1.5 Kinetic Energy and gravitational potential energy:

We previously defined energy as the ability to do work, or the amount of work you have to do to attain that energy. We introduce two kinds of energy here. Gravitational potential energy, the kind of energy that a rock has sitting at the top of a cliff:

$E_{gp}=mgh$

Exercise 1: you have two rocks: rock A and Rock B. Rock A has twice the mass of rock B, *and* is also twice as high off the ground as rock B. What is the ratio of the energies of rock A to rock B?

Kinetic energy is:

$E_K=\frac{1}{2}mv^2$

Exercise 2: you have two rocks: Rock A has twice the mass of rock B, *and* is also twice the speed as rock B. What is the ratio of the energies of rock A to rock B?

Because energy is conserved, these formulas make it easy to find the speed of a falling object as a function of how high it is: the loss of potential energy is the same as the gain in kinetic energy and vice versa. Well this is easy if there are no other energy transformations. In real life, friction often turns some of the mechanical energy into thermal energy, and we must account for the heat loss by subtracting it from the mechanical energy.

Exercise 3: You have two rocks dropped from the same height. Rock A has twice the mass of rock B. What is the ratio of their speeds when they hit the ground?

Exercise 4: You have two rocks of equal mass. Rock A is dropped from twice the height as rock B. What is the ratio of their speeds when they hit the ground?

The unit of energy is the same as the unit of *work* is the ***Joule*** after James Joule. $J = kg*m^2/s^2$.

Exercise 5: verify using both formulas above that the unit of gravitational potential energy is the same as that for kinetic energy is the *Joule*.

Exercise 6: I throw a rock upward with an initial speed of *20 m/s.*

- How high does it get?
- What is its speed when it is *10 m* high?