Chapter 6 Written Homework Problems
DUE: February 24 at the beginning of class
SHOW ALL WORK FOR FULL CREDIT

1. A pallet of shingles weighing 2000 N is held above the ground at the end of a 20 m long cable attached to a crane. A worker pushes the pallet sideways by 1 m from the vertical and holds the pallet in place. *(a)* What force is exerted by the worker holding the pallet in place? *(b)* How much work is required to hold the pallet in place? *(c)* If work was required to move the pallet sideways how much work was required? *(d)* How much work is done on the pallet by the cable tension?

2. Use work and kinetic energy considerations to find the minimum stopping distance for a car of mass m with anti-lock brakes traveling with an initial speed of v_i. Assume an appropriate frictional force for the tires on the road surface and leave all quantities in algebraic form. If one doubles the initial speed of the car by how much does the stopping distance increase?

3. A mass m at rest is accelerated to a final velocity, $\boldsymbol{v_f}$, in time t_f. Assuming constant acceleration, *(a)* What is the work that is done on the mass *as a function of time* in terms of the final speed v_f at time t_f? *(b)* What is the instantaneous power delivered to the mass as a function of time? A top-fuel dragster weighs 2300 pounds and can accelerate from rest to 100 mph in 0.8 s. *(c)* Assuming uniform acceleration, what is the instantaneous power being delivered to the dragster at the end of 0.8s, in units of both watts and horsepower?

4. An amount of work W_1 is required to stretch spring with spring constant k_1 a distance d. An amount of work $2W_1$ is required to stretch spring with a spring constant k_2 a distance $d/2$. What is the ratio of k_1 / k_2?

5. An accelerator is used to bring a proton to a velocity of $1.60\text{x}10^6$ m/s. The proton is then directed for a head-on collision with a stationary americium nucleus. The proton is 1 m from the americium nucleus when its velocity of $1.60\text{x}10^6$ m/s and is repelled with a force, $\boldsymbol{F}$, having a magnitude $F = C/x^2$, where x is the distance between the proton and the nucleus and C is a constant with a value of 2.19×10^{-27} N-m^2. The repulsion is due to the fact that the proton and americium are both positively charged and like-charges repel one another. The mass of the proton is $1.67\text{x}10^{-27}$ kg. Assume the americium nucleus remains at rest. How close is the proton to the americium nucleus when it momentarily comes to rest?

6. In the Earth's gravitational field a mass m is moved slowly from the bottom of a vertical circular track to a height $h < R$ as shown in the Figure. Show that the magnitude of the work done on the object due to friction is $\mu mg(2hR - h^2)^{1/2}$, where μ is the coefficient due to friction between the mass and the track.