Classical Mechanics - PHYS 310 - Fall 2013 HW # 4
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Please return it by the 20th of September 2013

- **Problem 1** A simple harmonic oscillator consists of a 150 g mass attached to a spring whose force constant is $10^4 dy/cm$.the mass is displaced by 2.5 cm,and released from rest. Calculate (a) the natural frequency ν_0 and the period τ_0. (b) the total energy and the maximum speed.

10 points

- **Problem 2** Allow the motion in the preceding problem to take place in a resisting medium, After oscillating for 8 s,the maximum amplitude decreases to half the initial value. Calculate (a) the damping parameter β. (b) the frequency ν_1 and compare it with the undamped frequency (c) and the decrement of the motion.

10 points

- **Problem 3** The oscillator in the problem 1 is set in to the motion by giving it an initial velocity 2 cm/s at its equilibrium position. Calculate (a) the maximum displacement and (b) the maximum potential energy..

10 points

- **Problem 4** Consider a simple harmonic oscillator. Calculate the time averages of the kinetic and potential energies over one cycle, and show that these quantities are equal. Why is this a reasonable result. Next calculate the space averages of the kinetic and potential energies. discuss the results.

10 points

- **Problem 5** Two masses $m1 = 90g$ and $m2 = 160g$ slides freely in a horizontal frictionless track by a spring whose force constant $k = 0.5N/m$. Find the frequency of oscillatory motion for this system. Can you explain this motion.

10 points

- **Problem 6** In class we proved the solution of the critically damped oscillator to be $x(t) = (A + Bt)e^{-\beta t}$. Show that $x(t) = Bte^{-\beta t}$ satisfy the equation of motion for the critically damped oscillator.

10 points