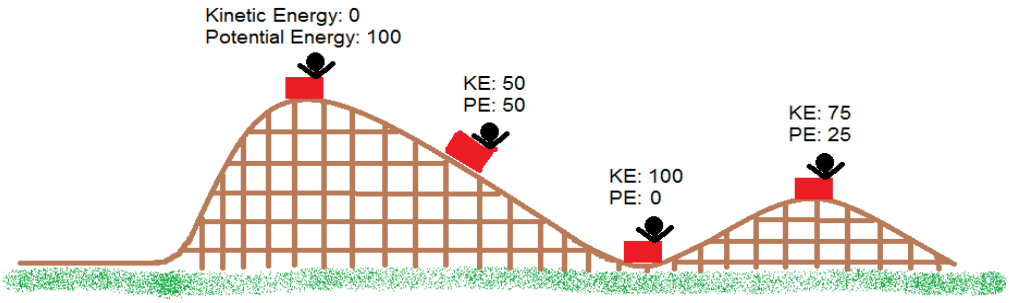
Chapter 4: Work and Energy
Section 3: Conservation of Energy

Law of conservation of energy: states that energy cannot be created or destroyed

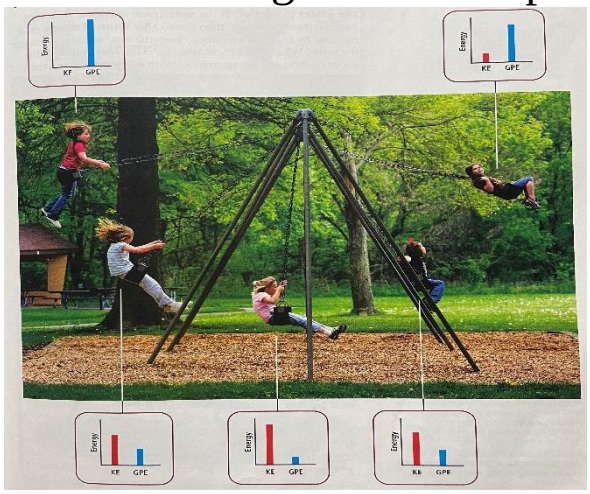
- Energy can only be converted from one form to another or transferred from one place to another
- Total energy remains constant



- If the roller coaster is using GPE only, the height of the other hills can never be greater than the height at the beginning.

Mechanical energy (ME): the sum of the kinetic energy and potential energy of the objects in a system

- ME = KE + EPE + GPE
  - KE = kinetic energy
  - EPE = elastic potential energy
  - GPE = gravitational potential energy



Notice the original height (left) of the girl is higher than the height on the right.

Also, as the swinger goes back and forth, the swinger will loss energy on each pass unless the swinger pumps his/her legs, or someone provides a push to the swinger.

Other energy transformations:

- Friction and air resistance convert some of the mechanical energy into thermal energy
    - Thermal energy is the energy of heat or hot objects
- Transforming electrical energy into thermal energy, radiant energy, sound energy, or mechanical energy
- Transforming chemical potential energy into thermal or mechanical energy (motion) for a car

Power: the rate at which energy is converted

- Measured in watts (W)
- Power = $\frac{\text{Energy (in Joules)}}{\text{Time (in seconds)}}$ = J/s = Watt (W)
- A 13-W lightbulb transforms 13 J of electrical energy into radiant energy each second

Energy from food is often measured in Calories (C).

- 1 Calorie = 4184 J
- Fat: supplies a person with 10 C (40,000 J) of energy
- Carbohydrates and proteins: supplies about 5 C (20,000 J) of energy
- The number of Calories depends on weight, body type, and physical activity.