Regents Physics Worksheet **Name**_____

Conservation of Energy Problems

Directions: Answer all the of the following problems on a separate sheet of paper.

All of the problems on this worksheet include some sort of energy loss during the motion of the object in question. Remember: $E_{Ti} - \text{Losses} = E_{Tf}$. The initial total energy (E_{Ti}) is still determined by whatever kinetic and potential energies the object has at the start of the problem. Losses are generally the work done against (or by) friction. Sometimes those losses are due to other circumstances other than friction (i.e. elastic heating as a ball compresses from a collision, the sound given off by the collision, etc.) If there are multiple parts to a problem, the final total energy (E_{Tf}) becomes the new total energy for the rest of the problem (or at least for the next part of the problem).

1. A spring (k = 624 N/m) is used to shoot wooden pucks across an icy surface (essentially frictionless). In the middle of the surface there is a sandy stretch that is 1.25 meters wide. The coefficient of friction on the sand is 0.150. The pucks have a mass of 0.700 kg. The spring is compressed 0.150 meters with a puck then released.
   A) What is the total available energy before the puck is released?
   B) How fast is the puck moving after being thrust by the spring?
   C) How much work is done by friction on the sandy surface?
   D) How fast is the puck moving on the other side of the sandy surface?

2. A cart (m = 2.40 kg) is released from a height of 1.50 meters on a ramp that goes to a flat carpeted surface. The ramp is 3.80 meters long. On the ramp the cart experiences a force of friction of 2.25 Newtons. On the carpet, friction increases to 4.95 Newtons. The cart is pushed so that at the top of the ramp it has a velocity of 3.00 m/s.
   A) What is the initial total energy?
   B) What is the velocity of the cart at the bottom of the ramp?
   C) How far on the carpeted surface does the cart travel before coming to a stop?

3. A cart (m = 3.75 kg) is rolling at 2.80 m/s on a flat platform that is 2.10 meters above the ground. At rolls off the end of the platform onto a 4.00 meter long ramp, then onto a very ultra smooth surface. While on the ramp the cart experiences a force of friction of 5.70 Newtons. On the smooth surface is a spring with an elastic constant of 1.290×10^3 N/m.
   A) How fast is the cart moving at the bottom of the ramp?
   B) How far is the spring compressed as the cart slams into it?

4. A ball (m = 0.250 kg) is dropped from a height of 6.00 m. It experiences an average force of air friction of 0.875 Newtons. When it bounces the ball loses 10% of the energy it currently has.
   A) What is the ball's total energy before it drops?
   B) How fast is the ball traveling as it first strikes the ground?
   C) How fast is the ball traveling as it leaves the ground?
   D) How high will the ball rise to? (Remember: it experiences air friction on the way back up too!)
   E) **Extra Credit:** How many times does the ball bounce? (5)