Workshop 3.
When Rubber Meets the Road

A rubber band twisted around the axle of a plastic car provides the force that moves the car forward. In this workshop, fifth-grade students continue their exploration of force and motion by recording and comparing the distance a vehicle travels under various conditions. Students predict the distance the car will travel by counting the number of twists in the rubber band, and observe the car's speed as it rolls across the floor. When the force of the rubber band stops acting, the force of friction slows the car to a stop.

On-Site Activities and Timeline

Getting Ready

30 minutes

Share What You Learned

As homework last time, you were asked to consider how airbags and seat belts save lives. Discuss your answers with the group.

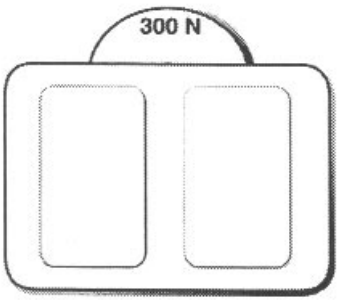
A Penny for Your Thoughts on the 10-Cent Experiment

In the video for Workshop 2, you saw an experiment in which two eggs were dropped. One egg fell on sand, the other on a hard surface. Perhaps you even tried it yourself. Make a list of several other ways to keep a dropped egg from breaking. Share your ideas with the other participants.

Does Our Weight Change in a Moving Elevator?

You may have noticed that when you ride in an elevator, there are times when you feel heavier or lighter than your normal weight due to the elevator's motion. (Have you ever jumped in an elevator just as it starts to move or is coming to a stop?) Now, imagine you are standing in the elevator on a bathroom scale. The first picture below shows the scale, seen from above, when the elevator is at rest. You can see that the scale reads 300 N. (N, a Newton, is a unit of force in the metric system. One Newton equals about 0.45 pounds, so a 300-N person weighs 135 pounds.)

With a partner, or in a small group, consider the following elevator situations. For each, draw an arrow on the bathroom scale to indicate what it would read. Don't worry about the *actual* numerical reading on the scale, but simply think about whether the scale would read higher, lower, or the same as it reads when the elevator is standing still. Explain your reasoning.



Elevator at Rest

Elevator Starting Upwards

Elevator Moving Up Between Floors

On-Site Activities and Timeline, cont'd.

Elevator Slowing Down Preparing To Stop

Elevator Starting Downwards

Elevator Moving Down Between Floors

Elevator Slowing to a Stop

Elevator at Rest on the Bottom Floor

To check your answers, go to the *Science in Focus: Force and Motion* Web site at:

http://www.learner.org/channel/workshops/force

Watch the Workshop Video

60 minutes

As you watch the video, look for the "10-Cent Experiment." You may want to try it yourself at home. Instructions can be found on page 33.

On-Site Activities and Timeline, cont'd.

Going Further

30 minutes

Reading the Speedometer

Materials:

Graph paper

Instructions:

In this exercise, you will have the opportunity to review what you have learned about motion and the ways to represent it. You will be describing motion in three different ways. In Activity A you will plot a graph, in Activity B you will draw some dots, and in Activity C you will write a story.

Complete each activity using the speedometer readings listed in the table below, all given in miles per hour (mph). Assume each of these readings was made after an equal interval of time. You may decide the length of the interval (i.e., one second, one minute, etc.).

Data are in mph

Speedometer Reading	Activity A Graph	Activity B Dots	Activity C Story
Reading 1	0	20	30
Reading 2	5	15	0
Reading 3	10	10	15
Reading 4	5	5	70
Reading 5	0	0	50

1. **Activity A:** Using a piece of graph paper and the five speedometer readings listed for Activity A, plot a graph of the object's motion. What type of object might move in this pattern?
2. **Activity B:** Using the five speedometer readings listed for Activity B, draw dots spaced in such a way as to indicate the motion of the object. What type of object might move at these speeds?
3. **Activity C:** Using a separate sheet of paper and the five speedometer readings listed for Activity C, make up a story about an object that might move along with the five speeds shown.

For Next Time

Homework Assignment

What Would the World Be Like Without Friction?

Congressman Notsosmart is testifying before a Senate Subcommittee about the nation's energy concerns. He explains that our nation has a dwindling supply of natural resources, and that we will put our future at risk if we do not find a way to curb energy use in the near future. The Congressman proposes that to reduce energy demands, the nation should do away with friction.

Write a letter to the Congressman explaining why you feel that this is a bad idea. Support your letter with examples that explain why we do not want to abolish friction.

Make good arguments to support your position by explaining to the Congressman what it would be like to live in a frictionless world. Be sure you back up your claims with appropriate examples. Be creative! Have fun!

The 10-Cent Experiment

Materials:

A toy car

A smooth board

Flat objects with different surface textures, such as:

A stopwatch

- Sandpaper
- A dish towel

Instructions:

1. Create a ramp by propping the board against a wall or firm support.
2. Roll the car down the ramp and record with a stopwatch how long it takes to reach the bottom.
3. Repeat, covering the ramps with different surface textures.

Questions:

Did the cars reach the bottom of the ramp at different times?

Why or why not?

Notes