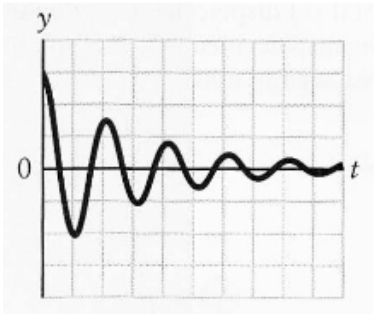
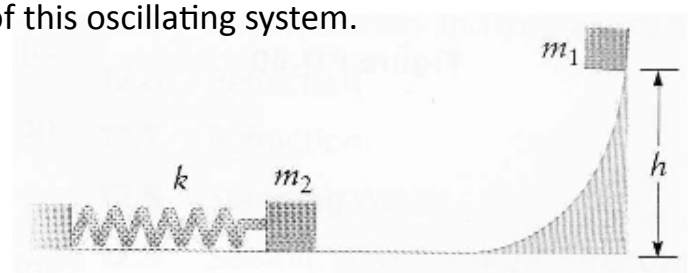
PHYS 1410 (3/19/13)

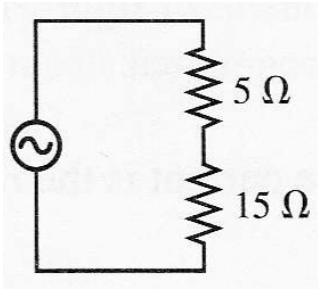
Problem 1: The figure below shows the displacement as a function of time for a harmonic oscillator. (a) Estimate the fraction of the mechanical energy that is "lost" to friction during one cycle. (b) How does this change with time? (c) Is the system overdamped? Why or why not?



Problem 2: A mass of 3.4 kg is released down a frictionless slope from a height of h=2.0 m. When it reaches the bottom of the slope, it undergoes a completely inelastic collision with a mass of 1.1 kg attached to a spring of spring constant k= 5.0 kN/m as shown in the figure. The combined mass then undergoes periodic motion. Calculate (a) the maximum velocity, (b) the frequency, (c) the maximum amplitude, and (d) the period. (e) Determine expressions for position as a function of time and velocity as a function of time for the combined mass of this oscillating system.



Problem 3: Consider the AC circuit where $V(t) = V_o \cos(\omega t)$, V_o =100 V and a frequency of oscillation of 60 Hz. (a) What is the peak voltage across each resistor? (b) Describe two ways to determine the instantaneous resistor voltages at t = 20 ms.



Problem 4: An object on a spring oscillates with a period of 0.80 s and an amplitude of 10 cm. At t = 0 s, it is 5.0 cm to the left of equilibrium and moving to the left. (a) What are its position and direction of motion at t = 2.0 s? (b) What about at t= π/5?