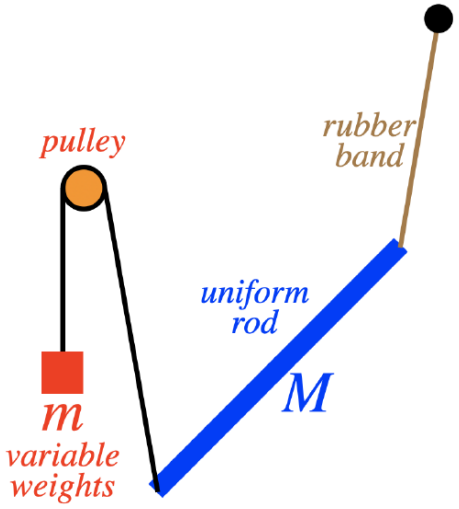
9.2: Activities

Equipment

- aluminum bar
- support assemblies, one with a pulley
- hanging weights & string
- rubber band
- paperclips
- plumb-bob
- ruler
- goniometer (adjustable protractor)

The General Idea

We will use methods of solving static equilibrium problems to indirectly measure forces present in a system of stationary objects. The system in question looks like this:



The lab consists of two parts:

1. You are allowed to adjust the amount of variable weight however you see fit. With this power, and armed *only* with a plumb-bob, determine the mass of the uniform rod. You should also vary the weights by very small amounts (amounts that don't change the system's state a noticeable amount) as a means of determining the uncertainty in your answer.
2. Reassemble the system with an amount of hanging weight that is *substantially different* from the weight you used in part 1. Then, armed with only a plumb-bob and a goniometer, do the following:
   - Re-compute the mass of the rod using this setup. Confirm that the value you compute falls within the boundaries of uncertainty of the answer you got in part 1.
   - Compute the force exerted on the rod by the rubber band. Devise a way to check your answer another way that doesn't involve static equilibrium methods (you may disassemble the system). There is no uncertainty check for this part of the lab, but you should compute by what percentage the two answers differ (if it is more than 5%, you have almost certainly made an error, as you should be able to get close to 1%).

Some Things to Think About

This lab is very straightforward in its statement, so there is not a lot to say about it, but here are a couple of things that you should know already:

- If you are not drawing free-body diagrams, choosing a coordinate system and a pivot point, breaking forces into components – basically treating this like a physics homework problem – then you are missing the point entirely.

- Make sure you are measuring angles properly with the goniometer – the vertex of the angle has to coincide with the goniometer's pivot, and the two lines that form the angle lie along the central lines in the arms of the goniometer.

Lab Report

Craft a lab report for these activities and analysis, making sure to include every contributing group member's name on the front page. You are ***strongly encouraged*** to refer back to the Read Me as you do this, to make sure that you are not leaving out anything important. You should also feel free to get feedback from your lab TA whenever you find that your group requires clarification or is at an impasse.

Every member of the group must upload a separate digital copy of the report to their lab assignment in Canvas *prior to leaving the lab classroom*. These reports are not to be written outside the lab setting.
