Equilibrium of Torques

Name_____TA_____

Partners_____

Section#_____Date_____

1. Preparation

Mass of meter stick (by weighing with a balance): _____ **(1)**
(Do not forget the units.)

Reading of the center of gravity r_c = _____

2. The balance of torques (*Please use different hanging masses.*)

m (hanging mass)	r_1	r_2	$\left|r_1 - r_2\right|$	$\left|r_c - r_1\right|$	$M = \frac{\left|r_1 - r_2\right|}{\left|r_c - r_1\right|} m$

Average and standard deviation: $M = ($ $\pm$ $) [$ $] \Leftarrow$ unit

Question 1
How does this compare with the mass obtained by weighing **(1)** the meter stick?

Question 2
Comparing the agreement of individual measurements with the average and with the result of weighing the meter stick, deduce whether accuracy is improved by choosing large or small value of m, $\left|r_1 - r_2\right|$ or $\left|r_c - r_1\right|$.

Question 3
What is the mass of your laboratory table? Provide a diagram and description of your method for determining the weight of a laboratory table.

Lab Procedure for Equilibrium Torques

Important Tips:
- Please use SI units. (meters, and kilograms)
- The range of r_1 should be from 0.25m to 0.75m. (If you want to challenge, go for it.)
- At equilibrium, the meter stick **must be horizontal**.
- Please try to read 4 digits for the meter stick calibration.

1. **Find the center of mass of a meter stick.**

   Get the balance of meter stick without hanging mass.
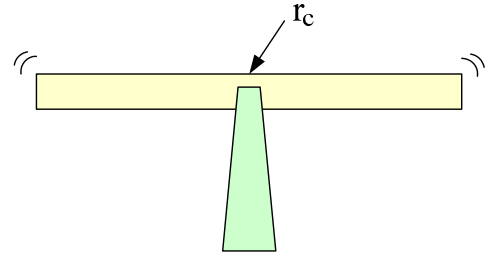
2. **Weigh the meter stick with a balance.**

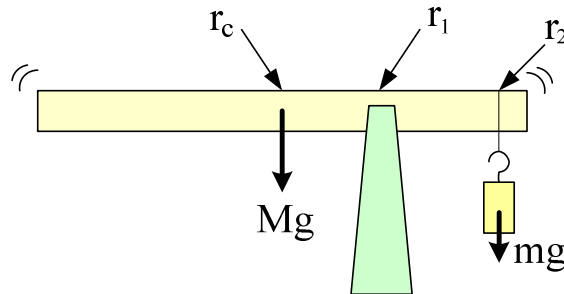   Before you do this, take off the metal apparatus from the meter
   stick. (You can measure the mass with a balance anytime.)

3. **Try six different r_1's.**

   Change the positions of fulcrum six times. Also change the hanging mass for each trial.

4. **Calculate $M = \dfrac{|r_1 - r_2|}{|r_C - r_1|} m$ for each case, and the average; then, obtain the standard deviation.**

   r_1, r_2, and r_c are just reading from the meter stick.

- **Lab Report**

Discuss the questions on the data sheet.

1. **How does this compare with the mass obtained by weighing the meter stick?**
   Suppose the mass obtained by this method is equal to the mass by weighing with a balance. If
   you got off results, please discuss the causes of error.

2. **Deduce whether accuracy is improved by choosing large or small value of m, |r₁-r₂| or |r_c-r₁|.**
   Compare the results and try to discuss the reasons.

3. **What is the mass of your laboratory table?**
   You do not have to do the actual experiment. Just explain the procedure to obtain the mass in
   terms of this lab. You will make sure if you understand this lab.