Names: _____

Mr. Croft

Monitoring EKG

50 Points

An electrocardiogram, or EKG, is a graphical recording of the electrical events occurring within the heart. A typical EKG tracing consists of five identifiable deflections. Each deflection is noted by one of the letters P, Q, R, S, or T. The P wave is the first waveform in a tracing and represents the depolarization of the heart's atria. The next waveform is a complex and consists of the Q, R, and S deflection. The QRS complex represents the depolarization of the heart's ventricles. The deflection that represents the repolarization of the atria is usually undetectable because of the intensity of the QRS waveform. The final waveform is the T wave and it represents the repolarization of the ventricles.

Because an EKG is a recording of the heart's electrical events, it is valuable in diagnosing diseases or ailments that damage the conductive abilities of the heart muscle. When cardiac muscle cells are damaged or destroyed, they are no longer able to conduct the electrical impulses that flow through them. This causes the electrical signal to terminate at the damaged tissue or be directed away from the flow of the signal. The termination or redirection of the electrical signal will alter the manner in which the heart contracts. A cardiologist can look at a patient's electrocardiogram and determine the presence of damaged cardiac muscle based on the time interval between electrical events.

In this activity, you will use the EKG Sensor to make a two-second graphical recording of your heart's electrical events. From this recording, you will identify the previously mentioned waveform components and determine the time intervals associated with each.

OBJECTIVES

In this experiment, you will

- Use the EKG Sensor to graph your heart's electrical activity.
- Determine the time interval between EKG events.
- Calculate heart rate based on your EKG recording.

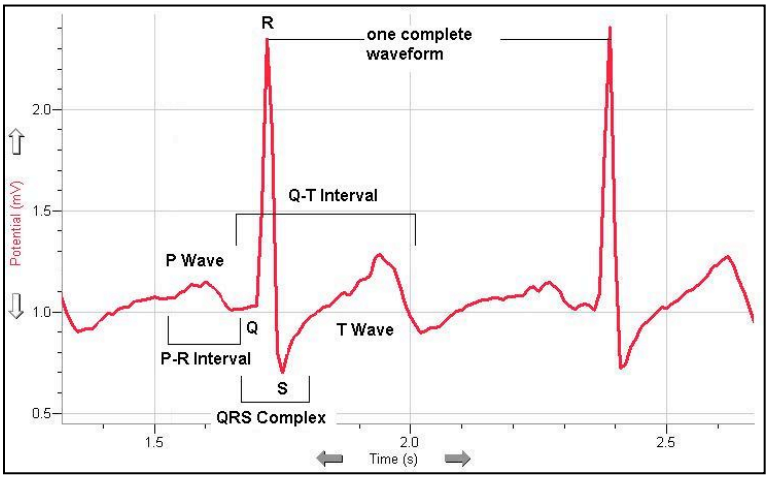

Figure 1

MATERIALS

LabQuest
LabQuest App
Vernier EKG Sensor
Disposable Electrode Tabs

PROCEDURE

1. Connect the EKG Sensor to LabQuest and choose New from the File menu. If you have an older sensor that does not auto-ID, manually set up the sensor.

2. Attach three electrode tabs to your arms, as shown in Figure 2. A single tab should be placed on the inside of the right wrist, on the inside of the right upper forearm (below elbow), and on the inside of the left upper forearm (below elbow).

3. Connect the three sensor leads to the electrode tabs as shown in Figure 2. Lay flat on top of a lab table. **Your arms should be hanging at the side on the table.**

4. Another member of the lab group should start data collection.

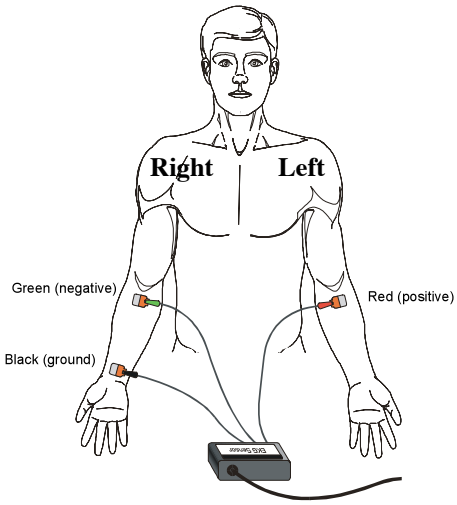

Figure 2

5. Once data have been collected, a graph will be displayed. To examine the data pairs on the displayed graph, tap any data point. As you tap each data point, the voltage and time values of each data point are displayed to the right of the graph. **<u>For at least two heartbeats</u>**, identify the various EKG waveforms using Figure 3 and determine the time intervals listed below. **Record the <u>average</u> for each set of time intervals in Table 1.**

   - **P-R interval**: time from the beginning of P wave to the start of the QRS complex.
   - **QRS interval**: time from Q deflection to S deflection.
   - **Q-T interval**: time from Q deflection to the end of the T wave.

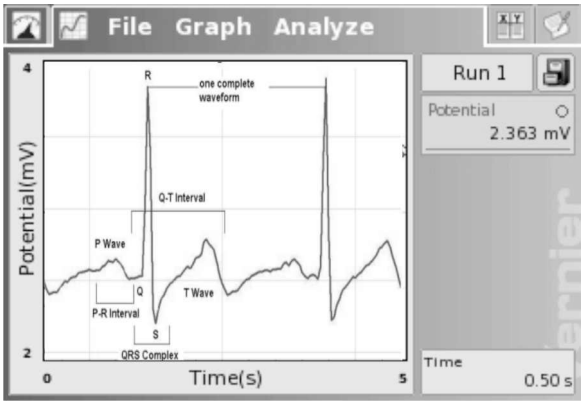

Figure 3

6. Calculate the heart rate in beats/min using the EKG data. Record the heart rate in Table 1.

7. If your EKG was unsatisfactory, repeat Steps 4–6.

DATA

Table 1	
Interval	**Average** Time
P - R	
QRS	
Q - T	

Heart Rate	_____ beats/min

Table 2	
Standard resting electrocardiogram interval times	
P - R interval	0.12 to 0.20 s
QRS interval	less than 0.10 s
Q - T interval	0.30 to 0.40 s

EXTENSION ACTIVITY

Using data collected with the EKG Sensor, it is possible to determine a more accurate maximum heart rate value for an individual. The commonly used formula for calculating maximum heart rate is:

Max Heart Rate = 220 bpm – Individual's Age = 220 bpm – _____ = _____ bpm

While this formula is sufficient for general purposes, it fails to take into account physical differences such as size, and fitness level. For example, an individual that engages in regular exercise will likely have a heart that operates more efficiently due to the effects of athletic training.

To calculate your maximum heart rate, do the following:

a. Have the same subject run **in place** for 1 minute.
b. Repeat Steps 4–6 to collect and analyze your electrocardiogram. When analyzing the data, only determine the **average** Q-T interval.
c. Divide 60 seconds by the Q-T interval to calculate your maximum heart rate.

Max Heart Rate = (60 seconds)/(Q-T Interval) = 60 seconds / _____ = _____ bpm

CONCLUSION (10 Points)

(SUMMARY OF EXPERIMENT, ANALYSIS OF DATA, DISCUSSION OF ERROR)

CONCLUSION (Continued):

QUESTIONS (8 Points Each)

1. The electrocardiogram is a powerful tool used to diagnose certain types of heart disease. Why is it important to look at the time intervals of the different waveforms?

2. a) Compare the standard resting electrocardiogram interval times with the data you collected.

   b) Compare the calculated maximum heart rate with the maximum heart rate based on the data you collected.

3. What property of heart muscle must be altered in order for an EKG to detect a problem? Explain.

4. a) Based on what you have learned regarding electrocardiograms, can they be used to diagnose all heart diseases or defects? Explain.

   b) Describe a cardiovascular problem that could be diagnosed by a cardiologist using an electrocardiogram.

SBRHS RUBRIC ON TECHNOLOGY LITERACY (4 Points Each)

This is the final lab of the year that utilizes the Vernier LabQuest. By now, you should be comfortable using the LabQuest for data collection and analysis. Your group will be evaluated on its use of this technology using the following rubric.

Level of Performance:	**4 = Exemplary**	**3 = Proficient**	**2 = Developing**	**1 = Beginning**
Gathering and Evaluating	Applies digital tools to gather, evaluate, and use information independently.	Applies digital tools to gather, evaluate, and use information with minimal assistance.	Applies digital tools to gather, evaluate, and use information with teacher support.	Does not apply digital tools to gather, evaluate, and use information even with teacher monitoring.
Effectiveness and Productivity	Demonstrates substantial understanding of the Vernier LabQuest.	Demonstrates understanding of the Vernier LabQuest.	Demonstrates partial understanding of the Vernier LabQuest.	Demonstrates no understanding of the Vernier LabQuest.