



Classroom Activity: Teacher Guide: Measuring Heart Rate with Your Own Stethoscope

What happens to people's heart rates when they exercise? Measure another person's heart rate using a stethoscope you create with a cardboard tube, a funnel, and tape.

Activity's uses:	Small group exploration
Area(s) of science:	Life Science
Difficulty level:	1
Prep time:	<10 minutes
Activity time:	10-20 minutes
Key terms:	health, heart, heart rate, sound, exercise, building a tool, circulatory system

Background Information

To listen to a patient's heart beating, a doctor uses a tool called a stethoscope, which is a long, thin plastic tube that has a small disc on one end and earpieces on the other end. The disc and tube of the stethoscope amplify small sounds, such as heartbeats. Every time a person's heart beats, the heart, which is a powerful pump, contracts and pushes blood through the body. This blood is full of oxygen, so the heart helps deliver oxygen to the rest of the body, while picking up nutrients and delivering them to other parts of the body. Heartbeats can be easily heard using a good stethoscope.

Genetics, gender, age, and health all affect people's heart rates. When people exercise, their bodies need more oxygen, and consequently, their hearts beat faster and their heart rates increase. A person who regularly exercises usually has a slower heart rate because a strengthened heart does not need to work as hard to pump oxygen through the body. A heart rate is usually calculated in terms of beats per minute (bpm), but to calculate a heart rate immediately after exercise, it is better to count the number of beats for 10 seconds and multiply that value by six (to get the number of beats in 1 minute). This is because the heart will quickly slow down after exercise. Consequently, the heart rate should be measured as quickly as possible after a person has stopped exercising.

In this science activity, students can make their own stethoscopes using a cardboard tube, a funnel, and tape, and use these to measure other students' heart rates at rest and immediately after exercise.

For Discussion

This science activity can serve as a starting point for a variety of science and health discussions. Here are a few examples of questions that can be used to start a discussion:

- What do you expect your resting heart rate to be? Why?
- How do you expect your heart rate to change when you exercise? If you predict that it will increase, how much do you expect your heart rate to increase when you exercise?
- What do you think affects how your heart rate changes when you exercise? How do you think your heart rate immediately after exercising would change if you got more or less exercise?
- How do you think your resting heart rate would change if you got more or less exercise?
- How do you think the cardboard tube and funnel allow you to hear someone else's heartbeat? Why do you think a real stethoscope would work better than the one you just made?
- The "stethoscope" that you make in this activity is similar to an old-fashioned hearing aid called an ear trumpet. How well does your stethoscope work as a hearing aid, and how do you think you could change the design of your stethoscope to be a better hearing aid?

Materials

Needed for preparing ahead:

- Duct tape or other strong tape
- Scissors (1)

Needed for each demo or small group at the time of the science activity:

- Plastic funnel (1)
- A cardboard tube from a paper-towel roll (1)
- Duct tape or other strong tape strip (1)
- Stopwatch or clock that counts seconds (1)



Figure 1. You need only a few simple household materials to do this fun science activity.

What to Do

Prepare Ahead (<10 minutes)

1. Use the scissors to cut strips of duct tape, one for each group. The strips should be long enough to go around the circumference of the cardboard tube at least two times.

Science Activity (10-20 minutes)

1. Each group should have one funnel, one cardboard tube, and one strip of duct tape.
2. Have students insert the narrow end of the funnel into the cardboard tube and tape the funnel and cardboard tube securely together using the duct tape.



Figure 2. Have students tape the funnel to the cardboard tube together using the duct tape, making sure that the tape completely seals the tube and funnel together. There should be no gaps or spaces where the tube and funnel are taped together.

3. Have the students practice listening to the heartbeat of other students using the homemade stethoscopes. The student listening should place the funnel flat on the chest of another student, on the left side roughly where the heart is, and place the hole at the end of the cardboard tube against the listener's ear. If there are other noises in the room, it can be difficult to hear, so try to have the students be quiet. Also, thick clothing may make it difficult to hear the heartbeat.



Figure 3. To listen to another student's heartbeat, have the listener place the funnel flat on the chest of the other student, on the left side roughly where the heart is. The listener should place his or her ear at the hole on the end of the tube, on the other end of the stethoscope.

4. To have the students determine the resting heart rates of other students, make sure the students being measured have been sitting for a while. Then, they can count the number of beats for 15 seconds and multiply that value by four. This number will be in beats per minute (bpm) as in Equation 1 below.

Equation 1.

$$\text{Resting heart rate} = (\# \text{ of heartbeats in 15 seconds}) \times 4$$

5. To have the students determine the heart rates of other students immediately after exercising, have the students that will have their heart rates measured exercise in place, such as by running in place or doing jumping jacks, for one minute. Immediately after they have stopped exercising, have the listeners count their number of heartbeats for 10 seconds and multiply those values by six as in Equation 2 below.

Equation 2.

Heart rate after exercising = (# of heartbeats in 10 seconds) x 6

How did their heart rates change?

Expected Results

You should see that when the students exercise, their heart rates increase compared to their rates when they have been resting. This is because when people exercise, their bodies need more oxygen, and consequently, their hearts beat faster and their heart rates increase. The heart rates in people who exercise regularly usually will not increase as much during exercise. Regular exercise strengthens the heart so that it does not need to work as hard.

For Further Exploration

This science activity can be expanded or modified in a number of ways. Here are a few options:

- What is the average heart rate for the entire class? You can have students report their heart rates and calculate the average for the class.
- How does age affect heart rate? You can have students compare the heart rates of children and adults, but be sure to use only healthy, physically fit people or the results will reflect health more than age.
- A person should use at least 50% of their maximum heart rate when they are exercising for the activity to qualify as exercise. You can have students read about maximum and target heart rates, and then, use that information to determine what physical activities they do that qualify as exercise.

Downloads and Links

- Measuring Heart Rate with Your Own Stethoscope Facilitator / Educator Guide [PDF](#)
- Measuring Heart Rate with Your Own Stethoscope Student Guide [web page](#) or [PDF](#)

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