Problem Set #2 due beginning of class, Monday, Oct.6. – 85 pts total
Remember to carry units throughout the equations, remember to draw a good picture.

#1 (25 pts) Provide graphs of your movement as a function of time – displacement-t, velocity-t, acceleration-t, net force-t, kinetic energy-t, power-t. What is the maximum power that you provide?

#2 (20 pts) Cars. Let's say I drive a 1000 kg (with me in it) car that can put out a constant force of 5000N!

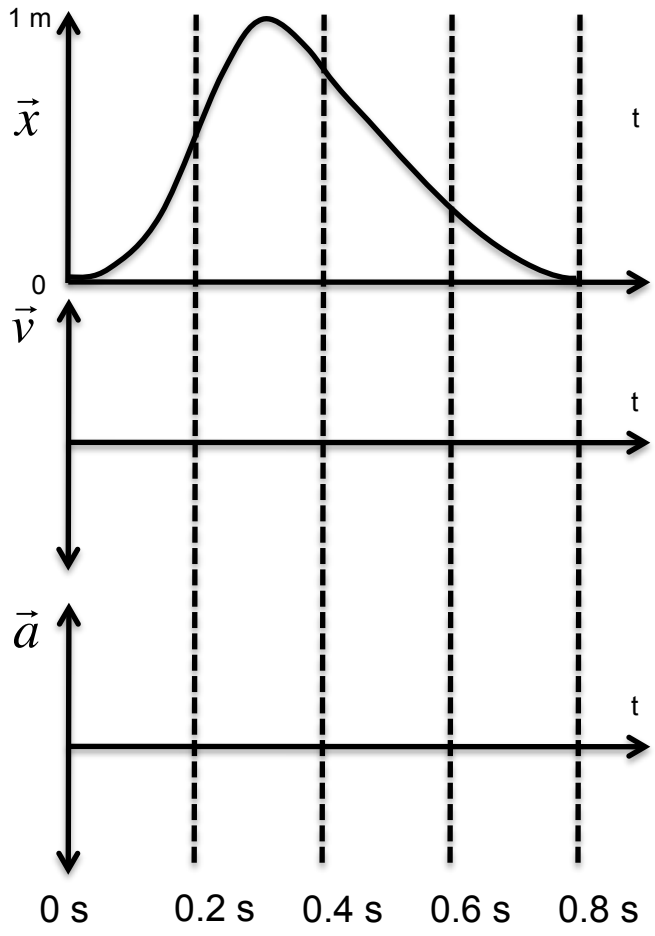
a) Assume there are no friction forces acting on the car other than that providing traction (impossible), and the car could provide this force at all speeds, how long would it take me to get to 30 m/s? ** Is this very fast?
b) Find the average power that the engine put out during the acceleration time, and the instantaneous power it is putting out at 30 m/s.
c) I hit a 2000 kg car, sticking to it. How fast am I moving immediately after the collision?**
d) Compare the final work of the slowing of the cars with the initial work of getting the car moving. And explain your answer.** ** If energy is lost, where did this happen, and where did it go?
e) After the collision, the locked up wheels provide 10,000 N of force to slow us down, how long are the skid marks?**

#3 (10 pts) In the last problem set, you dropped a 10 kg box from 50 meters and it hit the ground at ~32 m/s. This time, you throw the box downward with an initial speed of 32 m/s. What is the speed when it hits the ground.

a) Please first do the analysis for **
b) Find the speed that it has when it hits the ground.
c) What if I throw it upwards at 32 m/s, what is the speed when it hits the ground?
d) What if I throw it straight off the cliff at 32 m/s horizontally, what is does it have when it hits the ground now?
e) Can I throw a 10 kg box at 32 m/s?

#4 (20 pts) See the graph at right of displacement of a 5 kg mass moved by a motor back and forth between x = 0 and 1 m. One period of the motion is shown.

a) **Please make the corresponding graph of velocity as a function of time. Make sure you label the axis so that we have an idea of what the actual velocity is. Write a short story of what is happening with speed and correlate it back to the displacement graph to make sure it makes sense.
b) Graph acceleration as a function of time. Then make a statement about the curvature of the displacement at different times. Write a short story of the acceleration and correlate it back to the displacement graph.
c) Make a graph of the force on the object as a function of time.
d) Also make a graph of the kinetic energy as a function if time.
e) Circle the point on your E-t graph indicating the greatest power output of the motor driving the part. Estimate the maximum power output.



#5) (10 pts) The velocity of an object is $v = 5\ m/s - (3\ m/s^2)t + (0.2 m/s^3)t^2$

a) **Find an expression for the acceleration as a function of time.
b) Calculate the acceleration at 6 s.
c) If it starts at 10 m, please find an expression for the displacement as a function of time.
d) Calculate the displacement at 6 s.