Conservation of Mechanical Energy

Energy:

The ability to do WORK or to alter the surroundings in some way.

Work is done when a force acts on an object and the object undergoes a displacement in the direction of the force.

Energy Examples: kinetic energy
gravitational potential energy
thermal energy

Law of Conservation of Energy:

Energy can neither be created **nor** destroyed**.**
Energy can be transformed **from one form to another.**

Total Mechanical Energy is conserved in cases where an object is moving freely in a gravitational field

-friction and air resistance are ignored

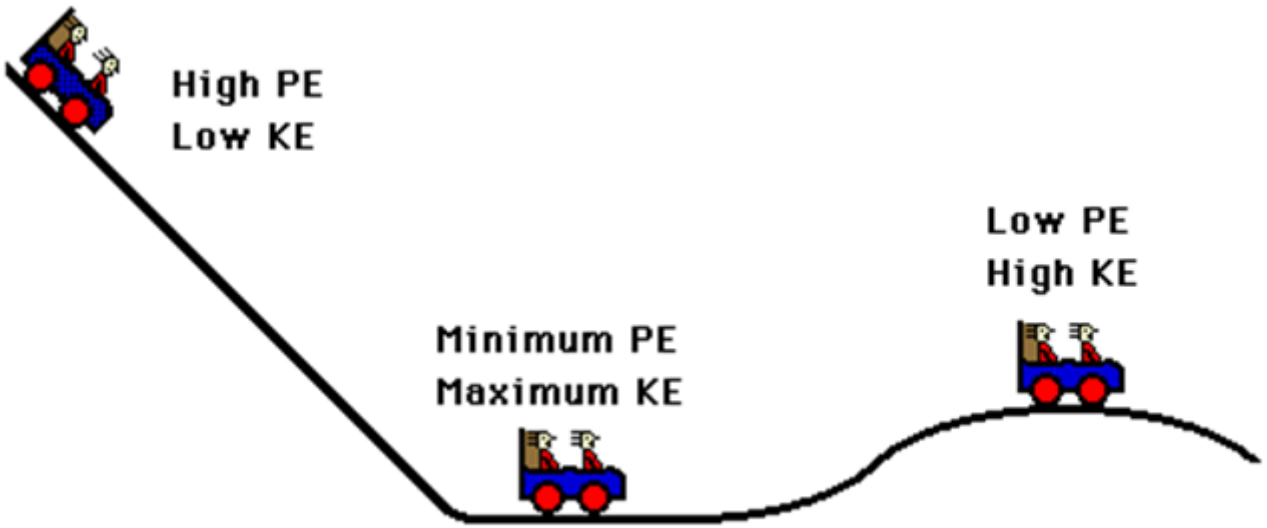
- Examples:
- Ball is thrown up in the air after leaving thrower's hand
- "gravity rides" like roller coaster
- pendulum swinging

$$E_T = E_g + E_k$$

OR

$$E_{g1} + E_{k1} = E_{g2} + E_{k2}$$

Examples: Roller Coaster



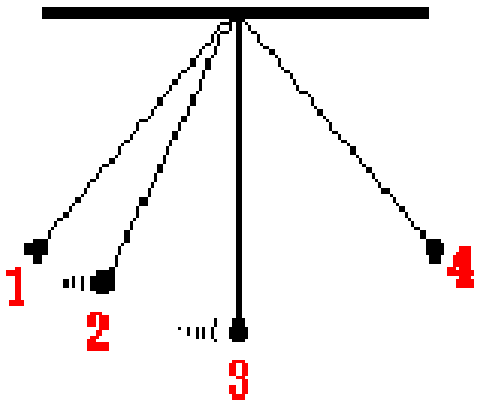
As the car falls it loses _____potential_____ energy and gains ____kinetic____ energy

As the car rises it loses _____kinetic_____ energy and gains _____potential_____ energy

The SUM of the kinetic energy and potential energy is ____constant_____.

Example 2: A Simple Pendulum

Assume the pendulum is released from rest from position 1



Position 1
PE = 6 J
KE = 0 J

Position 2
PE = 4 J
KE = 2 J

Position 3
PE = 0 J
KE = 6 J

Position 4
PE = 6 J
KE = 0 J

Energy is converted between Potential Energy and Kinetic Energy but the TOTAL ENERGY is CONSTANT!!

Problem: A 0.550 kg ball is thrown down from a cliff 30.0 m high with a speed of 5.00 m/s. Assume air resistance is neglible.

Find:

a) The ball's initial kinetic, gravitational potential and total mechanical energy.

b) Find the ball's potential energy at a height of 10.0 m above the ground and it's kinetic energy at that height.

c) Find the ball's speed just before it hits the ground.

Ans: 1.a) E_{k1}=6.88 J, E_{g1}=162 J E_T=169 J

b) E_{g2}= 54.0 J, E_{k2}= 115J

c) v_{final} = 24.8 m/s