PHYSICS IN MOTION
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Unit 3D
Newton's Second Law Part 2
Shoe Friction Lab

Name:

Date:

In today's activity, you will be calculating the coefficient of friction between your shoe and the top of your desk.

Materials:

- shoes
- spring scales
- additional masses

Pre-Lab Questions:

1. Draw a free-body diagram for your shoe when it is at rest just before being pulled by a spring scale.

2. What is the equation for static friction?

3. How will you determine the maximum value for the static frictional force when pulling an object with a spring scale?

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4. What is the equation for kinetic friction?

5. How will you determine the value for the kinetic frictional force when pulling an object with a spring scale?

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Lab Procedure Part I:

In our experiment today, we will examine the static and kinetic friction associated with different types of shoes. You will need various shoes from your group (e.g., tennis shoes, sandals, flip flops, dress shoes, etc.) in order for there to be different shoes to examine. You will then fill in the data table below and calculate the frictional forces using a spring scale.

Sample Calculations:

Show one calculation for each of the following:

-weight of the shoe

-coefficient of friction

Table I. Static Friction

Type of Shoe	Mass (g)	Mass (kg)	Weight (N)	Normal Force (N)	Max. Static Friction (N)	Coefficient

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Table II. Kinetic Friction

Type of Shoe	Mass (g)	Mass (kg)	Weight (N)	Normal Force (N)	Kinetic Friction (N)	Coefficient

Lab Procedure Part II:

Change the weight of one of the shoes used in part one by adding additional mass to the shoe in increments. Repeat the procedure from part one by determining the maximum static frictional force and the kinetic frictional force on the shoe for each new weight.

Table III. Static Friction

Mass (g)	Mass (g)	Weight (N)	Normal Force (N)	Max. Static Friction (N)

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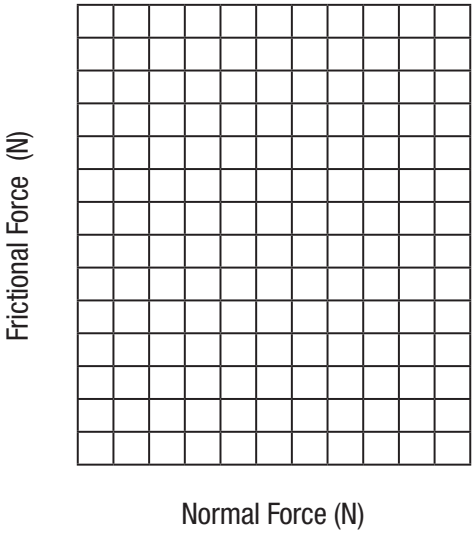
Table IV. Kinetic Friction

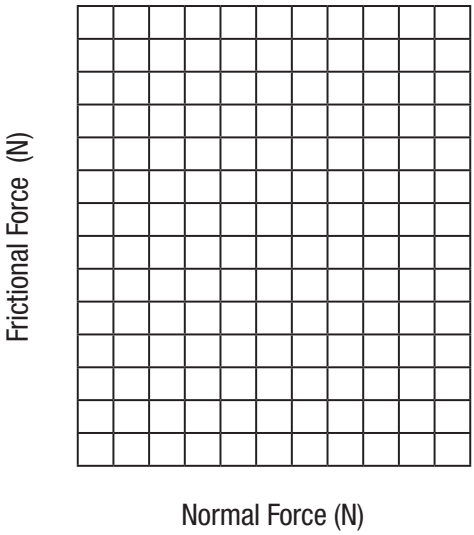
Mass (g)	Mass (g)	Weight (N)	Normal Force (N)	Kinetic Friction (N)

Graph the maximum static frictional force against the various weights of the shoe, and then graph the kinetic frictional force against the various weights of the shoe.

Static Friction vs. Normal Force



Kinetic Friction vs. Normal Force



Find the slope of the line of best fit for each of these graphs.

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Questions to consider:

1. How does the coefficient of static friction compare to the coefficient of kinetic friction for the shoes?

2. Which type of shoe has the highest coefficient of friction? Is this surprising?

3. What happens to the maximum static friction and the kinetic friction when additional mass is added to one of the shoes?

4. What does the slope of the line of best fit for the graphs above represent?