

# Friction Lab

Name:  
Period:  
Mr. Z.'s Physics Class  
11/14/05

We've just learned that any time that two surfaces are in contact with each other, there is a force of *friction* between them, a force that tries to keep them from sliding past one another. The size of the friction force depends on how big the normal force is; after all, the harder the two surfaces are pressing against one another, the harder it will be to slide them. To find the size of the friction force, you multiply the size of the normal force by a number  $\mu$ , the "coefficient of friction," which is different for every pair of surfaces. The coefficient of *static* friction, determining the force it can produce to keep two surfaces from starting to slip, is usually less than the coefficient of *kinetic* friction, determining the force pushing back against movement that is already happening.

Force	Symbol	What is it?	Direction is...	Size is...
Friction	$\vec{F}_F$	When two surfaces are pressed against one another, this force resists them trying to slip. The "coefficient of friction" $\mu$ is different for every pair of surfaces.	Opposing the force or movement.	$\mu F_N$

## 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  $\mu_s$ ?
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  $\mu_k$ , 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,  $\mu$  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 forces,  $\mu$ , 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,  $\mu_s$ , drag force, and  $\mu_k$  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. ( $\mu_s$  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. ( $\mu_k$  is equal to the drag force divided by the normal force).

Normal Force	Start Force	$\mu_s$	Drag Force	$\mu_k$

*What do you expect to be true about the  $\mu_s$  and  $\mu_k$  that you find in each run? Did it work out?*