Problem Set 7: Motion With Dissipative Forces, Potential Energy, Conservation of Energy

Design Engineering Challenge: "The Big Dig" 2.007 Contest
Hockey Puck Handling Concepts

For the Spring 2004 contest table ("The Big Dig", see http://pergatory.mit.edu/2.007), assume that we have decided on a strategy to move the hockey pucks with a vehicle, but now we have to decide between the concepts that the vehicle could employ:

1. Draw the FBD for a two-wheel drive car, which is simple to build.
2. If the car's mass is located in the center midway between the wheels, given a coefficient of friction m between the wheels and the table, what would be the maximum force with which the car could push an object? This is called the *tractive* effort.
3. The hockey pucks can be rolled into position if handled carefully, but if they tip over, they will have to be pushed. Draw the FBD of the vehicle as it *pushes* a hockey puck, and as it rolls a hockey puck.
4. Is their anything special about the contact between the vehicle and the hockey puck to ensure low friction rolling at *all* contact interfaces?

OR you are not really happy with the vehicle idea, and instead want to try a concept where a scoop engages the hockey pucks and flips them up into the bins:

1. How much kinetic energy must be imparted to the hockey pucks in order to make them fly into the paddles without touching (and hence losing energy) the ramp?
2. What elements of the 2.007 kit of parts could store and suddenly release energy to enable them to flip up the hockey pucks? Estimate if they can store enough energy to accomplish this goal. How many pucks could they flip up?
3. Do you think this is a feasible idea? What are the risks and possible countermeasures?