

Torques and Static Equilibrium

As you work through the steps in the lab procedure, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

Part 1: Data

Record the mass of the hanger.

Record the center of gravity of the meterstick.

Record the sizes and positions of the two hanging masses for the three sets. (Include the total mass attached to the meterstick at each position.)

Table 1

	Hanging Masses	Mass (g)	Position (cm)
Set 1	m_1		
	m_2		
Set 2	m_1		
	m_2		
Set 3	m_1		
	m_2		

Part 1: Analysis

Show that the condition for static equilibrium, $\Sigma\tau = 0$, is in fact satisfied.

Table 2

	Clockwise Torque (N · m)	Counterclockwise Torque (N · m)	Sum (N · m)
Set 1			
Set 2			
Set 3			

Part 2: Finding the Mass of the Meterstick

Record the location of the hanger in equilibrium.

Record the total mass attached to the meterstick at this location.

Complete the table assuming that the condition for static equilibrium is satisfied.

Table 3

Clockwise Torque (N · m)	Counterclockwise Torque (N · m)	Sum (N · m)

Calculate the mass of the meterstick and its uncertainty.

Use the triple beam balance to measure the mass directly.

What is the difference between the two values?

Is this within the measurement error that you calculated?

Part 3: Determining an Unknown Mass

Record the mass of m_1 plus the hanger and its uncertainty.

Record the position of m_1 and its uncertainty.

Record the mass of m_2 plus the hanger and its uncertainty.

Record the position of m_2 and its uncertainty.

Calculate the magnitude of the sum of the torques about the pivot point due to m_1 plus the hanger and m_2 plus the hanger.

Find the mass of the bucket/washer system.

Part 3: Error Analysis

Find the error on your mass calculation due to your measurement errors of the masses and their positions.

Measure the mass of the washer/bucket system using the balance.

Compare this measurement to your prediction above and its expected error.