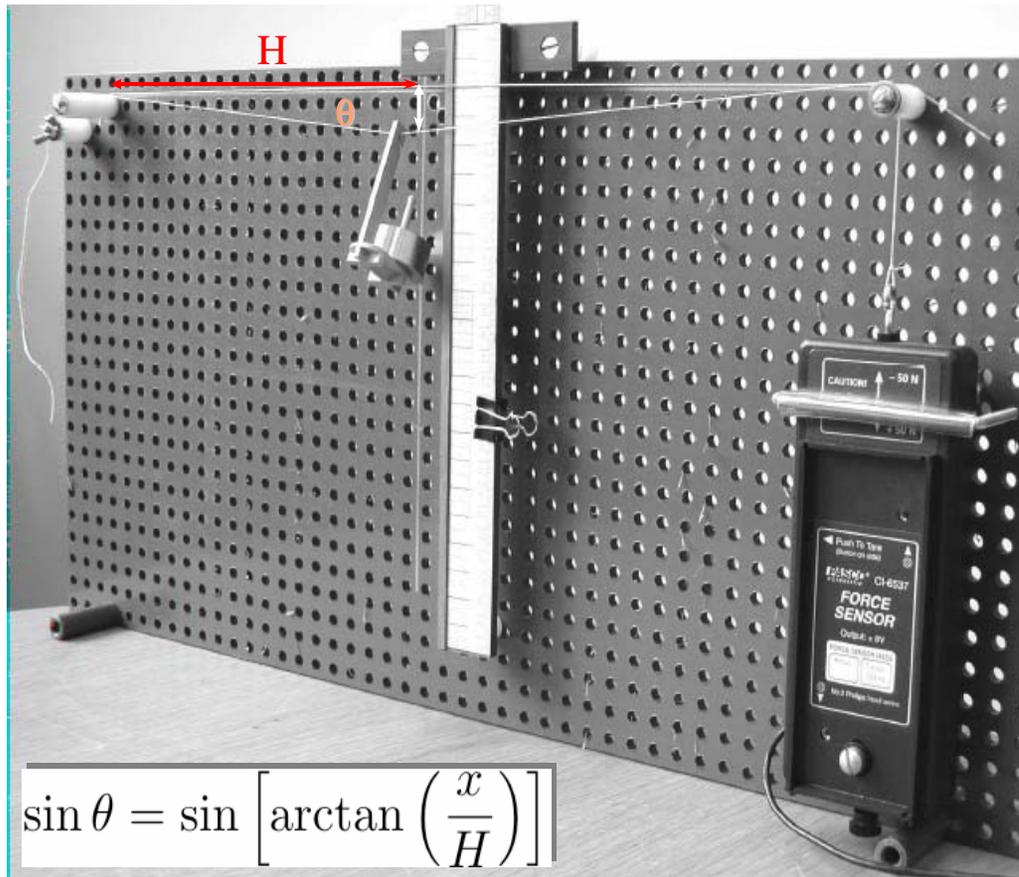


# Experiment 05A: Static equilibrium



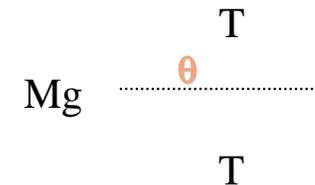
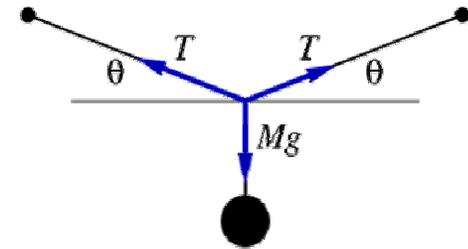
# Goal

When a weight is suspended by two strings in the center as shown in the photograph below, the tension is given as follows:



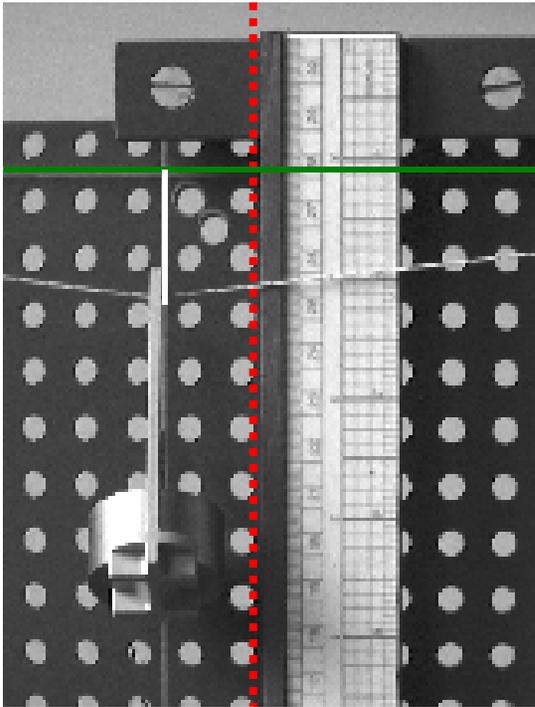
$$\sin \theta = \sin \left[ \arctan \left( \frac{x}{H} \right) \right]$$

$$T = \frac{Mg}{2 \sin \theta}$$



**Goal:** Measure T for several values of  $\theta$  using measurements of  $x$ ,  $H$  (fixed), to verify the equation above!

# Setup



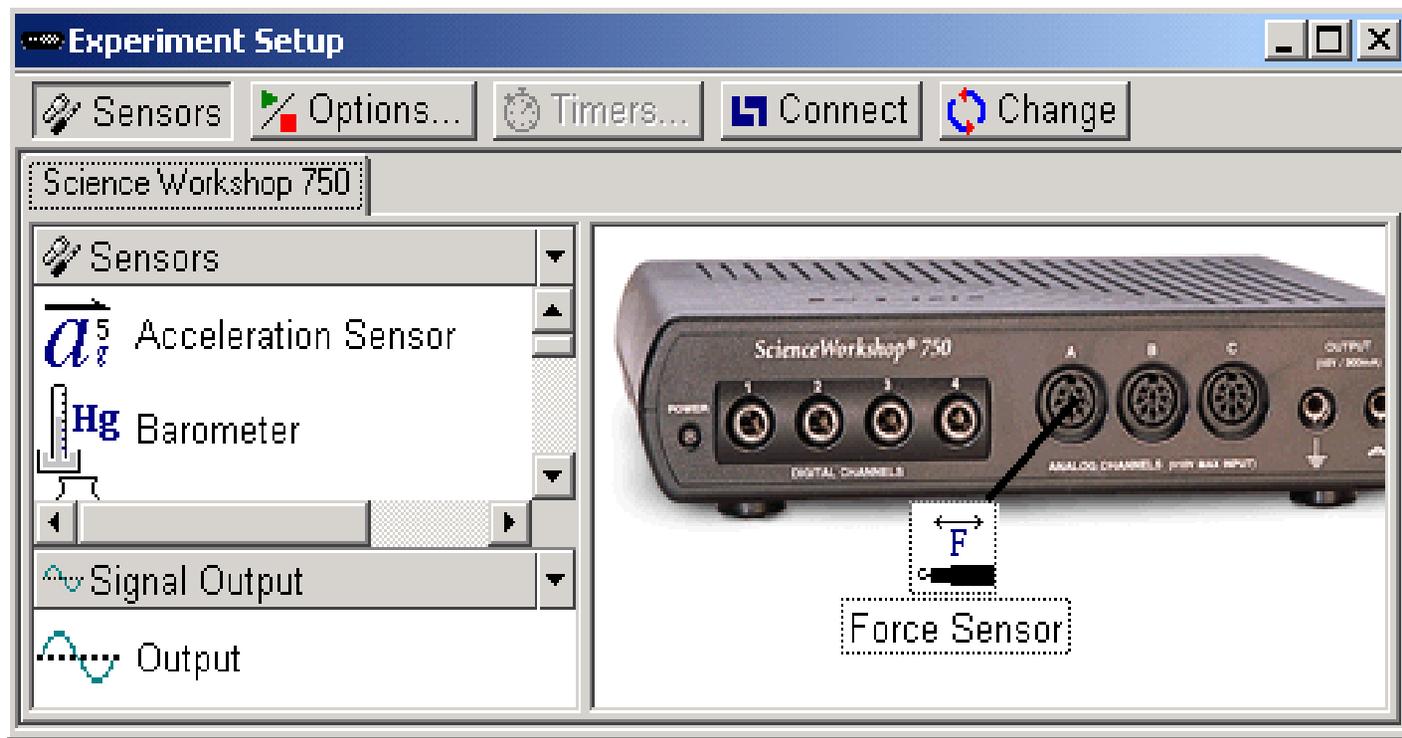
- Align the **right edge** of the ruler with the center of a column of holes.
- Maintain the same horizontal distance for all measurements.
- A **second string** along the top marks the **horizontal line** between the two string support lines.
- The vertical drop ( ) from this line is what you have to measure to determine the angle  $\theta$ .

- Ensure string passes over pulley before all measurements.
- Keep line of sight perpendicular to board to minimize parallax.



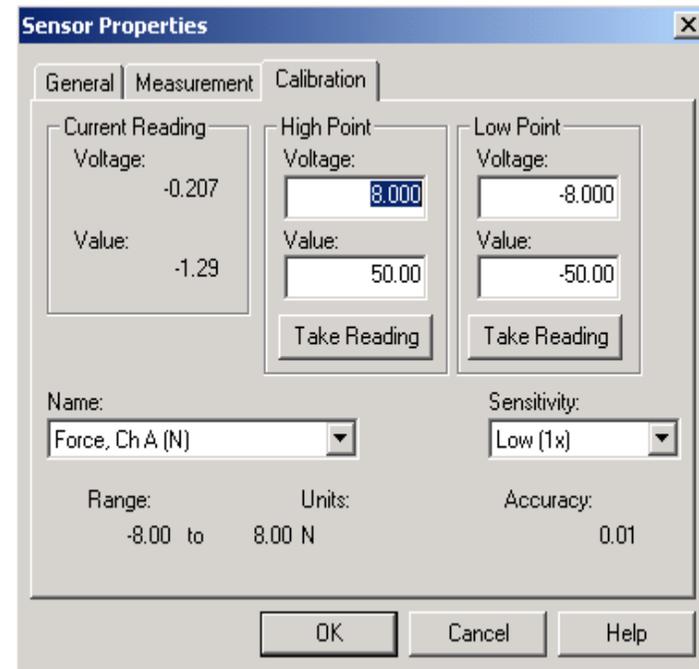
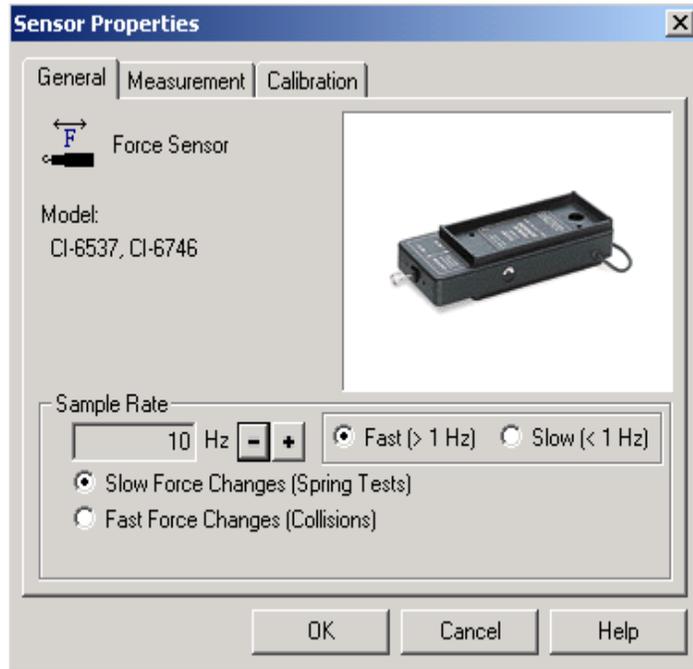
# Setting DataStudio

- Create a new experiment. Drag the force sensor to the interface in the **Experiment Setup** window.



- Double-click the force sensor icon to open a window to set the **Sensor Properties**.

# Force sensor



- Under **General** set **Sample Rate** to 10Hz and select **Slow Force Changes**.
- Under **Calibration** choose **Sensitivity Low (1x)**

Next: Click  Options...

# Options for force sensor

Sampling Options

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

Units: inches Accuracy: 1.00E-3

Edit All Properties...

Include a list of prompt values for this keyboard data.

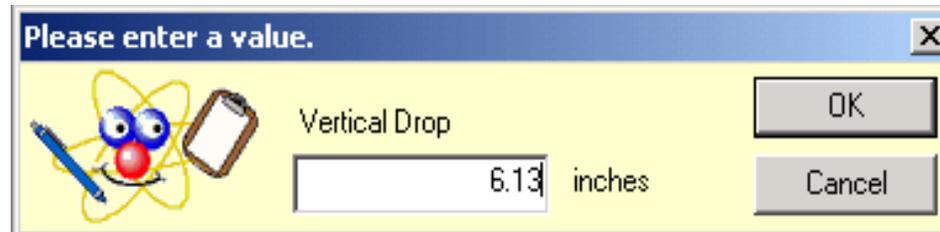
OK Cancel Help

- ❑ Check all three boxes.
- ❑ Choose **New Keyboard Data** from the pull-down list in the **Keyboard Data** area.
- ❑ Click **Edit all Properties** tab which will open another window which allows to name variables and assign units (e.g. Vertical drop and units in mm)
- ❑ Click **OK** on **Manual Sampling** window. A new variable should appear in the Data window.

Ready to go...!

# Data taking

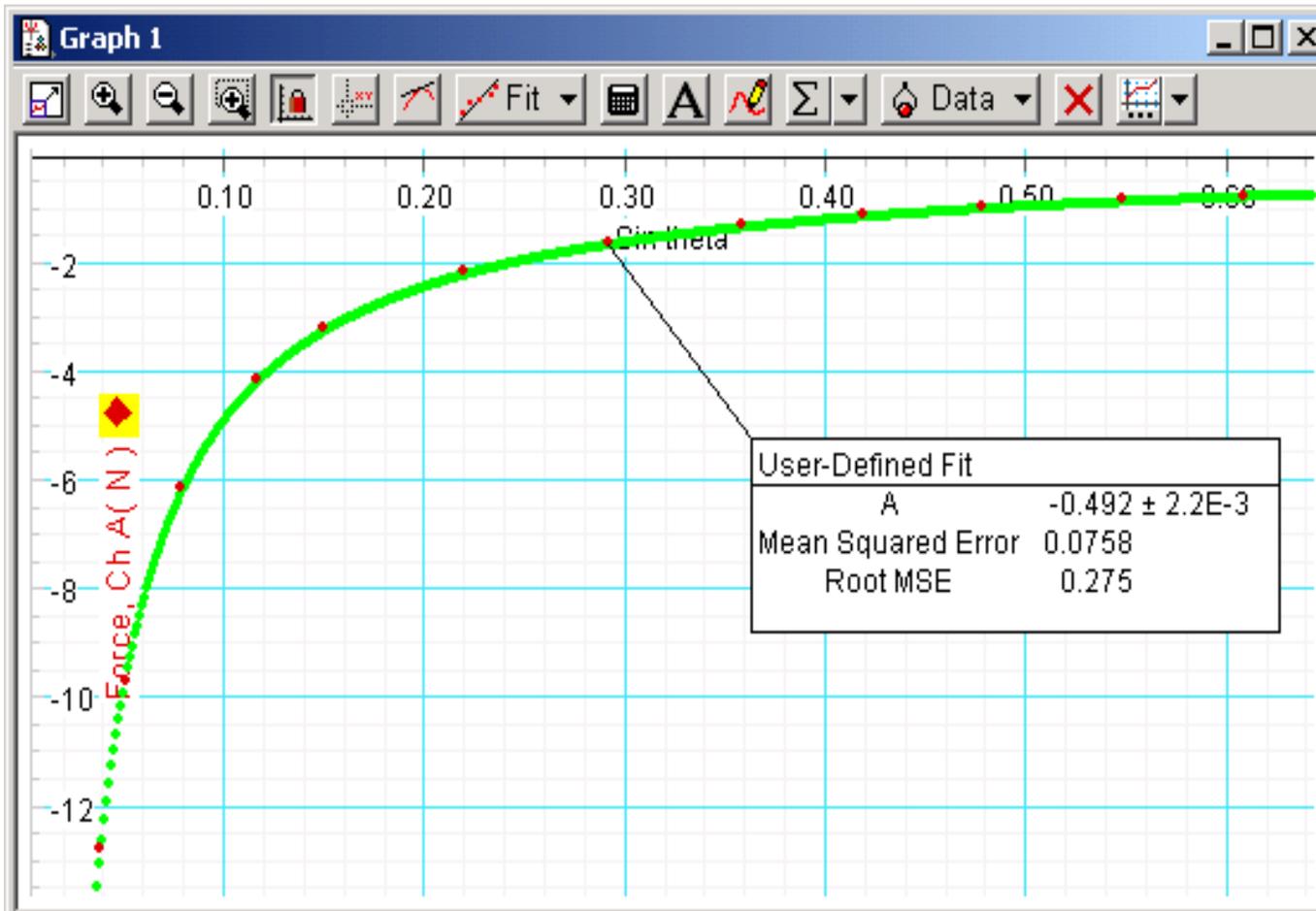
- ❑ Click **Start!** Button turns to **Keep**.
- ❑ Measure vertical drop, click **Keep**.
- ❑ Enter vertical drop into window.



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

# Analyzing data

- Calculate  $\sin\theta$  from your vertical drop measurements (see write up).
- Plot force on y axis,  $\sin\theta$  on x axis.
- Fit  $y = A/x$  (User-defined fit) to your data.



# Report

- Hand-in experiment report.
- There is a follow-up question as part of your PS!