

LAB
1 Laboratory
Activity

Pushing People Around

When we push something, we unconsciously compensate for how much mass it has. We know that if an object has a larger mass it will require more force to get it moving and if it has a small mass it will require less force. But how much difference is there? In this experiment, we will see what variables affect acceleration.

Strategy

You will see what happens when you use a constant force to pull a skater. You will examine the relationship between force, acceleration, and mass.

Materials

tape
meter stick
roller skates
skating safety equipment (helmet, pads)
spring balance
stopwatch

Procedure

1. Mark positions on the floor at intervals of 0 m, 5 m, 10 m, and 15 m with the tape. The floor should be smooth, straight, and level.
2. Have one student stand on the 0-m mark with the skates on. A second student stands behind the mark and holds the skater. The skater holds the spring balance by its hook.
3. The third student holds the other end of the spring balance and exerts a constant pulling force on the skater. When the skater is released, the puller must maintain a constant force throughout the distance. Measure the time to each of the marks. Record this in the Data and Observations section along with the spring balance readings at each mark.
4. Repeat steps 2 and 3 for two different skaters in order to vary the mass. Keep the force the same. Make sure the skaters hold their skates parallel and do not try to change direction during the trial.
5. Repeat steps 2, 3, and 4 with a different constant force. Use the same three skaters. Record these results in the Data and Observations section.

Laboratory Activity 1 (continued)

Data and Observations

Table 1

Roller Skater Distance, Trial 1			
Trial	Distance (m)	Force (N)	Time (s)
1	5		
	10		
	15		
2	5		
	10		
	15		
3	5		
	10		
	15		

Table 2

Roller Skater Distance, Trial 2			
Trial	Distance (m)	Force (N)	Time (s)
1	5		
	10		
	15		
2	5		
	10		
	15		
3	5		
	10		
	15		

Laboratory Activity 1 (continued)**Questions and Conclusions**

1. Until the time of Galileo and Newton, people believed that, disregarding friction, a constant force was required to produce a constant speed. Do your observations confirm or reject this notion?

2. What happens to the speed as you proceed farther along the measured distance?

3. What happens to the rate of increase in speed—the acceleration—as you proceed farther along the measured distance?

4. When the force is the same, how does the acceleration depend upon the mass?

5. When the mass of the skater is the same, how does the acceleration depend upon the force?

6. Suppose a 4-N force is applied to the skater and no movement results. How can this be explained?

Strategy Check

_____ Can you pull someone with a constant force?

_____ Can you explain the relationship between force, mass, and acceleration?