Coefficient of Friction Lab Investigation:

Name: _____
Date: _____ Period _____

Purpose: A: To find the coefficient of sliding friction
B: To compare sliding friction with rolling friction

Apparatus: 1. Smooth board with hard surface to be used as an incline plane
2. Wooden block
3. Wax paper
4. Meter stick
5. Balance

Introduction:

When a block rests on an inclined plane, as shown in the diagram below, its weight concentrated at the center of gravity of the block, acts vertically downward. Since the block cannot move in that direction, the weight of the block is resolved into two component forces. One component, F_x acts parallel to the plane and tends to slide the block down the plane. The other component, F_N acts at right angles to the plan and tends to break it, or to make the block stick to the plane. If the slope of the plan is great enough to cause the block to slide at uniform speed, the ratio of the parallel force to the perpendicular force is the "coefficient of friction" between the block and the plane.

The coefficient of friction (μ) may also be defined as the ratio of the force required to slide or roll an object at uniform speed over a horizontal surface to the weight of the object itself. It can be found experimentally by weighing the object, and then using a spring balance to measure the force needed to slide the object at slow, uniform speed. For example, if a force of 8 Newtons is required to slide a 20 N block over a horizontal surface at a constant rate, the coefficient of friction is 8 N / 20 N or 0.4. Or you may write this in the following equation:

$$F_{fr} = \mu F_N \qquad \mu = F_{fr} / F_N$$

The coefficient of friction (μ) depends on the materials and the nature of the surfaces and is the ratio of the Force of Friction divided by Force Normal.

Procedure:

1. Sliding friction

Trial #1

Place the plane in the position shown in the previous page. The slope should be gentle enough so the wooden block, when placed upon the plane will not slide down the incline. Now increase the pitch of the plane gradually until a grade is reached at which the block will slide slowly down the plane with uniform speed when it is given a gentle push. Record this angle as θ. At this angle, the force of friction (F_{fr}) is equal in magnitude and opposite in direction to F_x. Using the weight of the block, construct a vector diagram in the space below, and determine the values of F_x and F_N. Since F_x equals F_{fr} in magnitude in this trial, you can calculate the coefficient of friction. Record your results here and in Data Table #1 on the next page.

F_w = _____
θ = _____
F_x = _____
F_{fr} = _____
F_N = _____
μ = _____

Trial #2

Using the same procedure as above, repeat the above procedure and calculate the coefficient of friction when a block is covered with wax paper. Wrap the block like a present. Record your finding and calculations here and in Table #1 on the next page.

F_w = _____
θ = _____
F_x = _____
F_{fr} = _____
F_N = _____
μ = _____

Trial #3

Using the same procedure as above, repeat the above procedure and calculate the coefficient of friction when a block is covered with plastic wrap. Wrap the block like a present. Record your finding and calculations here and in Table #1 on the next page.

F_w = _____

θ = _____

F_x = _____

F_{fr} = _____

F_N = _____

μ = _____

Trial #4

Using the same procedure as above, repeat the above procedure and calculate the coefficient of friction using one of your partners shoes instead of the wooden block. Record your finding and calculations here and in Table #1 on the next page.

F_w = _____

θ = _____

F_x = _____

F_{fr} = _____

F_N = _____

μ = _____

DATA TABLE #1

TRIAL	θ	F_W	F_X	F_N	F_{fr}	μ
1						
2						
3						
4						

Postlab questions: Answers are to be complete statements.

1. What information does this experiment furnish concerning the difference between starting and moving friction?

2. How is the coefficient of friction affected by the orientation of the block?

3. Does the coefficient of sliding friction depend on the kinds of material in contact? Support your answer with data from this experiment.

4. Does this experiment supply any evidence concerning the cause of friction? Elaborate.

5. How is the coefficient of friction related to the angle of the incline?

Name: _____
Lab Partner (s)_____

Date: _____ Period _____

SCORE
_____ 5 Technique
_____ 10 Data
_____ 15 Vector Dia
_____ 20 Questions
_____ 50 Total