

Physics 106A - Classical Mechanics  
Presentation Problem #2  
For Tues., Oct. 17 2000

Assigned to group 2: Wozny, Kohler, Bandeh-Ahmadi, Cheng, Williams, Guskin, Madhau

*Prepare the answer to this problem for presentation to the class. It is your goal not only to solve the problem yourselves, but to explain the solution clearly, in such a way that your colleagues will understand. Be prepared to discuss your reasoning.*

These problems illustrate conservation laws.

1. A simple pendulum consists of a point mass  $m$  suspended from a massless rod. The support point of the pendulum is driven rapidly up and down with a vertical motion described by:

$$A \cos \omega t$$

where  $A$  and  $\omega$  are adjustable constants.

A. Write down the Lagrangian for the system.

B. Derive the equation of motion.

C. Is the Hamiltonian  $H$  constant? Is  $H$  the total energy? What can you say about conservation of energy?

2. Invent a concrete example (one we have not discussed in class) of each situation:

A.  $H$  is conserved but  $H \neq E$ .

B.  $H = E$ , but  $\frac{dH}{dt} \neq 0$ , so  $H$  is not conserved. In the case you make up, explain physically what the reason for nonconservation of energy is.