Name: _____ Date: _____

## $m_r^\beta$ Physics Practice: Work, Energy, and Conservation of Energy (CoE)

When work is performed on an object, its energy changes. The type of energy depends on the situation. If the work changes the object's speed, the object's kinetic energy changes. If the object moves to a different energy level in a gravitational field, potential energy changes. If there is friction, some of the work heats the object.

Previously, we found that lifting an object with mass $m$ to a height $h$ above the surface of the earth (for $h$ small relative to the size of the earth) requires work equal to the gravitational force $F = mg$ times the height $h$. So work $W = mgh$. The units of work can be expressed as the units of force times the units of distance, so typical metric units of work (and therefore energy) are N·m, also known as *Joules* (J).

**1.** If we lift a 3kg object from the ground, and set it on a shelf 2m high, what kind of energy changed? What was the change in energy?

**2.** If the object is nudged off the shelf, it falls to the ground, accelerating at 9.8 m/s/s. After $t$ seconds, it will have fallen $\frac{1}{2}(9.8)t^2$ meters.

a. How long will it take the object to hit the ground?

b. How fast is it going just before it hits the ground?

**3.** Let's generalize the previous problem. An object begins falling, accelerating toward the ground at rate $g$. Assume for now that air friction is negligible. When the object has fallen $h$ meters,

a. How long has it been falling?

b. How fast is it falling?

c. When the object began falling, it started trading potential energy for kinetic energy. When it has fallen $h$ meters, how much potential energy has been converted to kinetic energy?

d. Find an expression for kinetic energy in terms of mass $m$ and speed $v$.