

**TEACHER INFORMATION**

# Heart Rate and Physical Fitness

1. Editable Microsoft Word versions of the student pages and pre-configured TI-Nspire files can be found on the CD that accompanies this book. See *Appendix A* for more information.
2. This experiment works equally well with either a Hand-Grip Heart Rate Monitor or an Exercise Heart Rate Monitor.
3. The receiver module of either type of Heart Rate Monitors 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.
4. Computer monitors can be a source of electrical interference. Keep the receiver module of the Heart Rate Monitor as far as possible from any computer monitors in the class.
5. 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.
6. The Exercise Heart Rate Monitor includes a transmitter belt, receiver module, large elastic strap, and small elastic strap.
7. 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 snugly, but not too tight. Both electrodes should be wet with either saline solution or contact lens solution. A 5% salt solution works well and can be prepared by adding 5 g of NaCl per 100 mL of solution. Typical symptoms of inadequate contact with the electrodes are a noisy signal with erroneous peaks, missing heart beat readings, 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 80 cm.
8. Data is not stored by the software for this experiment, requiring them to record the heart rate values as they are being collected. Students will monitor the strip chart graph of the heart rate signal to ensure the sensor is registering the signal. The students will monitor the heart rate values from the sensor console.
9. You must start data collection for the rate meter to show values.
10. If a larger meter is desired, rather than launching the sensor console, you can adjust the page layout to show two instances of the DataQuest app, split horizontally. One app can show the graph of the signal, while the second app can show the meter. If using this configuration, it is recommended that you hide the details boxes (select Hide Details from the Options menu) in both DataQuest applications.

## **SAMPLE RESULTS**

Sample data from two students are listed below. The first student was a 17 year old male and the second was a 16 year old female.

Condition	Rate, Student 1 (beats/min) or time	Points	Rate, Student 2 (beats/min) or time	Points
Standing heart rate	73	11	93	9
Reclining heart rate	54	12	69	11
Reclining to standing	69	11	84	8
Pre-exercise heart rate	72		93	
After 5 steps	87		116	
Recovery rate	57 s	12	98 s	10
Endurance	14	10	23	2
Total		56		40

## **ANSWERS TO QUESTIONS**

1. The heart rate generally lowers when a student moves from a standing position to a reclining position. The forces of gravity do not have to be overcome for blood to flow while in a reclining position.
2. The heart rate generally increases when a student moves from a reclining position to a standing position. The forces of gravity do have to be overcome while in a standing position.
3. The heart rate generally increases when a student exercises twice as long. It will not increase to twice the rate, however, because the heart will adjust to the new stress and increase the blood flow to meet the body's needs. The blood flow is proportional to the heart rate. When the blood flow is appropriate, the heart rate will no longer continue increasing.
4. Answers will vary. Factors such as weight, regular exercise, health, etc., may play a part in determining the maximum heart rate of a student.
5. An athlete's heart is more efficient at moving blood through the body. Each contraction of an athlete's heart moves a greater volume of blood than an average individual. More blood per contraction means more oxygen for the body's cells. Because of this athletes must work harder to increase their heart rate to its maximum values.
6. Answers will vary.
7. The heart rate increases significantly when an individual moves from a reclining position to a standing position. The force of gravity on the blood makes the heart work harder, as in Question 2. This increased stress might provoke a heart attack in susceptible people.