Midterm #1, 121, Schwartz Name____________________________

From the syllabus: In order to achieve an "A": Consistently

- correctly identifies underlying physics concepts,
- sets up problem with good drawing and reasons,
- formulates method to solve problem,
- correctly uses units and
- verifies whether answer makes sense.

An answer alone is worth no credit. Please estimate answers: don't leave them in roots, trig., fractions.

Very important. Many people didn't get concepts
From the timeline for week 4, day 3, I have:
My take on how to know which lens you're to use:
1) Energy: When there is a before and after that converts energy. Such that everything you're interested in (like height and speed) have a corresponding energy term (like PE and KE).
2) momentum: When there is an interaction between two objects, such as a collision, or an "inverse collision" when one object pushes or pulls on another object. Especially important if motion of both bodies are to be considered (as opposed to when the earth pulls on your body, when we really don't consider what happens to the motion of the earth).
3) Dynamics: if there are forces and energy.
4) Kinematics: when everything in front of you has to do with displacement and the time rates of change. In particular, you already have these equations, and don't have to figure them out by examining forces, momentum, or energy.
....as we examined in class, some interactions require more than one lens - such as which curved frictionless track brought the ball to the end in the shortest amount of time. We need to consider energy (or dynamics) to compare their speeds, and then kinematics to compare times from speeds.

1) Jane (50 kg) standing on a tree limb spots Tarzan (100 kg) down below, and it's not going well for him, standing motionless among a group of hyenas. She rescues him by grabbing a frictionless vine and swinging down from the limb she is on, in a circular arc like on a swing. At the bottom of her swing, she's moving at 12 m/s horizontally, and runs into Tarzan with a *THUD* and proceeds to hold him with one arm while holding the vine with the other arm.
   a) How high did she jump from? energy (gravitational potential energy is changed to kinetic energy at the bottom, so you can find her speed before the collision) ~ 7m
   b) How fast are the two of them going after she grabs him? momentum (inelastic collision – momentum is conserved, but not mechanical energy).3 m/s
   Is mechanical energy (KE+PE) conserved in this process? If so, how do you know? If not, what portion of the energy is lost?) Energy: many different ways you could do this. The most obvious one is to calculate the potential energy of Jane before, and the kinetic energy of the two of them after the collision. 2/3

2) A 2000 kg truck has an engine that accelerates it from 20 m/s to 40 m/s in 5 seconds.

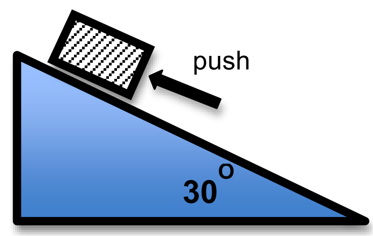
a) Find the truck's average acceleration. Kinematics allows us to find the acceleration with speed and time, 4 m/s^2

b) Find the average force that the wheels must provide. dynamics allows us to find force given mass and acceleration 8,000 N

c) Find the work done by the engine in this 5 seconds. Work and energy. We can use work is change in energy, or work is force times distance. 1.2 x 10^6

d) Find the average power the engine provides during this 5 seconds. Energy because power is d(energy)/dt, or P=F*v (dot product) 240 kW (like 320 HP?)

3. A 10 kg object is shown on a frictionless surface.



a) If I push on the box up the hill with a force of 70 N, what is the box's acceleration? Dynamics because we're dealing with forces and acceleration. Follow "the protocol" ~ 2m/s^2

b) What is the normal force acting on the box? Dynamics because we're dealing with forces and acceleration. Follow "the protocol" ~ 87 N

4) I throw an object directly upward at 15 m/s, it leaves my hand at an elevation of 10m above the ground (I'm in a tree) and it lands on the ground and stays there. Please graph the velocity, displacement, and acceleration at right. Kinematics because everything has to do explicitly with displacement and the time rates of change. It gets to about 21 m in height, and comes back down, no? What happens when it hits the ground?