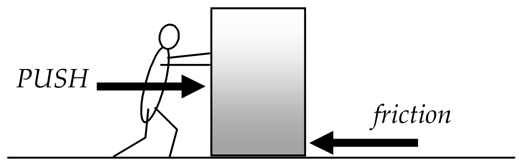
Friction Forces

Introduction:

Friction may be defined as the contact force parallel to the contacting surfaces. It is caused by the microscopic electrical attraction between the atoms of both surfaces. There are two main kinds of friction: static and kinetic. Static friction keeps the surfaces at rest whenever an outside force is applied. In other words, whenever we push against an object and it doesn't move, we are experiencing the force of static friction acting against us (see diagram below).



Once we are able to get an object to slide, then static friction no longer acts. Kinetic friction comes into play as a force that causes a drag against the motion. This drag is heard (as a scraping sound) and may be felt (as heat released by the surfaces).

It is well known that the "stickiness" of two surfaces in contact depends on the types of materials involved. For example, a 1-inch cube of solid plywood does not "stick" as well on polished stainless steel as it does on sandpaper. A measure of the "stickiness" of two surfaces in contact is the coefficient of friction, μ (Greek letter "mu"). We say that the plywood-steel boundary has a low μ and the plywood-sandpaper boundary a high μ.

Just as there are two types of friction, there are two types of coefficients: static μ_s and kinetic μ_k. In general, $\mu_s > \mu_k$ (why?) In this experiment you will be using one method to measure μ_s and a different method to measure μ_k.

Make sure that your group has a meterstick, a hooked wooden block, a surface board, a set of slotted weights, an Ohaus spring scale (with gram divisions), a balance, and a scientific calculator.

Group Members ____

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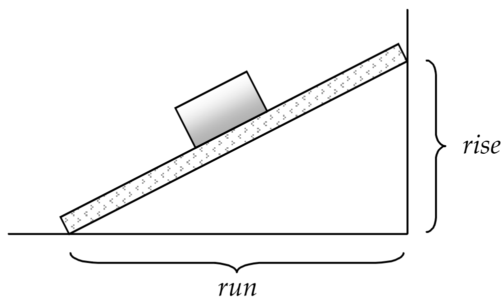
Friction Forces Data Sheet

Part I. Measuring the Coefficient of Static Friction

1) Place the hooked wooden block in the middle of the sandpaper on your surface board. Lift one end of the board slowly until the block begins to slide. (It is easier to do this along a wall. See diagram below.)
2) Measure the *rise* and the *run* of the board. Use your calculator to find $\mu_s = \frac{rise}{run}$.
3) Repeat Steps 1-3 for the three other materials (cardboard, rubber, cork) on your surface board.

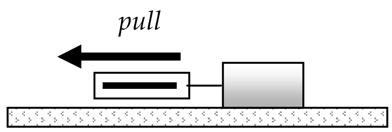


Material	*rise* in meters	*run* in meters	μ_s (no unit)
Sandpaper			
Cardboard			
Rubber			
Cork			

Part II. Measuring the Coefficient of Kinetic Friction

1) Set the hooked block on one pan of your balance. Adjust the sliding weight until you reach equilibrium. Record the *weight* of the block in grams.
2) Place the hooked wooden block near one end of the sandpaper on your surface board.
3) Attach the spring scale to the hook and pull the block so that it moves at constant speed along the board. Record the pulling force (*pull*) in grams. (See diagram below.)
4) Use your calculator to find $\mu_k = \frac{pull}{weight}$.

5) Repeat Steps 2-4 for the three other materials (cardboard, rubber, cork) on your surface board.



Material	*pull* in grams	*weight* of block in gms	μ_k (no unit)
Sandpaper			
Cardboard			
Rubber			
Cork			

Part III. Question – Answer using complete sentences.

1) Are your values for the coefficient of static friction greater than your values for the coefficient of kinetic friction? Why should we expect this outcome?

2) Suppose you used a wooden block of a different weight. Would your values for the static and kinetic coefficients change? Explain your answer.

TURN IN THIS DATA SHEET TO YOUR LAB INSTRUCTOR WHEN YOU ARE FINISHED.