Lab 9: Torque

Name ____________________________
Partner __________________________

Objective: To practice balancing torques, and to investigate how torques can be used to calculate useful information.

Part I:

1. Obtain a meter stick, pivot, pivot attachment, two mass hanger attachments, two mass hangers, an array of masses and an unknown mass. Measure the mass of the mass hanger attachments and the pivot attachment, and record them below.

   Mass Hanger Attachments ___________________ Pivot Attachment ___________________

2. Place the pivot attachment loosely on the meter stick and place it on the pivot. Move the meter stick until it balances. Record the position of the pivot attachment. This marks the center of gravity of the meter stick.

   Center of mass point: _______________________

3. Place one mass hanger attachment at the 10 cm mark and hang the unknown mass from it. Place the other mass hanger attachment on the other side of the pivot at some random point. Add masses to that mass hanger until the meter stick balances. Record the known mass (including the mass of the hanger), the distance from the known mass to the pivot ($l_{\text{known}}$) and the distance from the unknown mass to the pivot ($l_{\text{unknown}}$).

   $l_{\text{known}}$: _______________________ Known mass: _______________________

   $l_{\text{unknown}}$: _______________________

4. Write down the equation for balanced torques and calculate the unknown mass.

5. Measure the unknown mass plus mass hanger with a balance. Unknown mass: _______________________

6. How do the measured and calculated masses compare? Explain the reason for any differences between them.
7. Place the pivot attachment (the fulcrum) at the 85 cm mark of the meter stick. Remove one mass hanger, and place the other between the 90 and 95 cm mark. Add mass to the hanger till the meter stick balances. Record the hanging mass (plus hanger) and the distance from the pivot to the mass hanger ($\ell_{\text{known}}$).

Known mass: _______________________

$\ell_{\text{known}}$: ____________________________

8. Draw a diagram of the set-up, and draw all the forces acting, including where they act. Label the lever arms.

9. Use the balanced torque equation to calculate the mass of the meter stick.

Meter Stick Mass: _______________________

10. Remove the meter stick and measure its mass using a balance.

Measured mass: _______________________

11. Calculate the percent difference between the calculated and the measured masses. Explain any differences.