

Measuring some coefficients of friction

You should still have the laptop computers and LabPro force sensors set up on your table.

1. Grab a different experiment file: go to the folder

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My Computer
  -> Student Shares on svphy01
      -> University Physics Students
          -> Team Physics 311
              -> Lab Pro
```

and drag onto your desktop the file *drag_block_mwr*.

2. Pick just one of the force sensors. Replace the rubber bumper on it with the hook.
3. Get one of the wooden "friction blocks" from the instructor. These blocks are covered with a fabric on two faces, and have a hook attached to one end. Also take out two of the heavy mass bars from your equipment set.
4. Measure the mass of the "friction block" and each of the mass bars.

Now, place the block on the table, motionless. Put one of the mass bars on top of it. Tie one end of a short (50 to 70 cm) piece of string to the block's hook, and the other end of the string to the force sensor's hook. Be sure to do the following every time you want to make measurements:

- first, click on the "Zero" button while the string is loose; this re-sets the sensor to read "0 Newtons" when there is no force acting
- then, click on the "Collect" button to start reading the force sensor
- **Beware the Tare: There is a tare button on the side of the force sensor. Be very careful not to accidentally press it. If you do, you will need to re-zero the sensors, but will not need to recalibrate.**

After you have started collecting data, wait for a second or two (you should see some data start to appear on the graph), then very gently pull on the force sensor. The computer will display the force with which you are pulling the block.

If you apply a very small force, the block won't move. In this situation, you are measuring the force of static friction between block and table.

If you apply a larger force, the block will start to slide. If you continue to pull as the block moves with a constant speed, you are measuring the force of kinetic friction between block and table.

Your job is to use the measured forces to figure out:

- a. coefficient of static friction between wood and table
- b. coefficient of kinetic friction between wood and table
- c. coefficient of static friction between fabric and table
- d. coefficient of kinetic friction between fabric and table

Try rotating the block so that you make measurements when the wide face is touching the table, and when the narrow face is touching the table.

- e. do the coefficients of friction change depending on the area in contact with the table?

Try placing **extra masses** on top of the block and repeat your measurement for the coefficient of kinetic friction between wood and table. Collect data using at least **five different total masses**. Measure each total mass with a balance. However, instead of determining the coefficient from each measurement, this time make a graph of frictional force versus normal force. Use the graph to determine both the coefficient of friction and its uncertainty.

- f. Is coefficient of kinetic friction between wood and table a constant?

You must hand in

- a neat table showing all your measurements
- a sample equation showing how you convert the measured forces to coefficient of friction
- a second neat table showing the coefficients of friction you have determined
- a Good graph showing the three lines you use to determine the coefficient of kinetic friction between the wood and table along with its uncertainty
- an answer to the questions "What factors DO affect the coefficient of friction?" and "What factors DO NOT affect the coefficient of friction?"

Do your answers to these questions agree with the description of friction in your textbook?