

MIT 8.01T Physics I

Experiment 5A: Static Equilibrium



When a weight is suspended by two strings as in the diagram $T = Mg/(2\sin\theta)$. The goal is to measure T for several values of θ , to verify the equation and the diverging tension required for a taught string.

Starting *DataStudio*:

Create a new experiment. Plug a force sensor into the drag it to the input in the Setup window.

🚥 Experiment Setup				
🐼 Sensors 🎽 Options 🖄 Timers 🖪 Connect 🚫 Change				
Science Workshop 750				
💞 Sensors 💌 💌				
$ \overline{a_{i}^{5}} $ Acceleration Sensor $ $	ScienceWorkshop* 750 A B C CUTPUT			
Hg Barometer				
Signal Output	°F'			
Cutput	Force Sensor			

Double-click the Force Sensor icon.

Force Sensor:

Sensor Properties					
General Measurement Calibration					
Force Sensor					
Model: CI-6537, CI-6746					
Sample Rate 10 Hz • Fast (> 1 Hz) Slow (< 1 Hz) Slow Force Changes (Spring Tests) Fast Force Changes (Collisions)					
OK Cancel Help					

Sensor Properties			×
General Measurement	Calibration		
Current Reading Voltage: -0.207 Value: -1.29	High Point Voltage: Value: 50.00	Low Point Voltage: -8.000 Value: -50.00 Take Reading	
Name: Force, Ch A (N) Bance:		Sensitivity:]
-8.00 to 8	.00 N	0.01	
l	OK	Cancel Help	

Set it for 10 samples/s and low sensitivity.



Set Up T-Square:



Align right edge of ruler on center of column of holes so it avoids weight hanging in center of string. Maintain same horizontal offset from ruler to center of pulley. You will measure force and vertical drop of string along ruler edge.

Ensure string passes over pulley before all measurements.

Keep line of sight perpendicular to board to minimize parallax.



Sampling Options:

Sampling Options	X					
Manual Sampling Delayed Start Automatic Stop						
 Keep data values only when commanded. Enter a keyboard value when data is kept. Prompt for a value. Keyboard Data Vertical Drop (inches) Name: 						
Vertical Drop						
inches 1.00E-3						
Edit All Properties						
Include a list of prompt values for this keyboard data.						
OK Cancel Help						

Check all 3 top boxes. New Keyboard Data Edit All Properties

Taking Data:

- •Click "Start"; button turns to "Keep".
- •Measure vertical drop, click "Keep".
- •Enter vertical drop into window.

Please enter a valu	ie.		×
$\sqrt{20}$	Vertical Drop		OK
		6.13 inches	Cancel

- •Shorten string, repeat for 10 to 12 measurements.
- •Ensure string passes over pulley.
- •Make 2 or 3 measurements with vertical drop 1.25 in or less. (String will be tight even without the weight.)
- •Click red stop button when finished.

Analyzing Your Data:

Calculate sinθ from your vertical drop measurements (see write up).
Plot force on *Y* axis, sinθ on *X* axis.

•Fit y = A/x to your data.



The Report:

Turn in one report page per group.

There is a follow-up homework problem about this experiment.