Potential Energy

Energy associated with forces that depend on the location of an object

Potential Energy

- “Stored energy of position”
- Examples
- 1. Gravitational: skier at the top of mountain, rollercoaster, skydiver, water tower

- 2. Compressed spring: spring, wound-up clock, wind-up toys such as “energizer bunny”

Gravitational Potential Energy

- PE(gravitational) = m x g x h
- h is the vertical height
- The higher an object is above the ground, the more gravitational PE it has.
- The Force of Gravity “restores” the position of the object back to the surface of the earth.

Example

- On my birthday I go skiing up in the Catskills at Windham. I ride the chairlift to the top of Windham Mountain. How much PE do I have at the top of the mountain?
- PE(gravitational) = m x g x h
- = 80 x 9.8 x 1000
- = 784,000 J
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Example

- A mass of 2.0 kg is lifted to a height of 10 m above the surface of the earth. Calculate the change in PE of the object.
- PE(gravitation) = m x g x h
- = 2 x 9.8 x 10
- = 196 J

PE of compressed spring (sometimes called “elastic PE”)

- PE(spring) = ½ k x^2
- x is the displacement of the spring from its equilibrium position in meters.
- K is the spring constant (N/m)

Example

- A spring whose constant is 2.0 N/m is stretched 0.40 m from its equilibrium position. What is the increase in the PE of the spring?

- PE(spring) = ½ k x^2
- = ½ (2) 0.4^2
- = 0.16 J

Group Activity

- 1. A 3 kg rock is raised 5.0 m above the ground. What is its change in PE?
- 2. A 20 N block of wood falls freely from rest from a point 3 m above the ground. With respect to the ground, what is its PE after the block has fallen 1.5 m?

  3. A spring with a spring constant of 200 N/m is stretched 0.2 m? How much PE is stored in the spring?

Group Activity

- 4. What is the spring constant of a spring that gained 8 J of PE was a result of being compressed 0.4 m?
- 5. Given a spring with spring constant of 500 N/m. The spring is compressed 10 m and so now how much PE is stored in the spring?