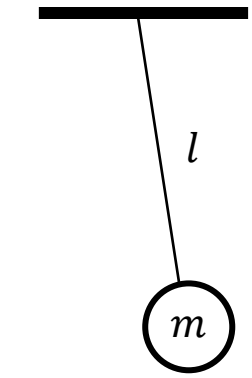
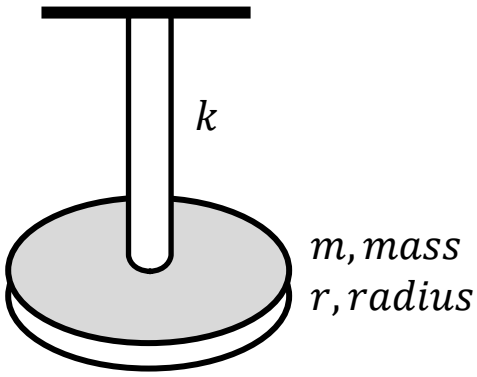
Homework Assignment:

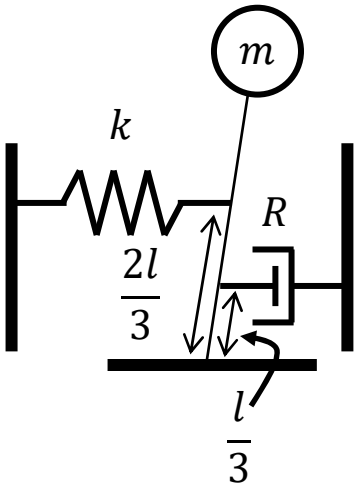
1. In class, we derived the equations of free motion (i.e. $x(t)$ and $\dot{x}(t)$) and natural frequencies for mass-spring and mass-spring-damper systems. Derive the equations of motion for the following and determine their frequencies of vibration:
   a. Simple Pendulum



   b. Shaft and disk



   c. Inverted Pendulum with spring and damper



Homework Assignment:

2. The Formula team is testing out a new torsion rod (see below) for their front suspension. Knowing that you are taking vibrations, they ask you to:
   a. Compute the natural frequency of the assembly given a torsional stiffness of $2550\ Nm/rad$ and a wheel mass of $47\ kg$. The distance between the wheel and the axis of rotation, r, is $0.3\ m$.
   b. In an effort to reduce the weight of the vehicle, the team is considering using smaller wheels with a weight of $35\ kg$. What effect does this have on the natural frequency?