

Torque Meter Stick

You may work with a partner during this activity. Be sure that you each try this!

Part 1 Meter Stick and Mass

1. Record the mass m_{ms} of a meter stick in grams: _____ and the location of its center of mass x_{cm} in cm: _____ (you can assume that the meter stick has a uniform mass distribution).
2. Your instructor will give you a mass M which you will be placing between the 15 cm and 65 cm marks. What is mass M in grams? _____
3. Calculate the position X_M where the mass M must be placed on the meter stick so that the center of mass X_{cm} of the **mass-meter stick system** is located at the 40 cm mark: $X_{cm} = \frac{MX_M + m_{ms}x_{cm}}{M + m_{ms}}$ and neatly show your work. Use the back of this sheet if necessary.
4. Put mass M at the 40 cm position, and use tape if you need to prevent it from falling off the meter stick.
5. You/your partner should place the left index finger under the meter stick at the 15 cm position and the right index finger under the meter stick at the 65 cm position.
6. Move both fingers with approximately the same speed (but opposite velocities) so that your fingers meet at the 40 cm mark. Was this difficult or easy to do? Explain.

Part 2 Meter Stick and No Mass

7. Remove the mass from the meter stick. You/your partner should place the left index finger under the meter stick at the 15 cm position and the right index finger under the meter stick at the 65 cm position.
8. With your fingers located at the 15 cm and 65 cm positions, which finger produces more torque? Why?
9. On which finger is there the most force and the most friction? Why?
10. Move both fingers with approximately the same speed (but opposite velocities) so that your fingers meet at the 40 cm mark.
11. Are you having difficulty doing this? Take a guess why this isn't as easy as it seems it should be or as it was for Part 1.
12. At what position is your left index finger when you are able to start moving your right index finger? Why?