Unit IV Energy Addendum - Inertia-Newton's 1st Law

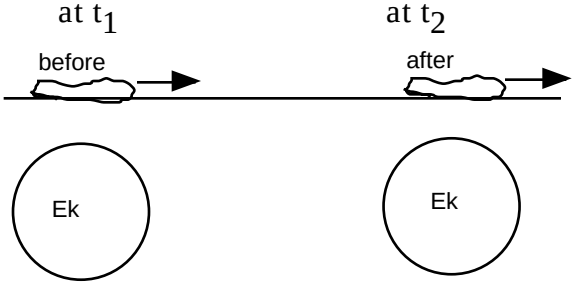
Lab: dry ice block sliding across floor (or balloon puck)

Leading Questions:

1. dry ice sitting on surface, not moving
- What energy is (are) involved in the ice just sitting there?
  (none-not moving, no gravitational potential, no dissipation(if sublimation is ignored at this point)

2. Now push dry ice along surface so it glides at constant velocity on surface
- Now what energy is involved?
  (energy of motion)
- Do the corresponding pie charts for Before and After (Before and After are both AFTER the push has occurred-comparing energies at different times while gliding):

Assign system: dry ice + table top



- Where does the energy come from originally?
  (the push given to the block- an external force-outside the system)
- Why is there no change in the pies? (no change in energy)
  (no friction-no dissipation-no "loss" of energy-all is still in motion)
- What would you have to do to cause the circles to be bigger?
  (push it with more force! or push for more time, so it goes faster-more E_k)

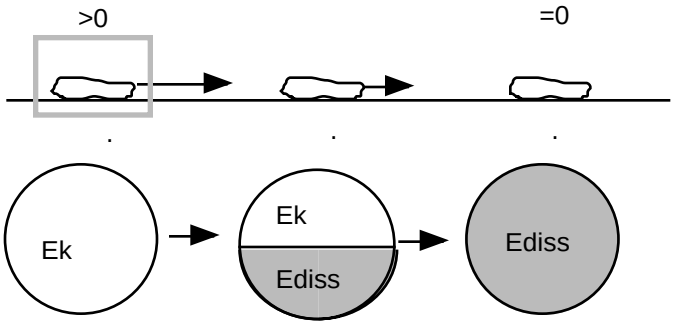
3. Repeat sliding motion - this time apply force sideways, so direction of block changes, but should be approximately same speed.

- What happened to the energy of the motion? What would change on the pie charts?
  (no change in energy-only a change in direction. Maybe a slight dissipation due to the contact when applying the force, **or** it could increase speed of block, so energy increases. Circle gets bigger in that case.)
- How are energy and direction related?
  (aren't related-energy is not a vector quantity)

4. Push puck on rougher surface, or somehow arrange so puck glides due a stop due to friction.

- What energy interactions are involved in the process?
  (E_{motion} to start, then energy is dissipated by friction, and motion reduces)

Pie Charts:



Analysis:

1. There are several important concepts in energy that arise from analyzing the motion of the dry ice. These concepts integrate very nicely with Newton's 1st Law, which is the goal of this unit:

- If there is no force to change the motion of the object, there is no change in the energy of the object. (no dissipated energy-no friction)
- Energy is not a directional quantity, but force is. A force can change the direction of an object with essentially no change in the energy of the object.
- An external force will change the motion of an object. When a force reduces the energy of motion of the object, energy is dissipated in the system.

2. This is a good place to start introducing the idea of transferring energy to a system via an external force, since the object had no energy until a force was applied to it. The pie chart could then be expanded to include a dot to represent the energy of the object *before* the force was applied, and then represent the energy transferred by the external force: