Workshop 2.
Drag Races

Forces can help put objects into motion and can also bring moving objects to a stop. In this workshop, fifth-grade students explore the physics of motion using plastic cars with strings and washers attached to provide a pulling force. The students test the speed of the vehicles and explain what forces bring the vehicles to a stop, as the cars collide with and displace barriers at the end of their run. Finally, the students discuss their findings to help solidify their understanding of the effect of forces on motion.

On-Site Activities and Timeline

Getting Ready

30 minutes

Share What You Learned

For homework last time, you made a list of practical and impractical ways of measuring the speed of a car passing on the street. You also listed ways of stopping a car that is in motion. Take some time to discuss your ideas with your partner or group.

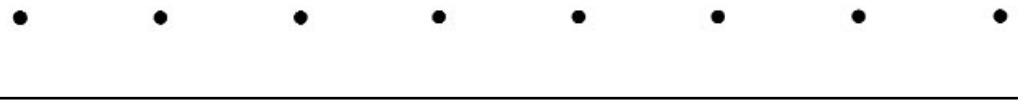
A Penny for Your Thoughts on the 10-Cent Experiment

In the video for Workshop 1, you saw an experiment with a marble and muffin paper. Perhaps you even tried it yourself. When the effects of air resistance were reduced, both objects fell at almost the same rate. Make a list of other ways to make both objects fall the same way when they are dropped. Share your ideas with the other participants.

Oil Drops and a Car's Motion

1. Suppose your car had a leaky oil pan that leaked one drop of oil on the road every second. Explain how the drops of oil could help you determine something about the motion of the car.
2. Now, work with a partner to discuss the following pictures of oil dripped on the road from a leaky car. The drops leak out of the car once every second. For each of the pictures below, describe what kind of motion the car is exhibiting, and how you know this.

a.



b.

c.

d.

On-Site Activities and Timeline, cont'd.

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 27.

Going Further

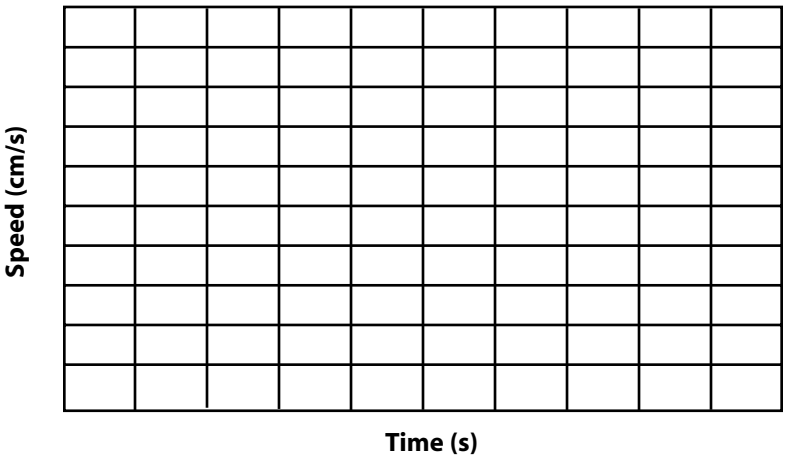
30 minutes

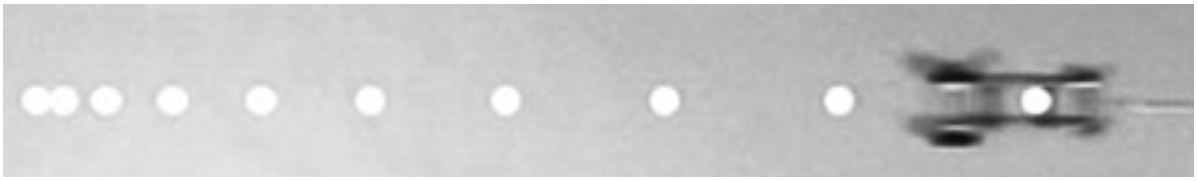
Plotting Motion

Below is a picture of a car's motion, with dots representing its position after time intervals of 1/5 of a second. We have also provided a data table, giving the car's speed in centimeters per second at different times during the run. Next to the table is a blank graph for you to complete.

1. Put a dot on your graph to represent each speed reading in the table.
2. Draw a smooth line through your data points.
3. Describe in words what the graph tells you about the motion of the car.

Speed (cm/s)	Time (s)
0	0
20	0.2
40	0.4
60	0.6
80	0.8
100	1.0
120	1.2
140	1.4
160	1.6
180	1.8

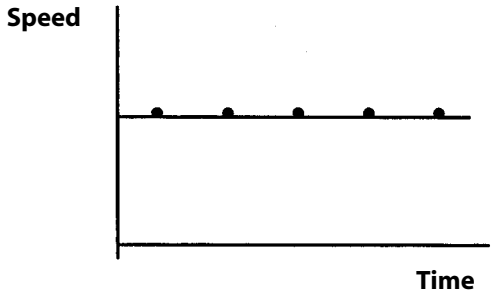


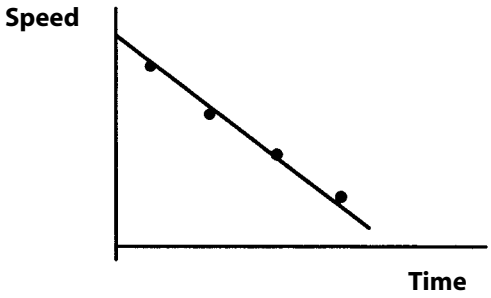


On-Site Activities and Timeline, cont'd.

Interpreting Motion Data

Examine the two graphs shown below. Discuss with a partner what you think they tell you about the motion of the car.

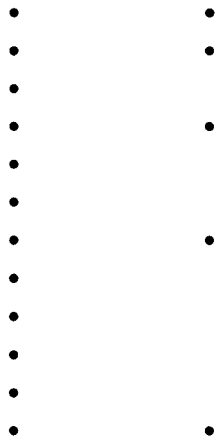




Which Is the Falling Ball?

Shown to the right are two pictures of the way a falling ball might appear if photographed during each second of fall. One of them is correct and the other is not.

1. Discuss with your partner what you think is different about the motion exhibited in each of the two pictures.
2. Describe the speed of the ball in each picture.
3. Which picture do you think is correct? Why?



For Next Time

Homework Assignment

Force, Motion, and Auto Safety

1. Use the Internet or other references to find information on how automobile safety devices help prevent injuries and fatalities in crashes.
2. In your journal, write responses to the following. Be prepared to discuss your ideas at the next workshop.

   a. Based on what you know about force and motion, explain the science behind why seatbelts and airbags save lives.

   b. When a car hits a barrier, how does the speed of the car determine the barrier's movement?
3. As a passenger, would you rather have a barrier that moves when you hit it, or a barrier that does not move? Explain why.

The 10-Cent Experiment

Materials:

Two raw eggs

A container of sand (depth of at least 6 inches)

A tile or other hard, flat surface

Instructions:

1. Drop the first egg onto the hard surface from a height of about 5 feet.
2. Drop the second egg from the same height onto the sand.

Questions:

Was there any difference in what happened to the egg?

Why or why not?

Notes