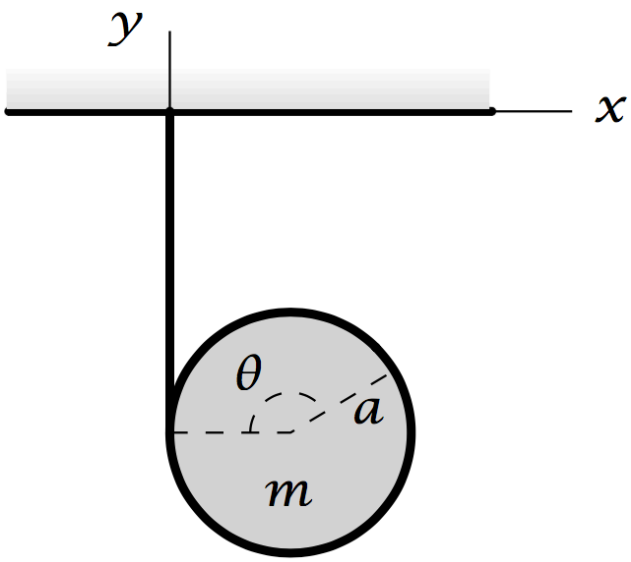
A string that is attached to a fixed support point is wrapped around a disk of radius a and mass m as shown below. The disk is allowed to fall from rest, and falls straight down. The moment of inertia of the disk about its center of mass is $I = \frac{1}{2}ma^2$.



a. Using the coordinates shown, find the Lagrangian and the equation of constraint.
b. Using the Lagrange multiplier method, find the equations of motion and the forces of constraint.
c. In this case you can easily integrate the equations of motion. Do this to find the equations for the motion of the disk $y = y(t)$ and $\theta = \theta(t)$.