

STEMkey
Module 104



**Human anatomy and
physiology with
smartphones**

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Activity 3 – Heart rate measurement

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Module IO4. Human anatomy and physiology with smartphones

Activity 3. Heart rate measurement

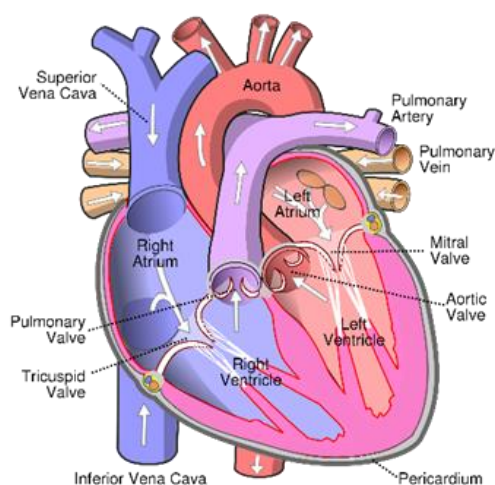
Objectives:

Students will learn how to use smartphone to count heartbeats in different ways.

Background

The heart drives the blood through the veins. It fulfils its task even before birth and until death. The heart is located in the thorax under the breastbone in a cavity called the cardiac cavity. It is a fist-sized hollow organ with a conical shape. It is divided by the septum into left and right halves. Each of these halves is divided into an atrium and a chamber. Thus, the heart has a left atrium and a left ventricle, and a right atrium and a right ventricle. Oxygen-rich blood flows through the left half (through the body), and oxygen-poor blood flows through the right half (directly to the lungs). Between the atrium and the ventricle is a heart valve, so the heart consists of two parts.

The pulse is the steady beating of the arteries as the heart pumps blood through them. In a healthy person, each compression of the heart chambers is followed by the pulse of the arteries, which can be felt as a rise or fall of the vessel wall. The pulse is felt at the wrist on the side of the thumb or at the neck by pressure of the fingers on the skin over the artery.



Work in pairs



60 min

Learning Outcomes

After completing the lesson, you will know that / learn about:

Knowledge about:

heart rate,
about factors influencing heart rate, and
how to interpret results of measurements.

Skills:

Students will learn how to measure heart rate using a smartphone.
Will learn about counting as a basic principle for obtaining data (frequencies) and how to statistically manipulate data from counts.

Attitudes:

to develop attitudes toward health issues based on evidence.

To develop attitudes toward priority of scientific interpretation of results in favour of alternative explanations.

Session description

- pre-lab activities
- work in the laboratory
- homework and assignments
- Summative evaluation

In this exercise, participants will measure their heart rate in different ways and during different activities.

Part 1: introduction of the activity (5 minutes)

Part 2: Measurements (counts) by use of traditional and smartphone-based approach. (25 minutes)

Part 3: Discussion of the results (30 minutes).

Part 4 (optional): measurement of EKG and other measures available by application of extensional sensors, if available (60 – 90 minutes).

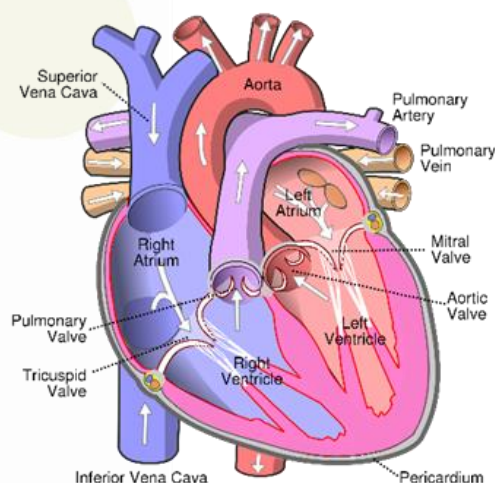
Students can use their own devices (BYOD) or devices provided by a teacher. The task is non-invasive and can be regarded as important lifelong competency.

Activity 1: Heart rate measurement



Worksheet

The heart drives the blood through the veins. It fulfils its task even before birth and until death. The heart is located in the thorax under the breastbone in a cavity called the cardiac cavity. It is a fist-sized hollow organ with a conical shape. It is divided by the septum into left and right halves. Each of these halves is divided into an atrium and a chamber. Thus, the heart has a left atrium and a left ventricle, and a right atrium and a right ventricle. Oxygen-rich blood flows through the left half (through the body), and oxygen-poor blood flows through the right half (directly to the lungs). Between the atrium and the ventricle is a heart valve, so the heart consists



of two parts.

The pulse is the steady beating of the arteries as the heart pumps blood through them. In a healthy person, each compression of the heart chambers is followed by the pulse of the arteries, which can be felt as a rise or fall of the vessel wall. The pulse is felt at the wrist on the side of the thumb or at the neck by pressure of the fingers on the skin over the artery.



LET'S GO EXPERIMENTING

Part 1: Heartbeat

PREDICTION Write down what the heart rate will be at rest and after 20 squats:

At rest: _____ after 20 squats: _____



Procedure: work in pairs

1. One person measures the heart rate by putting his (her) fingers on the wrist of the other person. When (s) he feels the pulse, (s) he begins to count.
2. Count for 1 minute (or 30 seconds and multiply accordingly - we are interested in beats per minute). Record the result in Table 1.
3. then the person who took the pulse does 20 squats and takes the pulse again. Write the result in Table 1.
4. The roles can be switched and the process repeated.
5. finally, calculate how many liters of blood were pumped to the subject, knowing that the heart pushes 70 ml of blood through the veins at one pressure.

RESULT 1:

Table 1: Results at rest and after activity.

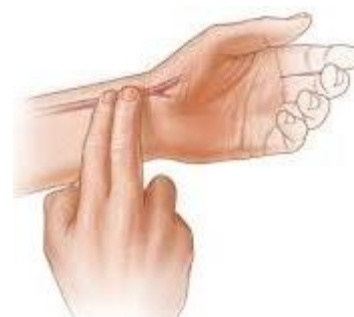
HEARTBEAT	Number of heartbeats per minute		Liters of blood per minute	
At rest				
After 20 squats				

Repeat the exercise process by measuring your heart rate using the HeartRate Monitor on your tablet or smartphone.

Interesting fact:

The app measures your heart rate by detecting tiny changes in color and light on your fingertip.

Cover the camera lens with a finger - the viewing frame should turn red.



Relax and hold still until the measurement is finished.

RESULT 2:

Table 2: Results at rest and after activity, measured with the HeartRate app.

HEARTBEAT	Number of heartbeats per minute		Liters of blood per minute	
At rest				
After 20 squats				

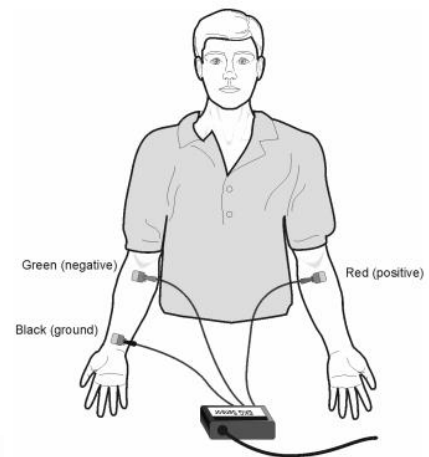
Part 2: ECG

Procedure: work in pairs

1. connect the ECG sensor to the Vernier interface.
2. Place the electrodes on the hands as shown in the figure.
3. connect the ECG to the interface as shown in the figure.
4. Sit on a chair, relax, and place your hands on your legs.

When you are in the correct position, the classmate will click to begin collecting data. (collect)

5. Calculate the heart rate in beats per minute using the data obtained.



RESULT 3:

Draw the resulting electrocardiogram.

Beats per minute:

EVALUATION OF THE WORKSHOP:

We are interested in your opinion about the use of the tablet in the workshop:

1. Because of the use of a heart rate monitor, the exercise was:

(Please check only one circle in each row).

	1 – I do not agree at all	2 – I do not agree	3 – I partially disagree	4 – I neither agree nor agree	5 – I partially agree	6 – I agree	7 – I completely agree
a) fun	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) instructive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) understandable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) unpretentious	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) successful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Answer the question by marking only one circle for each line.

	Exercise 1 (measuring with the finger on the wrist)	Exercise 2 (ECG meter, Vernier)	Exercise 3 (app Heart Rate Monitor)
a) Which exercise did you have the least difficulty with?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) Which exercise did you have the most difficulty with?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) If you had to repeat the exercise, which method of execution would you choose?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Arrange the exercises from least difficult (1) to most difficult (3):

Exercise 1 (measuring with the finger on the wrist)	Exercise 2 (ECG meter, Vernier)	Exercise 3 (app Heart Rate Monitor)