PHY 501 **Classical Mechanics** Fall 2006

Homework 01

(due Friday September 22)

For each of the systems listed below,

(a) introduce convenient generalized coordinate(s) q_j,

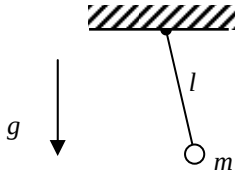
(b) write down the Lagrangian L as a function of $q_j, \dot{q}_j$ and (if appropriate) time,

(c) write down the Lagrangian equation(s) of motion,

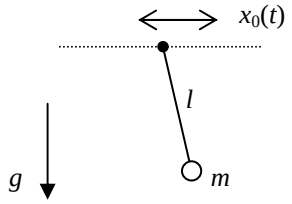
(d) calculate the Hamiltonian H; find whether it is conserved,

(e) calculate energy E; is $E = H$?; is energy conserved?

Problem 1.1. (Graded of 10 points). A stretchable pendulum (i.e. a mass on a spring which exerts force $F = -k(l - l_0)$, where k and l_0 are positive constants) confined to a vertical plane:



Problem 1.2. (10 points.) A fixed-length pendulum hanging from a horizontal support whose motion law $x_0(t)$ is fixed. (No vertical plane constraint here.)



Problem 1.3. (10 points.) A block of mass m that can slide, without friction, along the inclined surface of a heavy wedge (mass M). The wedge is free to move, also without friction, along a horizontal surface. (Both motions are within the vertical plane.)