Torque Lab

Purpose: To explore the concepts of torque and calculate balancing forces.

Materials: balance stand, 3 meter stick hooks , string, hooked mass, slotted masses, meter stick, & rock.

Procedure:

1. Record all data on the data sheet. If you run out of space for calculations, attach any additional work to your data sheet. **Each student is to hand in their own lab work.**

2. Make sure the electronic scale is balanced each time you use it and try and use the same scale each time.

3. Weigh your meter stick. Remember weight is a force and measured in Newtons. w = mg and because this is a lab you need to use 9.8 m/s^2 for the acceleration from gravity.

4. Set up a stand and meter stick as demonstrated by your instructor. Place the meter stick in the meter stick holder. Move the holder on the meter stick so that it is balanced and tighten the screw on the bottom (don't overdo it!). Record this value as the center of gravity of your meter stick.

Working Backwards with Two Weights

5. Take two different weights (hooked mass & slotted masses). Use the meter stick hooks to hang both of the weights and arrange the weights so that the meter stick is balanced. Draw the arrangement with weights on the data sheet and label them with the actual weight. **Be sure to show the location of your fulcrum in each of the diagrams.** The fulcrum is shown as a triangle below the scale.

6. In the space provided under the diagram on your data sheet, work backwards to show the torque from each of the weights that are causing a net torque of zero. You will need to use the distance from the fulcrum to each of the weights. Show all of your work, including a sum of torque statement, on the data sheet. Use each weight and radius recorded in your sum of torque statement and see/confirm the torque calculates to zero.

Working Backwards with Three Weights

7. Choose three weights and repeat the same experiment. This may take a bit of trial and error. Think and be patient. Draw the arrangement of the weights and readings on the data sheet.

8. Work backwards to show the torque from all three of the weights causing a net torque of zero. Show all of your work, including a sum of toque statement, on the data sheet.

Working Forward with Two Weights

9. Choose two different weights then used earlier. Pick one weight and choose a location for that weight. Record the weight and location of that weight on the data sheet.

10. Wanting a net torque on the meter stick of zero, calculate the location of the second weight on the data sheet.

11. Place the weight at the calculated location. Is your system balanced? In a different color, show where you needed to move the weights to balance the system.

Working Forward with Three Weights

12. Now choose three different weights. Choose the lighter two of the three weights and place them on one side of the meter stick in different locations. Record the weights and locations of the two weights on the data sheet.

13. Wanting a net torque on the meter stick of zero, calculate the location of the third weight on the data sheet. If it's off the meter stick then choose a heavier third weight and re-calculate.

14. Place the weight at the calculated location. Is your system balanced? In a different color, show where you needed to move the weights to balance the system.

Unbalanced Meter Stick

15. Move the fulcrum to the 25 cm point. You now have a weight at the center of mass of the meter stick equal to the weight of the meter stick. Show this weight on your data sheet.

16. Using only a single weight of your choice, calculate where to place the weight so that the system is balanced. Show all your work on the data sheet.

17. Place the weight at the calculated location. Is your system balanced? In a different color, show where you needed to move the weights to balance the system.

Unknown Mass

18. Choose a location for your fulcrum, other than the CG (be sure to mark it on your data sheet), and another different weight on the side of the meter stick that is the longest. Show both the weight you chose & the weight of the meter stick on your data sheet.

19. Now get an unknown mass (rock) and find its location that will cause the net torque on the meter stick to be zero. Record its location on the data sheet.

20. Using a sum of torque statement, determine the mass of the rock.

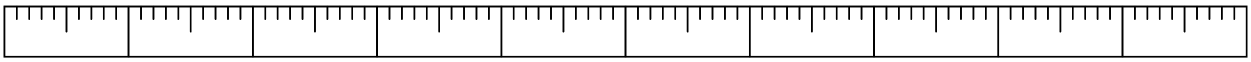
Name ______________________________ Period: _____ Date _______________

Lab Partners: ____

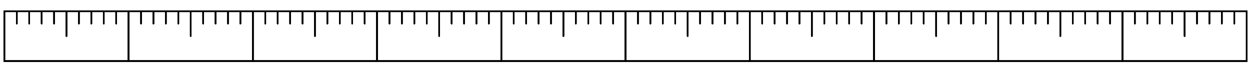
Torque Lab Data Sheet

Location of the center of gravity of your meter stick: ______ **Weight of your meter stick:** ______

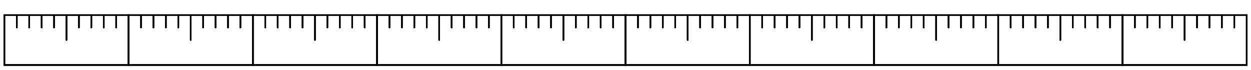
Working Backwards with Two Weights



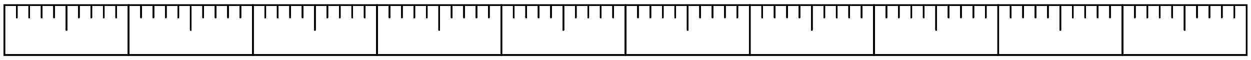
Working Backwards with Three Weights



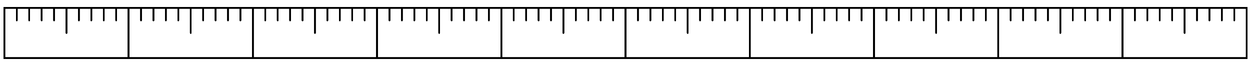
Working Forward with Two Weights



Working Forward with Three Weights



Unbalanced Meter Stick



Unknown Mass