Group 2 (Potential Energy)
Group 3 (Conservation of Energy)

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Equations of Work

W=Fd

The Work-Energy Theorem

The net work on a system equals the change in the quantity $\frac{1}{2}mv^2$.

$$W_{net} = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2 \tag{7.11}$$

Potential Energy

Potential energy is the stored energy of position possessed by an object.

Equations:

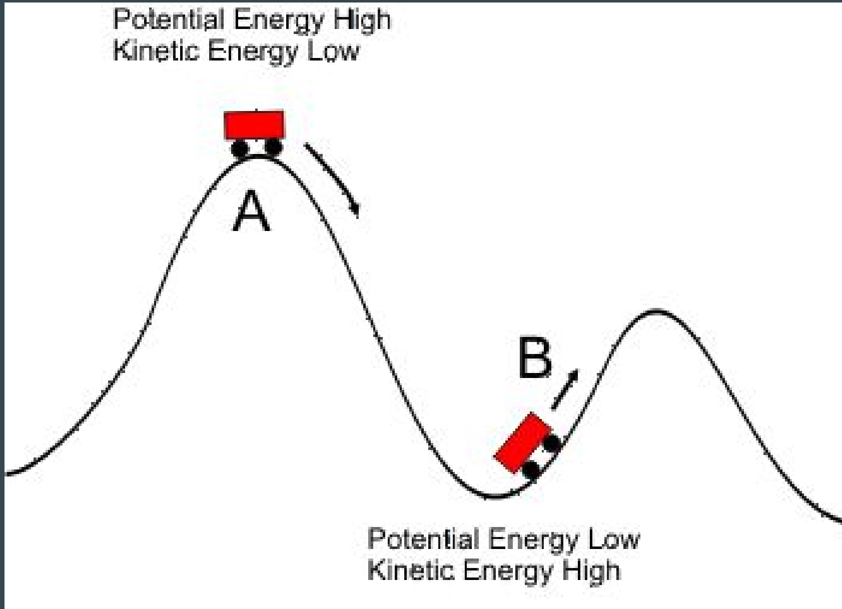
Gravitational Potential Energy = mass • g • height

Elastic Potential Energy = $P.E = \frac{1}{2}kx^2$

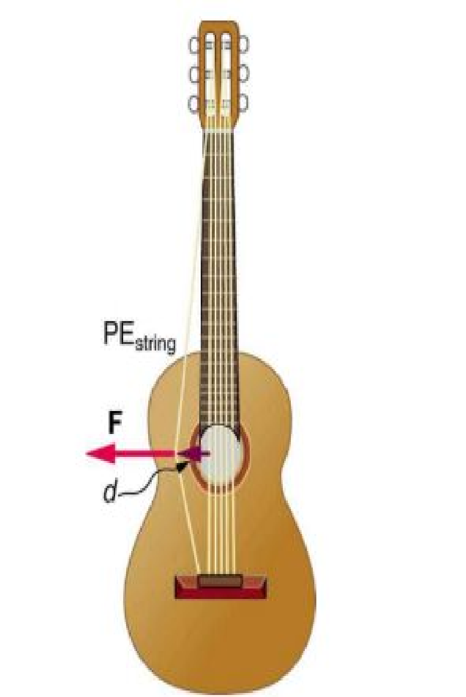
k= spring constant x= displacement

Examples of Potential Energy:

A good example is a Roller Coaster. When it reaches the top it has potential (or stored) energy. When it goes down the hill it starts to turn to kinetic energy again.



Example of Elastic Potential Energy



Every time something is stretched, compressed or deformed it has elastic potential energy. Common example are compression of a spring, compress of your pillow, pulling on a rubber band or pulling on a taut rope. Guitar strings are an example of elastic potential energy; pulling or plucking the guitar strings would result in an example of elastic potential energy

Conservation of Energy

Energy is neither created nor destroyed, but can be change from one form to another.

Initial PE + Initial KE = Final PE + Final KE

Example: A rock

- When held in air has Potential energy and no Initial Kinetic Energy
- Potential energy converts into Kinetic energy as it falls
- When it hits the ground the energy is fully Kinetic, thus the PE would be zero

Problem #16

A hydroelectric power facility (see Figure) converts the gravitational potential energy of water behind a dam to electric energy. What is the gravitational potential energy relative to the generators of a lake of volume 50.0 km3 (mass=5.00×10^13 kg), given that the lake has an average height of 40.0 m above the generators?

PE(g)= mgh

m=5x10^13 g= 10 m/s^2 h= 40m

PE(g)=(5x10^13)(10 m/s^2)(40m)

PE (g)= 2x10^16 J

Problem 25

25. (a) How high a hill can a car coast up (engine disengaged) if work done by friction is negligible and its initial speed is 110 km/h? (b) If, in actuality, a 750-kg car with an initial speed of 110 km/h is observed to coast up a hill to a height 22.0 m above its starting point, how much thermal energy was generated by friction?

a. 110 km/h = 30.6 m/s

$mgh = ½ mv^2$

$gh = ½ v^2$

$10h = ½(30.6)^2$ h = 47.7

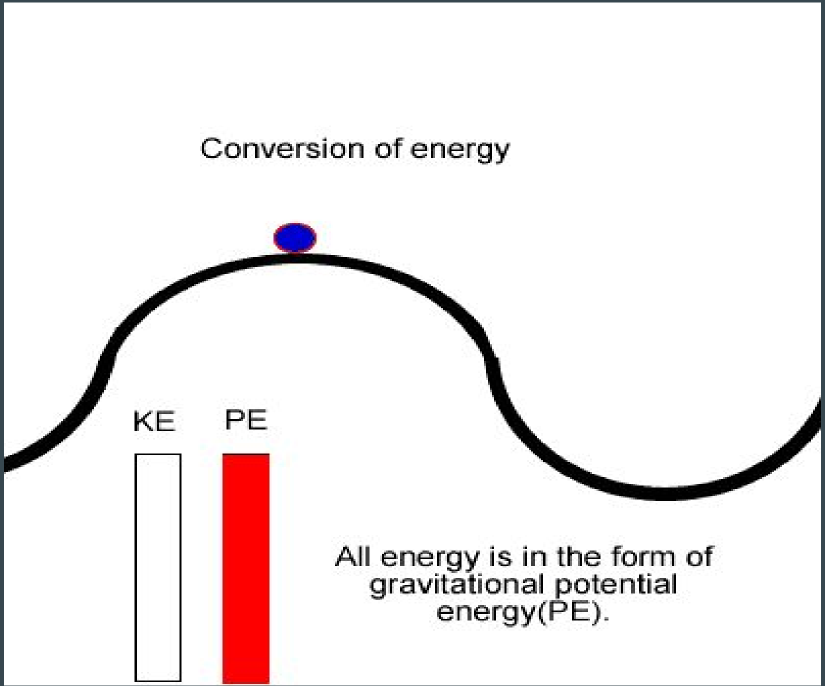
b. w = mgh

w = (750)(10)(22.0) = 165,000 J

Lab

Potential Energy

Conservation of Energy



https://www.youtube.com/watch?v=VcjaMztsLg8

Problem 28

28. If the energy in fusion bombs were used to supply the energy needs of the world, how many of the 9-megaton variety would be needed for a year's supply of energy (using data from Table 7.1)? This is not as far-fetched as it may sound—there are thousands of nuclear bombs, and their energy can be trapped in underground explosions and converted to electricity, as natural geothermal energy is.

Large fusion bomb (9 megaton)	3.8×10^{16}

Annual World Energy Use = $4 \text{ x } 10^{20}$ J

Large Fusion Bomb (9 - megaton) = $3.8 \text{ x } 10^{16}$

$(4 \text{ x } 10^{20}) / (3.8 \text{ x } 10^{16}) =$

$1.05 \text{ x } 10^{4}$ bombs needed

(about 10527 bombs)

50 megaton ->