Friction Lab

PSI Physics Name:_____

An Experiment to Determine the Coefficient of Friction

Objective:

The objective of this lab is to learn about the two basic contact forces, Normal force and Friction force, and the variable that relates them, the coefficient of friction μ. In this lab, you will experimentally find the value for the coefficient of friction for a variety of surfaces.

Background:

When an object is in motion along a rough surface, the force of friction acts opposite to the direction of the object's motion.

Materials:

- Blocks or plastic boxes with different surfaces (for example sandpaper, wood, mirror, etc.)
- 5 N and 10 N spring scales
- 0.1, 0.2, 0.3, 0.4 and 0.5 kg Masses

Procedure: You will perform 4 sets of measurements for 3 different surfaces. For each measurement:

You will pull the block or box at a constant velocity with a spring scale parallel to the direction of motion. The reading that you record on the spring scale will give be the applied force, and is equivalent to the friction force that the block experiences.

Step by step:
For each surface (you will do 3):

1. Above the data table, write the material of the surface of the block/box and the surface on which you will be pulling the block/box.
2. Using a spring scale, measure the **weight** of the block or box. Record the *Weight of Block* in newtons (N) in the data table.
3. You will add weight onto the block/box. Masses such as 0.1, 0.2, 0.3,… kg work well. Select four different masses (combinations). Find the weight of each mass (m•g) and record this as *Added Weight* in the table.
4. Add the weight of the block and the added weight. Record this as *Total Weight* in the table.
5. The Normal Force is equal to the *Total Weight* . Copy the *Total Weight* values to F_{Normal} in the table.

For each of the added weights:

6. Pull the block or box at a constant velocity with a spring scale parallel to the direction of motion. The reading that you record on the spring scale will give be the applied force, and is equivalent to the friction force that the block experiences. Record this as $F_{app} = F_{friction}$ in the table.

Data Collection:

Table 1: Surface: _____ on _____

Weight of Block (N)	Added Weight (N)	Total Weight (N)	F_{Normal} (N)	$F_{app}=F_{friction}$ (N)

Table 2: Surface: _____ on _____

Weight of Block (N)	Added Weight (N)	Total Weight (N)	F_{Normal} (N)	$F_{app}=F_{friction}$ (N)

Table 3: Surface: _____ on _____

Weight of Block(N)	Added Weight (N)	Total Weight (N)	F_{Normal} (N)	$F_{app}=F_{friction}$ (N)

Analysis:

1. Sketch and label the free body diagram for block/box with added weight.

Graphical Approach:

2. Graph $F_{friction}$ (vertical axis) vs. F_{Normal} (horizontal axis) for the 3 different surfaces. Connect the points with a straight line.

3. From the graph, write the equation for the line in terms of $F_{friction}$, F_{Normal}, and using μ_k to represent slope:

4. Find the slope of your graph for the 3 surfaces. These are the coefficients of friction μ_k for each surface.

   a. Surface 1:

   b. Surface 2:

   c. Surface 3:

Conclusions:

1. Summarize your results:

Surface	μ_k

2. Which surfaces had the smallest and largest coefficient of friction?

3. How did the coefficient of friction relate to the types of surface you used?

4. What happened to the **force of friction** when you increased the weight on the block?

5. What happened to the **coefficient of friction** when you increased the weight on the block?

6. Give at least two ways to reduce the amount of friction.

Application:

7. The force required to slide a parked car (brakes locked) of mass 1000 kg is 8000 N. What is the coefficient of friction between the tires and the road?