PH351 – Problem set 5. Due Monday, October 31

0. Make sure that you know how to do the problems from homework set 4!

1. Consider the average energy <W> in a driven oscillator. Show that this energy is mostly potential energy when $\omega << \omega 0$ and is mostly kinetic energy when $\omega >> \omega 0$, while it is an equal mixture of potential energy and kinetic energy when $\omega = \omega 0$.

2. A driven LCR circuit obeys the equations

$$L\ddot{Q} + R\dot{Q} + Q/C = V_0 \cos \omega t$$

and

$$f_0 = V_0 / L$$

$$\omega_0^2 = \frac{1}{LC}$$

$$\gamma = R/L$$

Find the complete solution for Q(t) given the initial conditions Q(0) = 0 and dQ(0)/dt = 5 Cs^{-1}. Take $\omega = \omega 0 = 100\ s^{-1}$, $\gamma = 1\ s^{-1}$, f0 = 3 Cs^{-2}. ("C" here stands for Coulombs of charge.) Note that the steady state solution is particularly simple for $\omega = \omega 0$. If you use this simplification, you won't get too bogged down with algebra.

3. Do Problem 3.3 in the text (Pain, The Physics of Vibrations and Waves)

4. Do Problem 3.4 in the text.