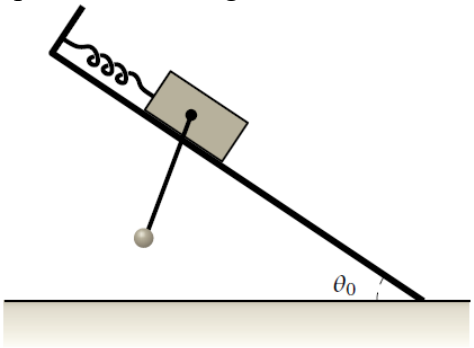
A block of mass M slides along a frictionless surface that makes an angle of θ_0 with the horizontal as shown below. The block is attached to a spring of rest length L and spring constant k. Hanging from the block is a pendulum of length l and mass m.



a. Define a set of Cartesian coordinates and express the position of the block and the mass in these coordinates.
b. Identify the constraints and the equations of constraint for this system. Are the constraints holonomic? How many degrees of freedom does this system have?
c. Write down the kinetic and potential energy for the system in the Cartesian coordinates you've chosen.
d. Pick a set of generalized coordinates (that obey the constraints) and express the kinetic and potential energy in the generalized coordinates.
e. Find the Lagrangian for the system and the equations of motion for the block and the pendulum bob using your chosen generalized coordinates.