GOALS
In this activity you will:
• Identify the parts of the process of stopping a car.
• Measure reaction time.
• Wire a series circuit.

What Do You Think?
Many deaths that occur on the highway are drivers and passengers in vehicles that did not cause the accident. The driver was not able to respond in time to avoid becoming a statistic.

• How long would it take you to respond to an emergency?
Record your ideas about this question in your Active Physics log. Be prepared to discuss your responses with your small group and the class.

For You To Do
1. To stop a car, you must move your foot from the gas pedal to the brake pedal. Try moving your right foot between imaginary pedals.
1. Estimate how long it takes to move your foot between the imaginary pedals. Record your estimate.

2. The first step in stopping a car happens even before you move your foot to the brake. It takes time to see or hear something that tells you to move your foot. Test this by having a friend stand behind you and clap. When you hear the sound, move your foot between imaginary pedals.

   a) Estimate how long it took you to respond to the loud noise. Record your estimate.

3. Create a simple electric circuit to test your response time. Your group will need a battery in a clip, two switches, a flashlight bulb in a socket, and connecting wires. Connect the wires from one terminal of the battery to the first switch, then to the second switch, to the light bulb, and back to the battery.

4. Close one switch while the other is open. Close the other switch. Take turns turning the light off and on with each person operating only one switch.

   a) Record what happens in each case.

5. Try to keep the light on for exactly one second, then five seconds. You can estimate one second by saying “one thousand one.”

   a) How quickly do you think you can turn the light off after your partner turns it on? The time the bulb is lit is your response time. Record an estimate of your response time in your log.
6. Find your response time using the electric circuit.
   a) How could you improve the accuracy of the measurement?
   b) How would repeating the investigation improve the accuracy?

7. Test your response time with the other equipment set up in your classroom. Use a standard reaction time meter, such as one used in driver education. You will need to follow the directions for the model available in your class.
   a) Record your response time.

8. Use two stopwatches. One person starts both stopwatches at the same time, and hands one to her lab partner. When the first person stops her watch, the lab partner stops his. The difference in the two times is the response time.
   a) Record your response time.

9. Use a centimeter ruler. Hold the centimeter ruler at the top, between thumb and forefinger, with zero at the bottom. Your partner places thumb and forefinger at the lower end, but does not touch the ruler. Drop the ruler. Your partner must stop the ruler from falling by closing thumb and forefinger.
   a) The position of your partner’s fingers marks the distance the ruler fell while her nervous system was responding. Record the distance in your log.
   b) The graph at the top of the next page shows the relationship between the distance the ruler fell and the time it took to stop it. Use the graph to find and record your response time.
10. Compare the measures of your response obtained from each strategy.

a) Explain why they were not all the same.

b) What measure do you think best reports your response time? Why?

11. Compare the measures you obtained with those of other students.

a) Record the results for the fastest, slowest, and average response times.

b) Why do you think response times vary for people of the same age? Discuss this with your group and then record your answer.

**Reflecting on the Activity and the Challenge**

The amount of time people require before they can act has a direct impact on their driving. It takes time to notice a situation and more time to respond. A person who requires a second to respond to what he or she sees or hears is more likely to have an accident than someone who responds in half a second. Your **Chapter Challenge** is to design and build an improved safety device for a car. You may be able to design a car that helps drivers to stay alert and helps them become more aware of their surroundings. Anything that you can do to decrease a driver’s response time will make the car safer.
Physcis To Go

1. Test the response time of some of your friends and family with the centimeter ruler. Bring in the results from at least three people of various ages.

2. How do the values you found in Question 1 compare with those you obtained in class? What do you think explains the difference, if any?

3. Take a dollar bill and fold it in half lengthwise. Have someone try to catch the dollar bill between his or her forefinger and middle finger. Most people will fail this task.
   a) Explain why it is so difficult to catch the dollar bill.
   b) Repeat the dollar bill test, letting them catch it with their thumb and forefinger.
   c) Explain why catching it with thumb and forefinger may have been easier. Try to include numbers in your answer such as the length of the dollar, the time for the dollar to fall, and average response time.

4. Does a racecar driver need a better response time than someone driving around a school? Explain your answer, giving examples of the dangers each person encounters.

5. Apply what you learned from this activity to describe how knowing your own response time can help you be a safer driver.
**Stretching Exercises**

1. Build a device with a red light and a green light. If the red light turns on, you must press one button and measure the response time. If the green light turns on, you must press a second button and measure the response time. Have your teacher approve your design before proceeding. How do response times to this “decision” task compare with the response times measured earlier?

2. Use the graph for response time to construct a response-time ruler with the distance measurement converted to time. You can now read response times directly.

3. Do you think some groups of people have better or worse response times than others? Consider groups such as basketball players, video game players, taxi drivers, or older adults. Plan an investigation to collect data that will help you find an answer. Include in your plan the number of subjects, how you will test them, and how you will organize and interpret the data collected. Have your teacher approve your plan before you proceed.