

## Experiment B-43 Respiration Rates



### Objectives

- To learn about the lungs and respiration rates.
- To measure respiration rates of the students.
- To compare female and male respiration rates.
- To compare respiration rates before and after exercise.

### Modules and Sensors

- PC + NeuLog application
- USB-200 module 
- NUL-236 Respiration monitor belt logger sensor 

### Introduction

The chest contains two lungs made up of sections called lobes, and are protected by the ribcage. The lungs bring oxygen into the body and remove carbon dioxide. We breathe air through the nose, mouth or both. The nose is the preferred route since it is a better filter for large particles than the mouth. However, when a large amount of air is needed, the mouth route is better.

The diaphragm is a large muscle located under the lungs. **Inhalation** occurs when the diaphragm moves down, the ribs flare outward, the lungs expand and air is drawn in. **Exhalation** occurs when the diaphragm relaxes and air leaves the lungs.

The respiratory rate is defined as the number of breaths taken during a period of one minute. The respiratory rate should be measured at rest. Women usually have higher respiration rates than men and children usually have higher respiration rates than adults.

The normal ranges for different age groups are:

- Elementary school children (6-12 years): 18-30 breathes per minute;
- Adolescents (13-17 years): 12-16 breathes per minute;
- Adults: 12-18 breathes per minute.

In general, people with low respiratory rates are considered to be fitter individuals.

In this experiment we will use a respiration monitor belt sensor in order to measure the breathing rates of different students. We will compare these rates among females and males and also before and after physical activity.

## Procedure

### Note:

The respiration monitor belt logger sensor is designed for educational use only and may not be used for medical diagnosis. If you suffer from asthma or you are not feeling well, do not conduct this experiment.

### Sensor setup


1. Connect the USB-200 module  to the PC.
2. Check that the respiration monitor belt sensor  is connected to the USB-200 module.

### Note:

The following application functions are explained in short. It is recommended to practice the NeuLog application functions (as described in the user manual) beforehand.


3. Run the NeuLog application and check that the respiration monitor belt sensor is identified.


## Settings

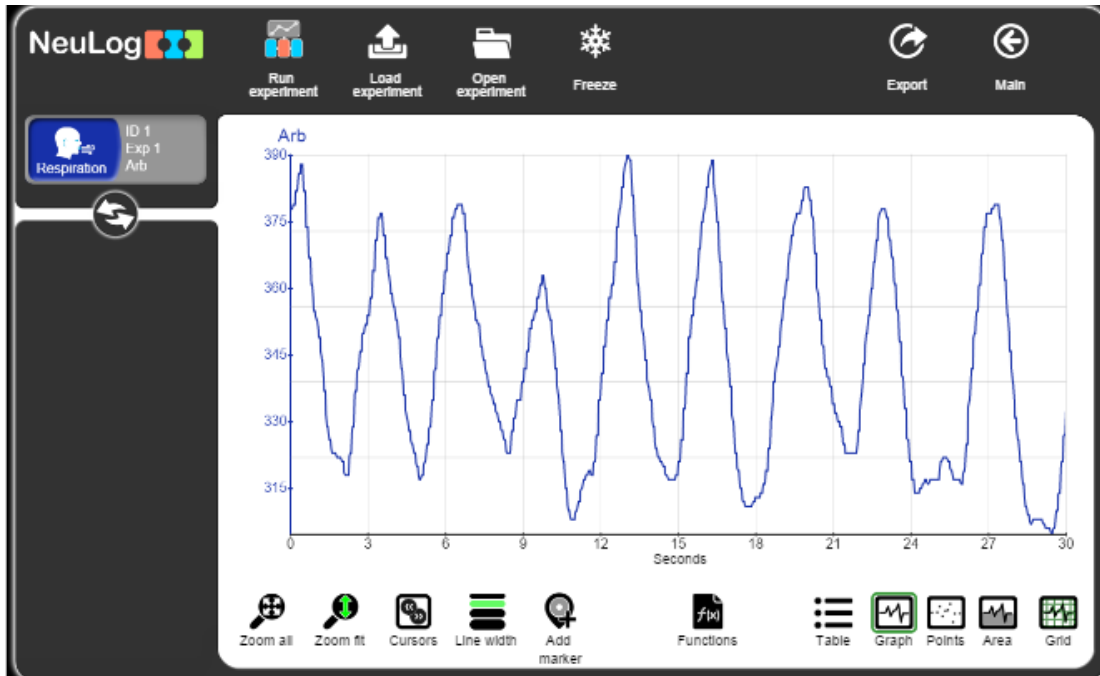
4. Click on the **Run Experiment** icon  and set the:  
  
Experiment duration to 30 seconds  
Sampling rate to 50 per second



## Testing and measurements



5. Wrap the respiration belt tightly, without causing discomfort, around the user's lower ribs and diaphragm area.
6. Ensure that the rubber tubing connected directly to the respiration belt is situated above the user's naval facing downwards.
7. Close the air pressure release valve by twisting the metallic knob until it tightens.
8. Using the hand-pump fill the respiration belt's bladder until it forms a snug but not uncomfortable fit.
9. Click on the **Record** icon  to start the measurement.
10. Do not look at the screen during the experiment, it may affect the results.

11. At the end of the measurement, click on the **Zoom fit** icon .
12. Your graph should be similar to the following:



13. Click on the **Export** icon  and then on the **Save value table (.CSV)** button to save your graph.
14. Click on the  icon to go back to the graph.
15. Each wave represents one breath. Count the number of waves on the graph. These are the number of breaths for 30 seconds. When multiplying this number by two we get the number of breaths per minute.

For the sample experiment: 9 waves X 2 = 18 waves = 18 breaths per minute.



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## Summary questions

1. What is the correlation between a student's gender and the respiration rate?
2. How did the respiration rate change after physical activity? Explain.
3. How did the respiration rate change after physical activity among the more athletic students? Explain.
4. Point out three more vital signs and elaborate about each one.