

Resting and exercise pulse with Cobra SMARTsense



Biology

Human Physiology

Cardiovascular system



Difficulty level

easy



Group size

2



Preparation time

10 minutes



Execution time

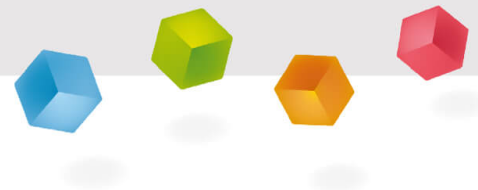
20 minutes

This content can also be found online at:



<http://localhost:1337/c/6135fd25fd803000038590f6>

PHYWE



Teacher information

Application

PHYWE



Pulse measurement: Measurement with the infrared sensor on the fingertip

Sporting exertion changes our pulse rate. The resting pulse rate is the pulse rate when the body is not under stress. You can measure it in the morning before getting up. For practical reasons, it is measured during the day while sitting or, better, lying down. The stress pulse is measured during exercise. The difference between the resting pulse and the pulse after exercise is studied in this experiment.

Other teacher information (1/5)

PHYWE

Prior knowledge



Students should already know the body's cardiovascular system and how the heart pumps blood throughout the body.

Scientific Principle



With the help of a pulse meter, the pulse can be measured on the finger.

Other teacher information (2/5)

PHYWE

Learning objective



Students should recognize that the resting pulse rate for a healthy person is 50 to 100 beats per minute, while it can be significantly higher during or immediately after physical exertion.

Tasks



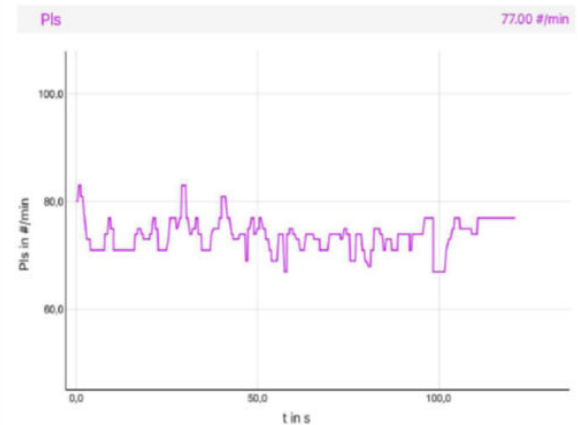
The students determine the resting and stress pulse. They also determine the relationship between heartbeat and pulse.

The method can also be used to examine the state of fitness, because the faster the resting pulse is reached after exercise, the greater the fitness.

Other teacher information (3/5)

Result and evaluation - Experiment 1

- The heart rate at rest in a healthy person is 50 to 100 beats per minute. It is best to measure the resting heart rate in the morning before getting up. For practical reasons, it is measured while sitting or lying down during the day.
- The figure on the right shows a resting pulse of just under 80 beats per minute. This can vary depending on the training condition and can even be below 50 beats per minute.
- It should also be noted that this sensor is not suitable for medical purposes and therefore not suitable for statements about the state of health.

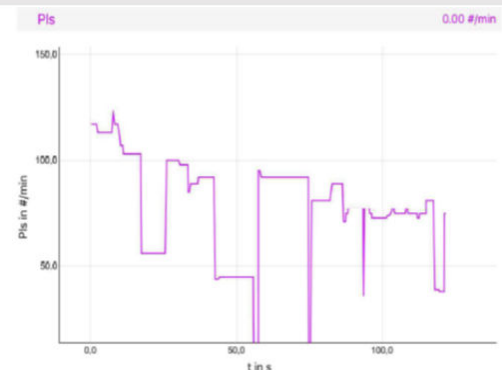


Resting pulse

Other teacher information (4/5)

Result and evaluation - Experiment 2

- When the body is under stress (here: push-ups, squats also possible), the muscles need more oxygen. The pulse increases to meet this demand. Even shortly after the effort, there is still an increased pulse (see figure on the right).
- It is recommended to measure the exercise pulse immediately after the physical exercise in a sitting position.
- After only a short time (approx. 30 s), a drop in pulse rate is noticeable.
- After approx. 1 minute, the pulse is almost the same as



Pulse during exercise with strong spikes, which can be avoided if measured immediately after the physical exercise in a seated position.

Other teacher information (5/5)

Other measurement methods

In addition to the pulse, the signal can also be selected as the measurement channel. The measurement is carried out optically with an infrared light source and a photosensitive detector. During transmission, the detector and emitter are opposite each other. When the heart contracts, the finger bed fills with arterial blood. In contrast, during diastole, the blood volume drops to its lowest level. The pulse sensor sends an infrared beam through the little finger. The hemoglobin in the blood absorbs infrared light. The higher the blood volume in the finger, the higher the light absorption by the hemoglobin. As the light absorption changes, so does the signal picked up by the detector.

Safety instructions

PHYWE



- Take into account the physical constitution of the students within the framework of physical stress!
- A pulse measurement taken at school should not be over-interpreted if there are deviations from exemplary pulse measurements in the illustrations. Circulatory disorders or damage to the heart muscle can only be determined with certainty by a doctor.
- The general instructions for safe experimentation in science lessons apply to this experiment.

PHYWE



Student Information

Motivation

PHYWE



Tour de France 2020. Trained cyclists have a resting heart rate of less than 40 beats per minute.

Sporting exertion changes our pulse rate. The resting pulse rate is the pulse rate when the body is not under stress. You can measure it in the morning before getting up. For practical reasons, it is measured during the day while sitting or, better, lying down. The stress pulse is measured during exercise. The difference between the resting pulse and the pulse after exercise is studied in this experiment.

Tasks

PHYWE



1. Determine the resting pulse and the stress pulse.
2. Determine the relationship between heartbeat and pulse.

Equipment

Position	Material	Item No.	Quantity
1	Cobra SMARTsense - Pulse, 30 ... 200 bpm (Bluetooth + USB)	12935-01	1
2	measureAPP - the free measurement software for all devices and operating systems	14581-61	1

Set-up (1/3)

PHYWE

For measurement with the **Cobra SMARTsense sensors** the **PHYWE measureAPP** is required. The app can be downloaded free of charge from the relevant app store (see below for QR codes). Before starting the app, please check that on your device (smartphone, tablet, desktop PC) **Bluetooth** is **activated**.



iOS



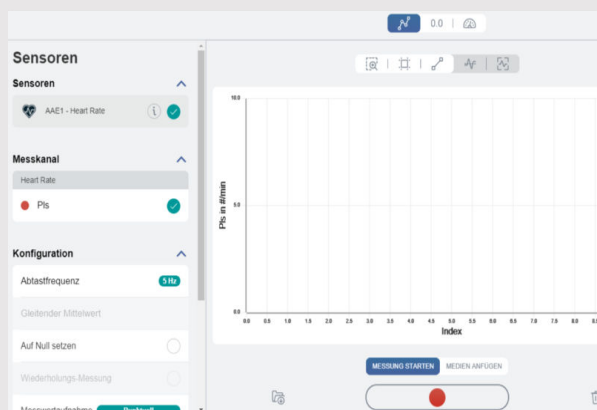
Android



Windows

Set-up (2/3)

PHYWE



Interface in the measureAPP
in the Windows 10 version

- Turn on the Cobra SMARTsense Heart Rate by pressing the power button. The sensor will be detected automatically.
- Select the Cobra SMARTsense Heart Rate in the PHYWE measureAPP. In this way, the pulse is automatically displayed in the measurement window as a function of time during the measurement (figure on the left).

Set-up (3/3)

PHYWE

- The subject lies down on the floor or assumes a comfortable position on a chair.
- Clamp the pulse monitor to the little finger so that the finger bone is not between the clamps (illustration on the right). The pulse sensor can also be clamped to the earlobe.



Procedure

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10 to 20 squats

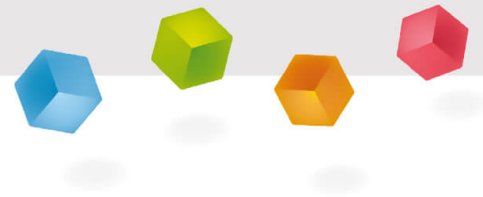
Experiment 1

- Start measured value recording.
- Wait until the pulse shows a constant value, after another 2 minutes stop the measurement with "Stop". Save the measurement.

Experiment 2

- Do 10-20 push-ups or squats (depending on the person's training level).
- Immediately afterwards, sit down on a chair and clamp the heart rate monitor back onto your finger.
- Start the measurement recording and stop it as soon as the resting pulse rate has returned.

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Report

Task 1

PHYWE

How quickly does the pulse rate change after the end of physical exertion?

Calculate the time after which the resting pulse is reached again. Calculate the pulse rate:

1. Immediately after the end of the load

Task 2

PHYWE

The resting pulse rate is different for many people. Which of the following things affect the resting pulse **positive**?

☐ Healthy diet☐ Sports☐ Stress Reduction☒ Check

Task 3

PHYWE

The resting pulse rate of a healthy adult is 50-100 per minute.

☐ True☐ False☒ Check

The easiest way to measure your resting pulse is in the morning before you get up.

☐ True☐ False☒ Check

Slide	Score / Total
Slide 19: Resting pulse	0/3
Slide 20: Multiple tasks	0/2

Total   0/5

 Solutions

 Repeat

 Export text