

PHYS 2022 - Homework 5
Due Wednesday, February 24, 2010.

Problems:

1. If the length L of a free un-damped mathematical pendulum is increased by ΔL ($\Delta L \ll L$), what is the relative change ($\Delta T/T$) in its period T ? Use differentials (i.e. $\Delta L = dL$, $\Delta T = dT$) and differentiation to solve this problem.
2. French 3-1
3. French 4-15
4. Particles of mass m are introduced at $t=0$ with very small initial velocity into a field that exerts on them the force $F_0 \sin \omega t$. (Note that, in the absence of the external force, the particles are free and would not oscillate. This is like a mass on a spring but without the spring!) Find the velocity of the particles after time t . What is the time-averaged speed of the particles? At what distance from the source does the velocity reach its maximum value? Sketch the position of the particles $x(t)$ and their speed $v(t)$. Repeat for when the particles are introduced at time $t = \pi/\omega$.
5. A heavy bowl in the shape of a semi sphere of radius R is laying on a table. A small ball of radius r is free to roll inside it. Find the frequency of small oscillations of the ball.