

TechLab Springboard: The Weight



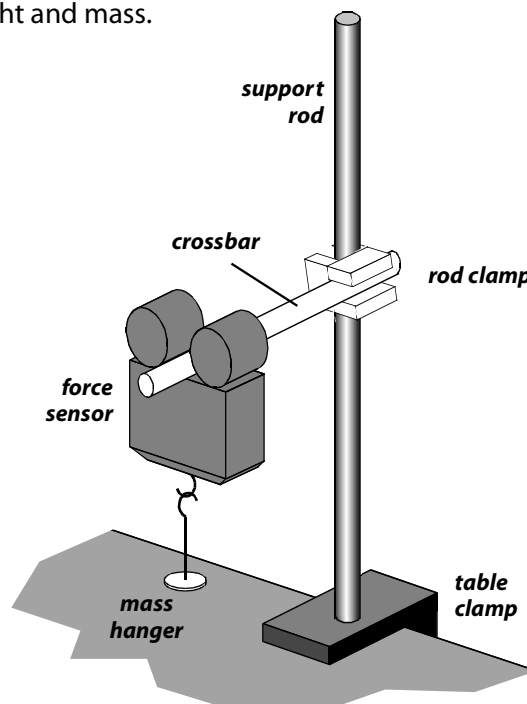
• Purpose •

In this activity, you will investigate the relationship between weight and mass.

• Apparatus •

- ___ computer (iBook or equivalent)
- ___ force sensor (PASport Force or equivalent)
- ___ interface device (USB Link or equivalent)
- ___ probeware (DataStudio or equivalent)
- ___ configuration file (optional)
- ___ Excel spreadsheet template

- ___ mass hanger ($m =$ _____ g)
- ___ slotted masses (100 g, 200 g, 500 g)
- ___ table clamp
- ___ support rod
- ___ rod clamp
- ___ crossbar (short rod)



• Procedure •

1. Arrange the apparatus as shown above to the right. When suspended, the mass hanger should only be a few centimeters above the table top. Once everything is set, remove the hanger from the sensor.
2. Start the computer. Plug the force sensor into the interface device. Plug the interface device into the computer. When asked what to do with the newly found probe, select "Weight vs. Mass" from the files offered in the Open Window.
3. Open the Excel spreadsheet template called "1.03 Weight vs. Mass XL." It's in the Excel PhysSheets folder on the hard drive (*X PhysMac X / Excel PhysSheets / 1.03 Weight vs. Mass XL*). If you cannot see DataStudio's Digits display while the spreadsheet is open, resize the spreadsheet so that you can.
4. Click the Digits display in DataStudio to switch the active application from Excel back to DataStudio. Click the on-screen Start button to initiate data sampling. Press the Zero button on the force sensor. Then place the mass hanger on the force sensor's hook.
5. Record the weight (in newtons) of the 50-gram mass hanger in the appropriate cell of the Excel spreadsheet. (If the reading is jumpy, click the on-screen Stop button. Doing so freezes the reading from the force sensor. Once you make your reading, click the on-screen Start button.)
6. Add 100 g of **slotted mass** to the mass hanger. The total mass is now 150 g. Record the corresponding weight in the appropriate cell of the Excel spreadsheet.
7. Repeat the previous step with 200 g, 300 g, 400 g, 500 g, 600 g, 700 g, and 800 g of mass added to the mass hanger.

• Analysis •

1. In Excel, switch from the "Weight vs. Mass Data" sheet to the "Weight vs. Mass Graph" sheet. The sheet tabs are located at the bottom of the sheet.
2. Secure a PhysBlessing and print a copy of the graph for each member of the group.

3. Add a line of best fit to your graph.

4. Determine the value of the slope. (Don't forget the correct **units**.) Show your method and/or calculation in the space below.

5. What is the meaning of the slope of this graph? (Hint: the slope is a ratio of unlike quantities. Consult *Springboard: Ratios* to assist in developing a verbal description of the meaning of this ratio.)

6. a. Under what conditions—if any—would the line of best fit have a steeper slope? (Describe the *environmental conditions*, not the *meaning* of the steeper slope.)

b. Under what conditions—if any—would the line of best fit have a shallower slope?

c. Under what conditions—if any—would the line of best fit have zero slope?

d. Under what conditions—if any—would the line of best fit have undefined (infinite) slope?