Name _____ Class _____ Date _____

Potential Energy

Energy is defined as the ability to do work.
In the toy car lab, the spring was compressed, waiting for you to release it, it had potential energy. The spring was stationary, but work had been done on it to move it to its present position. Now, we know that the farther we compress a spring, the faster and farther the toy car will displace.
Potential energy is energy of position, not of motion. The amount of potential energy possessed by an object is proportional to how far it was displaced from its original position. If the displacement occurs vertically, raising an object off of the ground, we call this gravitational potential energy.
We can calculate the gravitational potential energy of an object with this formula:

gPE = weight x height or gPE = mgh

An increase in the weight of an object or the height to which it is raised will result in an increase in the potential energy the object possesses. Once the object is dropped, the potential energy begins to decrease due to reduced height.

Sample Problem

A 3.7kg object is lifted to a height of 3 meters. What is the potential energy of this object?

1. Identify the information given to you in the problem:
    - mass = 3.7 kg
    - height = 3 meters
2. Insert the information into the gravitational potential energy formula:
    - gPE = weight x height
    - gPE = mg X height
        - gPE = 3.7kg(10m/s/s) x 3 meters
        - gPE = 37 N x 3 meters
        - gPE = 111J

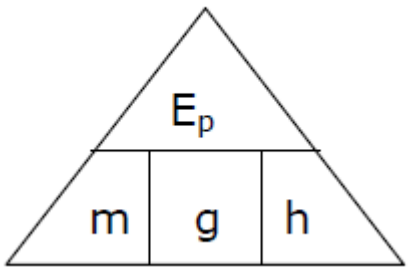
Sample Problem

A 30 kg child climbs 15 meters up a tree. When he stops to have a look around, what is the child's potential energy?

1. First we identify the information provided in the problem:
    - mass = 30 kg
    - height = 15 meters
2. Right away, you should note that you are not given the weight of the child, but rather the mass. First you must convert the child's mass to his corresponding weight on Earth.
    - weight = mass x gravity
    - weight = 30 kg x 10 m/s^2
    - weight = 300 N
3. Now, insert the information for weight and height into the gravitational potential energy formula:
    - GPE = weight x height
    - GPE = 300 N x 15 meters
    - GPE = 4450J

Problem Solving

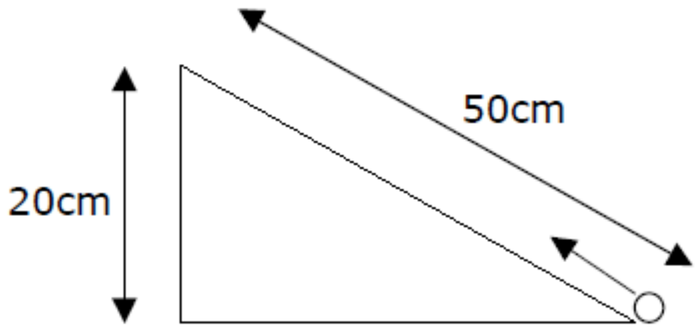
You might want to use this triangle to help you with questions involving potential energy.



Example 1:
A box has a mass of 5.8kg. The box is lifted from the garage floor and placed on a shelf. If the box gains 145J of Potential Energy (Ep), how high is the shelf?

Example 2:
A man climbs on to a wall that is 3.6m high and gains 2268J of potential energy. What is the mass of the man?

Example 3:
A 800g ball is pulled up a slope as shown in the diagram.
Calculate the potential energy it gains.
Note: In potential energy problems we are only interested in vertical distances



Answers:
Solution 1: The shelf is 2.5m high
Solution 2: the mass of the man is 63kg.
Solution 3: The ball gains 1.6J of potential