

## Lab: Static and Kinetic Friction

**Objective:** Investigate various types of friction and calculate the coefficients of friction for various surfaces.

### Tasks

- A. Finding the Coefficient of Static Friction  
~ using four different surfaces, find the minimum force just to get the block moving. Do this three times and take an average for each block.
- B. Finding the Coefficient of Kinetic Friction  
~ using four different surfaces, find the force necessary to keep the block moving at a constant speed. Do this three times and take an average for each block.
- C. How Friction is Affected by Mass  
~ using one surface only (one block), find the force required to start the block moving and the force to keep the block moving. Next, add a 1 kg mass to the top of the block and find the force to keep it moving and to get it moving. Repeat with four different masses on top of the block.
- D. How Tension Is Affected by Length  
~ add a 500 gram mass to the top of one block and find the force to keep the block moving. Repeat this when a string is used to connect the spring scale to the block. The string length can be around 5 cm. Repeat this four times with string of different lengths, not to exceed 20 cm.

### Calculations

To find the coefficient of friction ( $\mu$ ):

$$F_{friction} = \mu F_{normal}$$

OR 
$$\mu = \frac{F_{friction}}{F_{normal}}$$

Because the object is moving at a constant speed, the total force is zero. Therefore the force of friction **MUST EQUAL** the force you are pulling with.

Because the object is not moving vertically off the table or through the table, the normal force **MUST EQUAL** the total weight of your block. The total force in the vertical direction is zero too.

### **Questions**

1. Looking at your data from Tasks A and B, which surface was the hardest to get moving? Explain why. Was the same material also the hardest one to keep moving? Explain why it should or shouldn't be.
2. Calculate your coefficients of static friction for each surface.
3. Calculate your coefficients of kinetic friction for each surface.
4. Compare the coefficients of kinetic friction to the coefficients of static friction for identical surfaces. Is there a pattern? Explain your results in terms of Newton's First Law.
5. Look at your results for Task C. How did the force to pull the block change as the mass of the block changed.
6. Calculate the coefficients of only kinetic friction for each trial (from Task C). How do the coefficients change as the mass of the block changes?
7. Look at your results for Task D. What is the relationship between the length of string used and the force required to keep the block in motion?

### **Conclusion**

Please write a comprehensive conclusion demonstrating your understanding of various types of friction. Your conclusion should be based on your actual data, not on what theoretically should happen. Please include sources of error that may have caused your results to deviate from what was expected.

### **A Final Note**

I would like this to be a lab report generated primarily by you. Please write your own procedure, create an appropriate data table, include necessary calculations, answer the questions, and write your own conclusion. You do not have to overdo it, but what you submit must include the components of a standard laboratory report.