Life is a Balancing Act: An Experiment with Balanced Torques

Mr. Traeger

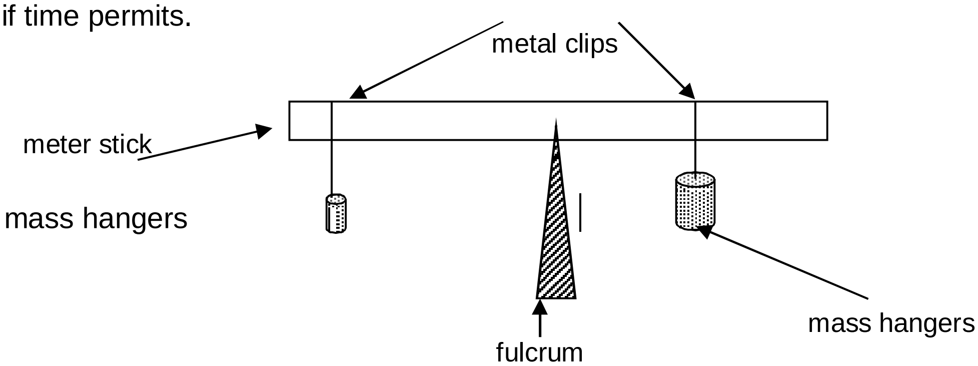
Names: ________________________ **Period**: ___________ **Date**: ___________ **Score:** __________

Purpose

This experiment is designed to show how the mass of an object (Force if we multiply by $g = 9.8\ m/s^2$) and its distance from a fulcrum affects torque. We will balance torques experimentally and then determine the relationship between mass and distance using a data table. We will also measure the mass of a wooden block and studentsôpersonal items if time permits.

Equipment

meter stick
- 2 metal clips with hooks
- balancing stand
- 10, 20, 50, and 200 gram mass hangers
- wooden block with hook
- triple beam balance



Procedure and Analysis

1) You will first need to measure the mass of the two metal clips on either side of the fulcrum. You *do not* need to measure the mass of the center clip. Use a triple beam balance to do this. Record the masses of the clips below. Make sure that you keep track of which clip will be mounted to the left of the fulcrum, and which clip will be mounted to the right of the fulcrum.

Mass of left clip: _________________ Mass of right clip: ________________

2) Before remounting the metal clips, make sure that the meter stick balances as much as possible.

3) Now, using the various mass hangers, hang one hanger on one side of the fulcrum. Hang another mass hanger on the other side of the fulcrum. Move the *clips* along the meter stick until the system balances. The fulcrum should remain near the 50 cm mark. Record the masses used on either side and the distances from the fulcrum to the center of the mass. Take your readings at the *center* of the metal clip. Note that the meter stick did not balance perfectly at 50 cm, so you will have to do a little math to calculate the distances from the fulcrum. Also, you will have to add the mass of the metal clip to the mass of the hanging mass. Use the data table below to record your data. Repeat this procedure of balancing for different masses and distances.

Left Side of Fulcrum		**Right Side of Fulcrum**	
Mass of left side in grams (hanger plus clip)	Distance from fulcrum in centimeters (Center reading minus distance from far left side of meter stick)	Mass of right side in grams (hanger plus clip)	Distance from fulcrum in centimeters (Distance from far left side of meter stick minus center reading)
ex) 50 g	10 cm	10 g	50 cm
1.			
2.			
3.			
4.			
5.			

4) Now, take a look at your data. Do you see any patterns in the data? Explain in words below what pattern you found.

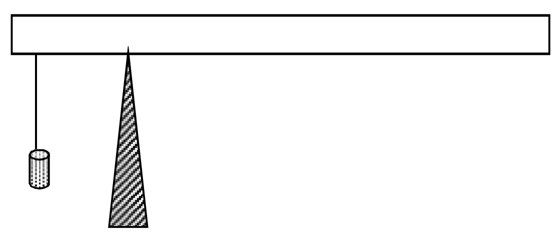
5) Now, see if you can create a mathematical formula for what you just stated in words in #4. Assign variables to each. Use subscripts if you have the same variable on either side of the equation.

6) Now, using the new formula that you just made, *calculate the mass of the class special object* by balancing it with a mass hanger. (*Hint: you can measure the mass of the hanger + clip and the two distances from the fulcrum*). If time permits, you may try to find the mass of any personal item (keys, pen, etc.). (This is your experimental value.)

7.) What is the actual mass of the special object? What is your groupȏs percent error?

$$\% \text{ Error} = \frac{\text{Experimental} - \text{Theoretical}}{|\text{Theoretical}|} \times 100.$$

8.) Extension: Move the fulcrum to 30.0 cm. Using a known mass on the short side of the meter stick, determine the *mass of the meter stick*. Label all forces on the meter stick pictured below. Explain the scenario.



9.) How does this lab relate to the center of gravity? Explain.