Physics 262, Exam 1, March 5, 2002, Dr. Baden

Please do all problems, and show your work clearly. Credit will not be given for answers with no work shown. Partial credit will be given.

Problem 1 (20 points). A mass of **1.50kg** stretches a vertical spring **0.315m**. The spring is then stretched an additional **0.130m** and released.

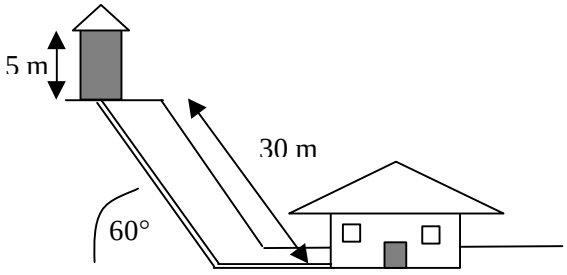
a) What is the frequency of the oscillation?
b) At what time $\mathbf{t_1}$ after release does the mass reach the equilibrium position?
c) What is the maximum velocity of the mass?
d) Calculate the maximum extension (amplitude)?
e) What is the total kinetic and potential energy at **t=0** sec?
f) What is the total energy at $\mathbf{t=t_1}$ sec?

Problem 2 (20 points). At 0.5m away, a normal conversation will register approximately 65dB on a dB-meter. Assume that the power is radiating outwards from a person's mouth uniformly over a hemisphere. Calculate

a) The power output of the speaker, in watts.
b) How many people would be required in order to produce a total sound output of 100W of ordinary conversation?

Problem 3 (20 points). A house at the bottom of a hill gets its water from a cylindrical water tower. The tank is always full of water, is **5m** deep (height) with a diameter of **2m**, and is connected to the house by a **5cm** diameter pipe that is **30m** long at an angle of **60°** from the horizontal. The first floor is located **3.1m** above the main floor, and has a bathroom that has a faucet in the sink. The faucet is **1m** above the floor, and the faucet has a **1cm** diameter.

a) Calculate the water pressure at the 1st floor bathroom faucet.
b) If water comes out of the faucet at **1.2kg/sec**, how long will it take to empty the water tower?



Problem 4 (20 points). A rectangular tub made of a thin shell of poured cement has length **L=80cm**, width **W=120cm**, and depth **D=50cm** and mass **M=200kg**. 3 people of mass **80kg** each are standing in the tub. How far below the surface of the water will the bottom of tub reach?

Problem 5 (20 Points). A **2m** rope hangs from the ceiling. The rope has a mass of **50grams**, and there is a **25kg** mass attached to the end of the rope. If you bang on the mass with a hammer, it will send a pulse up the rope, the pulse will be reflected at the rope/ceiling boundary, and travel back to the mass. How long will the round trip take for the pulse? (Ignore the mass of the rope when calculating any Tensions.)