

3. Set up the Heart Rate Monitor. Follow the directions for your type of Heart Rate Monitor.

Using a Hand-Grip Heart Rate Monitor

- a. Sit in a chair, facing away from the calculator and your classmates. Grasp the handles of the Hand-Grip Heart Rate Monitor with your hands. The fingertips of each hand should be placed on the reference areas of the handles. The left hand grip and the receiver are both marked with an alignment arrow. When collecting data, be sure that the arrow labels on each of these devices are in alignment (see Figure 1). The reception range of the plug-in receiver is 80–100 cm, or about 3 feet.

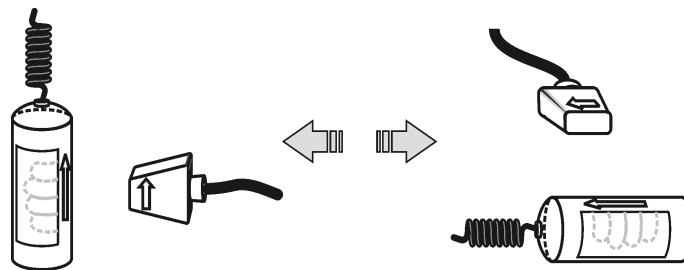


Figure 1

- b. Monitor the live readouts on the calculator screen to determine that the sensor is functioning correctly. There will be a 10–15 second delay while data are collected before the first heart rate is reported. The readings should be consistent and within the normal range of the individual, usually between 55 and 90 beats per minute.
- c. If the readings appear unreasonable, reposition your fingers and check the sensor and receiver alignment.
- d. Once it is apparent that the sensor is functioning correctly, continue with Step 4.

Using an Exercise Heart Rate Monitor

- a. Depending upon your size, select a small or large size elastic strap. Secure one of the plastic ends of the elastic strap to the transmitter belt. It is important that the strap provide a snug fit for the transmitter belt.
- b. Wet each of the electrodes (the two grooved rectangular areas on the underside of the transmitter belt) with 3 drops of saline solution.
- c. Secure the transmitter belt against the skin directly over the base of the rib cage. The POLAR logo on the front of the belt should be centered. Adjust the strap for a tight fit.



Figure 2

- d. Take the receiver module of the Heart Rate Monitor in your right hand and have a seat. Face away from your classmates. Sit quietly. Remember that the receiver must be within 80 cm of the transmitter in the Heart Rate Monitor belt.

Part I Sitting Heart Rate

- Once the subject has been seated quietly and reasonable readings have been obtained for about a minute, a partner should select $\overline{\text{Start}}$ to begin monitoring heart rate. Another partner should begin timing at the same time.

Part II Reclining Heart Rate

- After 4 minutes of data collection have gone by, the subject should recline on a clean surface or table and facing away from all classmates. Note: A partner should tell the subject when it is time to recline.

Part III Standing Heart Rate

- After 8 minutes of data collection have gone by, the subject should stand facing away from all classmates. A partner should again tell the subject when it is time to stand. Data collection will automatically stop after 12 minutes (720 seconds).

Part IV Recording Data

- Examine the graph that is displayed after data collection ends. You should be able to recognize three parts that match with the subject's sitting, reclining, and standing heart rates.
- Determine the subject's sitting heart rate.
 - Select $\overline{\text{Anlyz}}$, and then select **Statistics...**
 - Note the flattest part of the first 1/3 of the graph (up to about 240 seconds) that matches with the sitting part of the experiment.
 - Use $\overrightarrow{\text{D}}$ and $\overleftarrow{\text{C}}$ to move the cursor to the beginning of this flattest part and then select $\overline{\text{OK}}$.
 - Move the cursor to the end of the flat part and select $\overline{\text{OK}}$.
 - Record the mean (average) heart rate (to the nearest whole bpm). This is the subject's sitting heart rate.
 - Select $\overline{\text{OK}}$ to return to the graph.
- Determine the subject's reclining heart rate.
 - Select $\overline{\text{Anlyz}}$, and then select **Statistics...**
 - Note the flattest part of the middle 1/3 of the graph (from about 240 seconds up to about 480 seconds) that matches with the reclining part of the experiment.
 - Use $\overrightarrow{\text{D}}$ and $\overleftarrow{\text{C}}$ to move the cursor to the beginning of this flattest part and select $\overline{\text{OK}}$.
 - Move the cursor to end of this flat part and select $\overline{\text{OK}}$.
 - Record the mean (average) heart rate (to the nearest whole bpm). This is the subject's reclining heart rate.
 - Select $\overline{\text{OK}}$ to return to the graph.
- Determine the subject's standing heart rate.
 - Select $\overline{\text{Anlyz}}$, and then select **Statistics...**
 - Note the flattest part of the last 1/3 of the graph (from about 480 seconds up to 720 seconds) that matches with the standing part of the experiment.
 - Use $\overrightarrow{\text{D}}$ and $\overleftarrow{\text{C}}$ to move the cursor to the beginning of this flattest part and select $\overline{\text{OK}}$.
 - Move the cursor to end of this flat part and select $\overline{\text{OK}}$.
 - Record the mean (average) heart rate (to the nearest whole bpm). This is the subject's standing heart rate.
 - Select $\overline{\text{OK}}$ to return to the graph.

11. Sketch or print copies of the graph as directed by your teacher.
12. Repeat Steps 4–11 with other members of the team serving as subjects. Note: After selecting **(Start)**, select **(OK)** to begin data collection.

DATA

Subject's name			
Sitting heart rate (beats/min)			
Reclining heart rate (beats/min)			
Standing heart rate (beats/min)			
Difference between sitting and reclining heart rates (beats/min)			
Difference between standing and sitting heart rates (beats/min)			
Difference between standing and reclining heart rates (beats/min)			

PROCESSING THE DATA

1. In the space provided in the data table, subtract to calculate the difference between the sitting and reclining heart rates for each subject.
2. Subtract to find the difference between the standing and sitting heart rates for each subject.
3. Subtract to find the difference between the standing and reclining heart rates for each subject.
4. Does the position of your body affect your heart rate?
5. Compare your results with those of other students.
6. Try to explain the results of the experiment.

EXTENSION

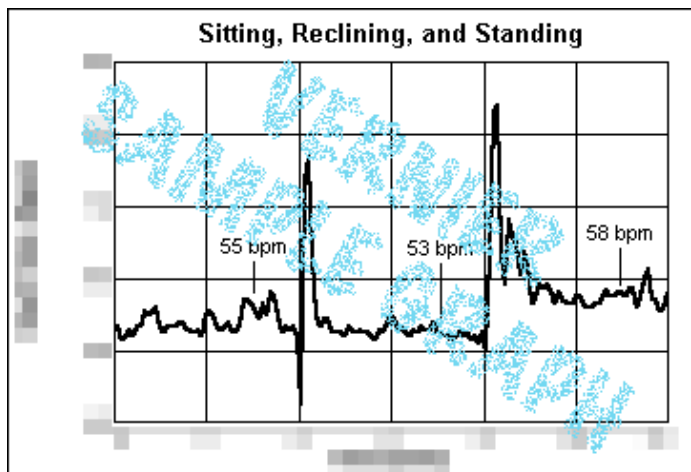
1. Measure your heart rate while standing on your head. Compare the results with your other results.

TEACHER INFORMATION**Heart Rate and Body Position**

1. The student pages with complete instructions for data collection using LabQuest App, Logger *Pro* (computers), EasyData or DataMate (calculators), and DataPro (Palm handhelds) can be found on the CD that accompanies this book. See *Appendix A* for more information.
2. The Hand-Grip Heart Rate Monitor consists of a set of hand grips and a plug-in receiver. The hand grips are held, one in each hand, by the individual whose heart rate is being monitored. The hand grips are marked for the right or left hand and each has the necessary markings showing where the individuals' fingers and palms should be placed. The left hand grip and the receiver are both marked with an alignment arrow. When collecting data, it is important that the arrow labels on each of these devices be in alignment.
3. The Exercise Heart Rate Monitor includes a transmitter belt, receiver module, large elastic strap, and small elastic strap.
4. It is important to have good contact between the transmitter belt and the test subject when using the Exercise Heart Rate Monitor. It is very important that the belt fit snug, but not too tight. Both electrodes should be wetted with either saline solution or contact lens solution. A 5% salt solution works well and can be prepared by adding 5 g per 100 mL of solution. Typical symptoms of inadequate contact with the electrodes are a noisy signal with erroneous peaks, missing heart beat rates, or a flat-line display. If the students receive a flat reading with no heart rate detected, have them move the transmitter and the receiver closer together. The range of the transmitter in the chest belt is 60 to 80 cm.
5. Computer monitors can be a source of electrical interference. Move the receiver module as far from the computer monitor as possible.
6. The receiver module will receive signals from the closest transmitter source. To avoid confusion or erroneous readings, have the test subjects from different lab teams stay at least 2 m apart.
7. It is possible to alter your heart rate by simply decreasing your respiratory rate and relaxing. Encourage students to stay alert and to breathe normally.

Experiment 25

SAMPLE RESULTS



Heart Rate and Body Position

Subject's name	Willie	Rebekka	Chris
Sitting heart rate (beats/min)	xxxx	xxxx	xxxx
Reclining heart rate (beats/min)	xxxx	xxxx	xxxx
Standing heart rate (beats/min)	xxxx	xxxx	xxxx
Difference between sitting and reclining heart rates (beats/min)	xxxx	xxxx	xxxx
Difference between standing and sitting heart rates (beats/min)	xxxx	xxxx	xxxx
Difference between standing and reclining heart rates (beats/min)	xxxx	xxxx	xxxx

ANSWERS TO QUESTIONS

Answers have been removed from the online versions of Vernier curriculum material in order to prevent inappropriate student use. Graphs and data tables have also been obscured. Full answers and sample data are available in the print versions of these labs.