Friction Lab

Name:
Period:
Mr. Z's Physics Class
11/13/06

$\overrightarrow{F_F}$ When I try to slide an object along some surface, there is a force of **friction** that tries to keep the object from sliding. We use the The friction will of course grow if the object is pushed into the floor more; in physics, this means that it depends on the **normal force** between the two. The amount of friction also depends on what material the surfaces are made of: sliding a chair across a wood floor is easier than sliding the same chair across a rug, but harder than sliding it along ice. We use a number μ ("mu", or the "coefficient of friction") to symbolize the stickiness - μ will be a number between 0 and 1 saying how big the friction force is as a fraction of the normal force.

You probably know from experience that there is often more friction when you first try to get something moving; the friction lessens once it starts to move. Since the normal force can't have changed, somehow the μ must have changed between standing still and sliding: the surfaces stick more when the object is not moving. We represent this in physics by using two different values of μ: μ_s is the value when the object is not moving ("s" for "static"), and μ_k is the stickiness value once it is sliding ("k" for "kinetic").

1. Finding the Coefficients of Friction

For this lab, you will use a block of wood that has felt glued to the bottom of it to make an even surface for friction. You will also need a single spring scale (5 N).

1. What is the weight of your block?

2. The first step is to find the coefficient of static friction. We will do this by seeing how much force it takes to get the block to move. Pull horizontally on the block with the spring scale. How much force does it take to get it to move?

3. The friction force that you just measured is equal to the coefficient of static friction times the normal force. What is μ_s?

4. Now, pull the block along the table at a constant speed. What force does it take to do this? *This is the trickiest part of the lab, because you need to be able to move at some constant speed and yet still be able to read the spring scale.*

5. What is μ_k, the coefficient of kinetic friction?

2. Increasing the Weight

The coefficient of friction is supposed to be determined just by the two surfaces involved. If we pile more weight on top of our block, μ should be unchanged. Of course, the force of friction will increase, because the normal force needed to support the block increases; however, the ratio of the normal and friction froces, μ, should not change). We're going to test this out in this part of the lab.

1. Fill in the top row of the data table below with your normal force, start force, μ_s, drag force, and μ_k from the previous section.
2. Get some bean bags and weights. You can put these on your block to increase the weight.
3. Fill in the first line below with the data you got for just the block alone.
4. Now, gradually increase the weight by adding weights and bean bags (I find that the bean bags provide a nice place to put the weights). At each step, you will need to find the weight (and hence the normal force) by hanging everything from the spring scale.
5. Record this normal force in the next row of the table.
6. Put the block on the table, with the bean bag on it, and pull it with the spring scale until it starts moving. Record the force needed to start it moving as the "start force."
7. Calculate the coefficient of static friction and write it into the table. (μ_s is equal to the start force divided by the normal force).
8. Record the force required to drag the block along at a constant rate as "drag force."
9. Calculate the coefficient of kinetic friction and write it into the table. (μ_k is equal to the drag force divided by the normal force).

Normal Force	Start Force	μ_s	Drag Force	μ_k

What do you expect to be true about the μ_s and μ_k that you find in each run? Did it work out?