Physics

The Force of Friction

Sliding friction is a complex force, but we will make some assumptions to make it more manageable. These assumptions are that the force of sliding or static friction does not depend on the speed you are sliding, and that it is directly proportional to the normal force between the surfaces. The purpose of this lab is to test one of those assumptions.

Here's what to do:

1. Get a 0-5 Newton force scale, a friction block, a slotted weight set, and some paper. Measure and record the mass of the friction block that the masses will rest on.

2. Hold the force scale horizontally, and adjust it so it reads zero. Hook the force scale to the Friction block, and gradually increase the force until it breaks free and starts to slide. Record the maximum force the scale read (Static friction), and the force necessary to make the holder slide at a constant speed along the table (Kinetic friction).

3. Perform step 2 after adding these masses (in grams) to the friction block: (0, 250, 500, 750, 1000)

4. Perform steps 2 and 3 for the block sliding along the table, and again for the block sliding on some paper.

5. Calculate the total weight (Not mass!) of the block and added masses for each different amount in Newtons. (i.e., block , block + 250 grams, block + 500 grams...) Don't forget to convert grams to kilograms!

6. For each of the trials above (all 20 of them) compute the coefficient of friction. ($F_f = \mu W$ where μ is the coefficient, W the weight, and F_f the force of friction)

7. Make two graphs of **force** (not the coefficient) of friction (vertical) vs. **weight** (horizontal) one for the paper data and one for the table data. Use a different type of point or different color ink for the two types of friction, the starting or maximum force (Static), and the sliding force (Kinetic). For each set of 5 points, draw a best fit straight line through the points you plot and find the slope of that line. Label each line with its slope. (The slope is the coefficient of friction that corresponds to the series of data)

8. Make sure your lab has the following when you turn it in:
   - A. Your RAW data in a nice data table..
   - B. Your calculated weights (all 5) and Coefficients of friction. (all 20)
   - C. Two graphs, one for each surface type. Each graph should have the following:
     - i. Title, axes labeled, etc
     - ii. A static and kinetic series each fitted with a line whose slope is labeled on the graph itself.
   - D. Write your own answer to the following questions. **Cite data specifically to support any statement you make:**
     - i. How do the static and kinetic friction compare? (Cite specific numbers to support your claim)
     - ii. Come up with a theory as to why they differ as they do (if they do). (Since static friction is measured before the object even accelerates, Newton's first law of motion is **not** applicable)
     - iii. The force of friction obviously must depend on the weight (or more correctly, the normal force), but our formula for friction asserts that this is a linear relationship. Does your data suggest that there is a linear relationship between friction and weight? (Do your data points lie on a straight line, or do they suggest a curve? Do your coefficients of friction stay the same, or is there a trend in them?)