Example Solution

Activity 4

Answers should be filled in on this sheet except where noted.

1. Pick up an acrylic frame, 4 hooks, and 2 rubber bands from the front of the room.
2. Find an object that can be used as a mass (25 grams is about the minimum).
3. Measure the mass of the object and convert it to a force, W.

Object weight: $W =$ 100.45g (0.985 N)

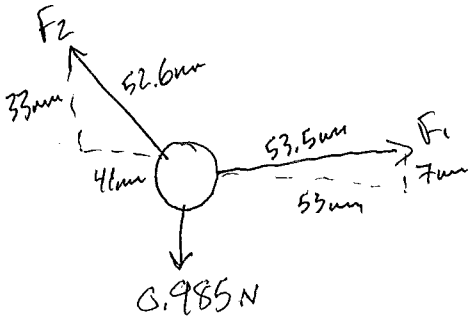
4. Suspend the mass from opposite sides of the frame using the two rubber bands.
5. Using a ruler, measure the x and y distances from one end of the rubber band to the other.

For the first rubber band: $\delta_{x,1} =$ 53mm

$\delta_{y,1} =$ 7mm

For the second rubber band: $\delta_{x,2} =$ 41mm

$\delta_{y,2} =$ 33mm



6. Using the weight from step 3 and the measurements from step 5, calculate the force in each applied to each rubber band. Show your work on a separate sheet.

$\Sigma F_x = F_1 \cdot \frac{53}{53.5} - F_2 \cdot \frac{41}{52.6} = 0$

$\Sigma F_y = -0.985 + F_1 \cdot \frac{7}{53.5} + F_2 \cdot \frac{33}{52.6} = 0$

For the first rubber band: $\dot{F}_1 =$ 1.06 N

For the second rubber band: $\dot{F}_2 =$ 1.35 N

7. Measure the length of each rubber band and use it to calculate the force in each rubber band using the provided calibration.

For the first rubber band: $L_1 =$ 53.5mm $\quad F_1 = 0.1687 \cdot 53.5 - 7.7431$

$F_1 =$ 1.28 N

For the second rubber band: $L_2 =$ 52.6 mm $\quad F_2 = 0.1687 \cdot 52.6 - 7.7431$

$F_2 =$ 1.13

8. Calculate the performance metric, $m = \sqrt{(F_1 - \dot{F}_1)^2 + (F_2 - \dot{F}_2)^2}/W =$ 0.316