

Name:

Partner:

Block:

Physics 11
M. Lam

Friction Lab

Objective

Determine the relationship between 1) the force of friction and normal force and 2) the force of friction and surface area

Equipment

spring scales
wooden blocks (4, all about the same size)

Introduction

In this lab, a set of wooden blocks will be pulled across a table at a constant velocity.

1. Draw and label a free-body diagram for the wooden blocks as they are pulled across the table at a constant velocity.
2. Compare the forces acting in the vertical direction as well as the forces acting in the horizontal direction as the blocks are pulled across the table at a constant velocity. Justify your answers with reference to Newton's first law.

The normal force is _____ the gravitational force.
greater than/less than/equal to
Justify your answer.

The force of friction is _____ the applied force.
greater than/less than/equal to
Justify your answer.

Experimental Method

1. Connect the spring scale to the hook of one wooden block. Determine the force of gravity of the block by holding the scale vertically and lifting the block off the table. Record the reading of the spring scale in Table 1 as the normal force.
2. Place the block on the table with the wooden side facing downwards. Pull the block with the spring scale so the block moves at a constant velocity. Keep the spring scale parallel to the surface as the blocks are pulled. Repeat a minimum of five times. Record the average reading of the spring scale in Table 1 as the force of friction.
3. Repeat steps 1 and 2 while increasing the number of blocks used. **Keep the surface area constant by placing the blocks on top of the first.** Record the readings of the spring scale in Table 1.
4. Once you have reached four blocks, repeat step 2 using different arrangements of the four blocks to vary the surface area. Record the average readings of the spring scale in Table 2.

Table 1: Force of Friction as the Normal Force Changes

Number of Blocks	Normal Force F_N (N)	Force of Friction F_f (N)
1		
2		
3		
4		

Table 2: Force of Friction as the Surface Area Changes

Number of Blocks	Surface Area	Force of Friction F_f (N)
4	1 face	
4	2 faces	
4	3 faces	
4	4 faces	

Analysis and Discussion

Use Table 1 to plot the force of friction (on the vertical axis) as a function of the normal force (on the horizontal axis). Include a best fit line.

Determine the slope of the best fit line. Clearly mark the points on the line used to calculate the slope (e.g. with an \times).

Use the slope to write an equation for the relationship between force of friction and normal force. Write the equation with appropriate variables (i.e. F_f and F_N). What quantity does the slope represent?

Discuss the effect that surface area has on the force of friction.

Discuss the sources of error.

Component	Criterion	Weight	Mark
Introduction	<i>Objective and introductory questions</i>	1	
Experimental Method	<i>Procedure and an apparatus diagram which shows how the blocks are pulled across the surface with the spring scale</i>	1	
Data	<i>Data quality and presentation</i>	2	
Analysis and Discussion	<i>Plot of force of friction vs. normal force</i>	1	
	<i>Slope of the force of friction vs. normal force graph</i>	1	
	<i>Interpretation of the slope</i>	1	
	<i>Determining the effect that the surface area has on the force of friction</i>	1	
	<i>At least two <u>significant</u> sources of error</i>	1	
Conclusion	<i>Summary of the experiment and final results</i>	1	
TOTAL		10	