Human Breathing

Teacher Notes

BIOLOGY
Human
Physiology

Driving Question:
How does exercise affect your breathing frequency?

Applied Technology: Data-logging

Student Level: Middle School Level (11-14)

Duration: 1 lesson period

Recommended Settings: Student Investigations

Learning Objectives

- To monitor human breathing patterns.
- To study the respiratory rates in rest and after exercises.
- To determine the effect of exercise on the respiratory rate.

Didactical Approach

In this activity students monitor their breathing patterns and explore how exercise affects the breathing frequency.

When precise volumes of the respiration are not required, the temperature can be used as a means to record breathing. A thermocouple is used as a sensor. Its heat capacity is sufficiently low to allow measurement of quickly changing temperatures. The sensor is used to measure the temperature of air passing in and out. The result is displayed as a wave, which you can use to find the respiration rate (breaths /min).

A thermocouple sensor has a small temperature sensitive point on the end of a wire. You can use this sensor also to measure the changes in temperature of your skin.

Concepts learnt in this activity:

- Breathing pattern in relation to exercise,
- Respiratory rate,
- Differences between breathing, ventilation and respiration

Materials

In your investigations you will use:

- Interface or data-logger e.g. CMA Vincilab,
- Thermocouple sensor,
- Cardboard tube.

Procedure

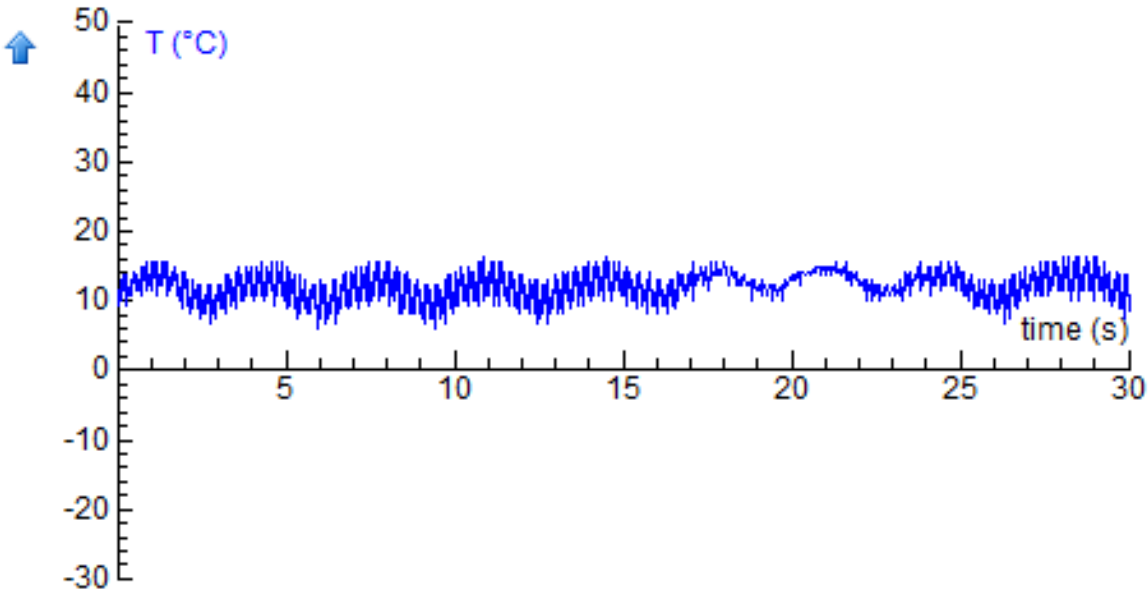
- Let the students make a breathing mouthpiece by placing a thermocouple tip in a cardboard tube (a toilet cardboard tube can be used here).
- Start the Coach 6 program and open Coach Activity ‘Human breathing’.
- Let students perform the investigations. Take care that the test subject(s) are healthy students and each of test subjects has its own (disposable) cardboard mouthpiece.

Questions and Assignments

- Describe a resting breathing pattern. How many breaths were taken each minute.
- Compare the results before and after the exercise. Explain the differences.
- Compare the results of the extra experiment (step 10) between different students.
- How does condition affect the recovery of breathing frequency?
- Determine the respiration period and rate.
- Combine this experiment with the recording of the heart rate.
- Are there differences between males and females?
- Does a person’s length have any influence?

Data Analysis

The graph below shows a typical breathing patters recorded with the thermocouple sensor.



Additionally you can let the students investigate the effect of holding of breath on the breathing cycle.

Breathing, ventilation and respiration are all words used to describe the physical process of moving air in and out of a body. Respiration is a particularly confusing term for biology students, because it often refers to the cellular level processes releasing energy from food. Yet the phrase 'artificial respiration' remains the common way of describing how we 'breathe' for someone who is not breathing, in order to ventilate their lungs. It is worth explaining the difference between the common and biological uses of these terms.

Resources

Coach Activity: Human breathing.cma7

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