PHYSICS **NAME**_____

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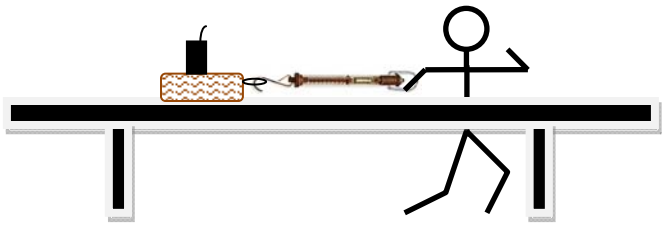
Lab 3-2: Friction



In this experiment, you will study the effects of various factors on the force of friction between a wooden block and the lab bench. Specifically, you will test the effects of surface area, speed, surface material, and normal force on the amount of force required to drag the block across the table at a constant speed.

INSTRUCTIONS

First, draw a complete free-body diagram for a block being dragged across the table via a spring scale in the space below.

If the block is being dragged at a constant velocity, then what is the relationship between the force exerted on the block via the spring scale and the frictional force exerted on the block by the table? Briefly explain.

Part One: Speed

Try dragging the block across the table, walking backwards at a constant speed, looking at the reading on the spring scale. Does the reading on the block stay steady? Give two reasons why it might not.

Even though the scale may bounce around a little, estimate the average value of the frictional force:

Spring scale reads _____ N.

Now try walking at a faster than normal pace (but still constant speed). Spring scale reads _____ N.

Now try walking at a slow pace. Spring scale reads _____ N.

Is there any noticeable relationship between frictional force and speed?

Part Two: Surface area

Again, drag the block at a constant speed to get a baseline reading: _____ N.

Now, flip the block over and do the same thing: _____ N.

Do the two sides of the block experience the same frictional force? If not, why do you think that might be?

Now, flip the block on its side and drag it at a constant speed again: _____ N.

Flip the block over on its other side and drag at constant speed: _____ N.

Is there a consistent difference in frictional force when the block is on its side as opposed to on its big face?

Part Three: Surface Material

Measure the mass of your block using one of the digital scales. Drag the block across the table at constant velocity and use the reading on the spring scale to determine μ_k , the coefficient of kinetic friction between the block and the table. Refer back to your free-body diagram and to any equations you might need, and show your work below:

Now, tape one of the materials onto the bottom of your block and drag again: _____ N. Calculate the coefficient of friction between this surface and the table. Choose another sample and do it again. Tabulate your results below:

Surfaces	**f_k (N)**	**μ_k**
Wood + Table		

Part Four: Normal Force

Remove any sample still taped to your block. Place masses on top of your block and measure the frictional force. Add 500 grams at a time, and measure the frictional force each time:

	f_k (N)
block alone	
block + 500 g	
block + 1000 g	
block + 1500 g	
block + 2000 g	

What happens to the frictional force as mass is added to the block? Does the increase in frictional force appear to be in proportion to the increase in mass?

Use your data above to make a table of the frictional force on the block as a function of the **normal force** on the block.

F_N (N)	**f_k (N)**

Make a graph of f_k vs. F_N and use Excel to calculate the slope of your line. Slope = _____.

What physical quantity is signified by your slope?