Conservation of Energy

The **law of conservation of energy** states that *within a closed, isolated system, energy can change form, but the total amount of energy is constant.*

A ball alone, acted on by gravity, is not an isolated system. A ball and Earth however, is a closed, isolated system.

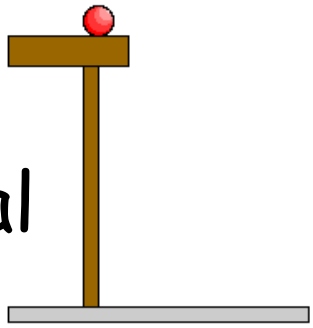
The ball can change between kinetic and gravitational potential energy. The sum of these two energies is often referred to as the **mechanical energy**.

Suppose a ball has a weight of 10.0 N. If it is sitting on a shelf 2.00 meters above the Earth's surface...

What type of energy does it have?

What would that value be?

If the ball rolls off the shelf and starts to fall, there are no forces acting on it other than the gravitational force of Earth, so the ball falls.



What would the potential energy be at 1.00 m?

The ball has lost potential energy, but has gained kinetic energy. The change in kinetic energy can be found from the work-energy theorem.

$$W = \Delta E_k$$

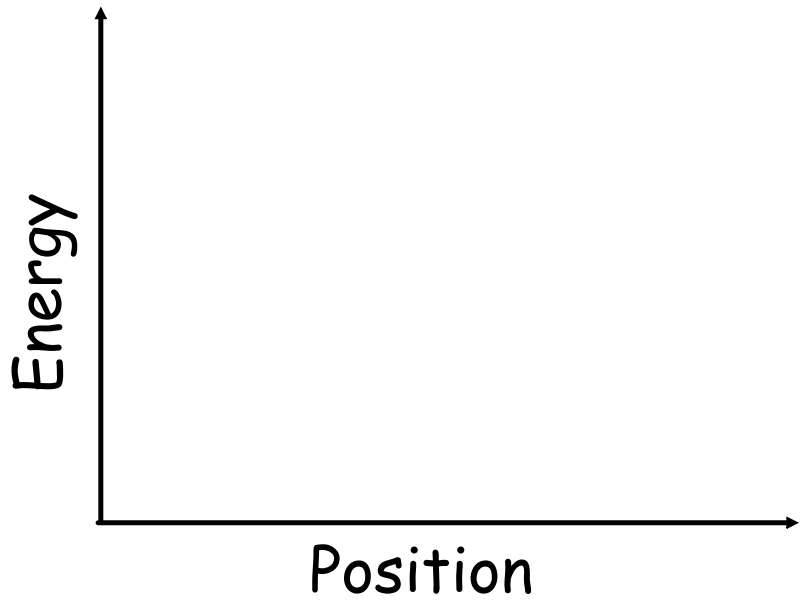
$$W = E_{kf} - E_{ki}$$

$$W = E_{kf}$$

What would the work, and therefor kinetic energy be after it has fallen a meter?

The decrease in potential energy is equal to the increase in kinetic energy

The sum of potential and kinetic energy is not changed. The mechanical energy is constant.



The equation describing the conservation of energy is

$$E_{ki} + E_{pi} = E_{kf} + E_{pf}$$

Example Problem

A large chunk of ice with mass 15.0 kg falls from a roof 8.00 m above the ground.

a) Find the kinetic energy of the ice when it reaches the ground.

b) What is the speed of the ice when it reaches the ground?

c) Is the answer the same as you would determine by solving as a constant acceleration problem?

Analyzing Collisions

During a collision, the kinetic energy of motion is changed into potential energy. If the potential energy is completely converted back into kinetic energy, the collision is called an **elastic collision**.

If, during a collision, some kinetic energy is changed into other forms, the collision is called **inelastic**.

Try questions 9-12 on page 230 and problems 20-27 on pages 238-239