

Forces ▪ *Consumer Lab*

Sticky Sneakers

Problem

How does the amount of friction between a sneaker and a surface compare for different types of sneakers?

Skills Focus

controlling variables, interpreting data

Materials

three or more different types of sneakers

2 spring scales, 5 N and 20 N, or force sensors

mass set(s)

3 large paper clips

tape

balance

Procedure 

1. Sneakers are designed to deal with various friction forces, including these:
 - starting friction, which is involved when you start from a stopped position
 - forward-stopping friction, which is involved when you come to a forward stop
 - sideways-stopping friction, which is involved when you come to a sideways stop
2. Use the data table to record your data.
3. Place each sneaker on a balance. Then put masses in each sneaker so that the total mass of the sneaker plus the masses is 1,000 g. Spread the masses out evenly inside the sneaker.

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4. You will need to tape a paper clip to each sneaker and then attach a spring scale to the paper clip. (If you are using force sensors, see your teacher for instructions.) To measure
 - starting friction, attach the paper clip to the back of the sneaker.
 - forward-stopping friction, attach the paper clip to the front of the sneaker.
 - sideways-stopping friction, attach the paper clip to the side of the sneaker.
5. To measure starting friction, pull the sneaker backward until it starts to move. Use the 20-N spring scale first. If the reading is less than 5 N, use a 5-N scale. The force necessary to make the sneaker start moving is equal to the friction force. Record the starting friction force in your data table.
6. To measure either type of stopping friction, use the spring scale to pull each sneaker at a slow, constant speed. Record the stopping friction force in your data table.
7. Repeat Steps 4–6 for the remaining sneakers.

Data Table

Sneaker	Starting Friction (N)	Sideways-Stopping Friction (N)	Forward-Stopping Friction (N)
A			
B			
C			
D			
E			
F			

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Analyze and Conclude

Answer the following questions in the space provided.

1. **Controlling Variables** What are the manipulated and responding variables in this experiment? Explain. (See the Skills Handbook for a discussion of experimental variables.)

2. **Observing** Why is the reading on the spring scale equal to the friction force in each case?

3. **Interpreting Data** Which sneaker had the most starting friction? Which sneaker had the most forward-stopping friction? Which sneaker had the most sideways-stopping friction?

4. **Drawing Conclusions** Do you think that using a sneaker with a small amount of mass in it is a fair test of the friction of the sneakers? Why or why not? (*Hint:* Consider that sneakers are used with people's feet inside.)

5. **Inferring** Why did you pull the sneaker at a slow speed to test for stopping friction? Why did you pull a sneaker that wasn't moving to test starting friction?

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6. **Developing Hypotheses** Can you identify a relationship between the brand of sneaker and the amount of friction you observed? If so, describe the relationship. What do you observe that might cause one sneaker to grip the floor better than another?

7. **Communicating** Draw a diagram for an advertising brochure that shows the forces acting on the sneaker for each type of motion.

Design an Experiment

Wear a pair of your own sneakers. Start running and notice how you press against the floor with your sneaker. How do you think this affects the friction between the sneaker and the floor? Design an experiment that will test for this variable. *Obtain your teacher's permission before carrying out your investigation.*
