

# Fighting Force of Friction

## Purpose

To learn how different materials can affect friction  
To investigate the amount of force needed to move an object

## Background

Friction happens when objects rub together. As the tree house detectives calculate the force needed to get Jacob into the tree house, they have to consider friction as an opposing force. The ropes rubbing against the pulleys cause friction that must be overcome. Though friction is always a factor in the amount of force needed to move objects, there are ways that friction can be reduced so that the amount of force needed is also reduced.

## Materials

spring scale  
4 different soled shoes  
various sized washers  
waxed paper  
sandpaper  
tape  
balance

## Procedure

1. Measure 30 cm of waxed paper. Tape the paper to a flat surface such as a table.
2. Measure 30 cm of sandpaper. Tape the sandpaper along the side of the waxed paper.
3. Label the shoes from A-D.
4. Using a balance, find the mass of each shoe and record.
5. Determine which shoe has the most mass and calculate how much mass needs to be added to the other shoes to make them all equal.
6. Use the balance to find the number of washers needed to add to each shoe so that they are all of equal mass.
7. Place the correct number of washers in each shoe.
8. Place the toe of shoe A on the far edge of the waxed paper and connect the spring scale to the heel of the shoe. See diagram 1.
9. Making sure that the spring scale is parallel to the flat surface, slowly pull the shoe forward across the waxed paper.
10. Read the measurement on the spring scale just as the shoe begins to move and record in data chart.
11. Repeat steps 8-10 using the sandpaper.
12. Repeat steps 8-10 with each of the different shoes.
13. Rate your shoes from the ones that required the least amount of force to move to those that required the most force.

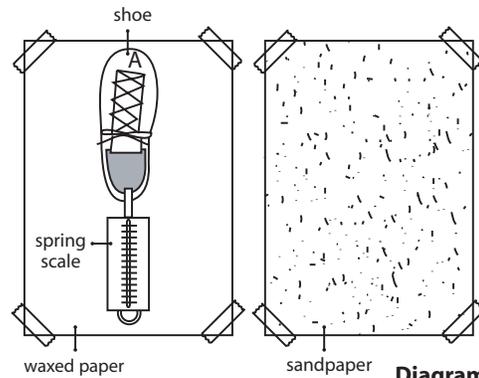


Diagram 1

## Data Chart

				Force on Flat Surface	
Shoe	Type of Sole	Mass	Number of Washers Needed	Waxed Paper	Sandpaper
A					
B					
C					
D					

## Conclusion

1. What are some differences in the shoes that required more force to those that required less force?
2. How do the soles of some shoes create more friction than others?
3. How did the force required for each shoe differ between the waxed paper and the sandpaper?
4. Which shoe required the least amount of force? Why?
5. Usually friction is thought of as a negative force that must be overcome to do work. What are some positive characteristics of friction in daily life?

## Extension

1. Gather each group's results and create a class chart or graph. Analyze and discuss the findings.
2. Use shoe boxes and add water, oil, salt, and so on to the waxed paper to determine the difference in the amount of force needed.

