Name:

Partner:

Physics 12
M. Lam

Equilibrium Lab

Block:

Objective
Investigate the conditions necessary to prevent the rotation of a loaded beam

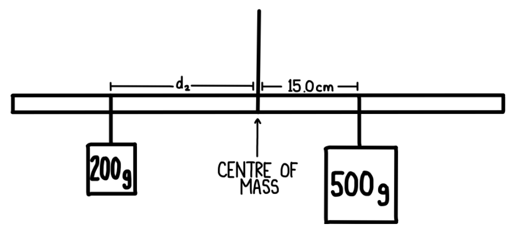
Equipment
meter stick
meter stick clamp with hanger (4)
ring stand
hooked weights
electronic balance

Experimental Method

1. Attach the meter stick clamp to the top of the ring stand.

2. Attach the meter stick to the meter stick clamp with the pivot exactly at the center of gravity (do not assume the center of gravity is at the 50.0 cm mark). Adjust the pivot point precisely until the meter stick is in equilibrium. Record the position of the center of gravity.

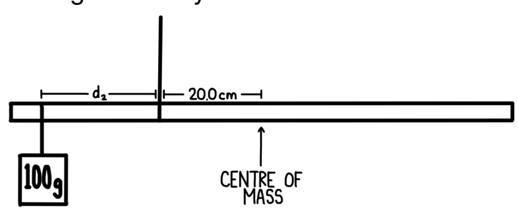
   Center of gravity position: ________________



3. Use a hanger to suspend a 500 g mass at a distance of 15.0 cm right of the pivot. Suspend a 200 g mass on the left side of the meter stick. Adjust the position of the mass until the meter stick is in equilibrium. Record your measurements in the table (Trial 1).

4. Move the 500 g mass to a distance of 25.0 cm right of the pivot. Suspend <u>two</u> different masses on the left side of the meter stick at different positions. Adjust their positions until the meter stick is in equilibrium. Record your measurements in the table (Trial 2).

5. Try another combination of three masses and positions of your choosing. Record your measurements in the table (Trial 3).



6. Remove the masses from the meter stick and adjust the position of meter stick on the clamp so the center of gravity is 20.0 cm to the right of the pivot. Use a 100 g mass to produce equilibrium. Record your measurements in the table (Trial 4).

7. Use an electronic balance to determine the mass of the meter stick. Record the mass below.

   Mass: ________________

Table 1: Force, distance and torque measurements for a meter stick in rotational equilibrium

Trial	Clockwise Torque			Counterclockwise Torque						
	F_1 (N)	d_1 (m)	τ_1 (N·m)	F_2 (N)	d_2 (m)	τ_2 (N·m)	F_3 (N)	d_3 (m)	τ_3 (N·m)	$\tau_2 + \tau_3$ (N·m)
1										
2										
3										
4										

Analysis and Discussion

1. Examine your calculated torques for trials 1, 2 and 3. When rotational equilibrium is achieved, what can you conclude regarding the clockwise torque when compared with the counterclockwise torque? State a general rule describing the condition required for rotational equilibrium.

2. Calculate the percent difference for each of trials 1, 2 and 3 when comparing the sum of the clockwise torques with the sum of the counterclockwise torques? *Note: Percent difference is not the same as percent error. Look up how percent difference is calculated if you are not sure.*

3. Calculate the mass of the meter stick using the measurements from trial 4. Compare this to the mass as measured on the electric balance. Calculate the percent error.

4. What are some likely sources of error that may have caused discrepancies in your results when comparing the torques and masses?