

How does respiration work? – Information for teachers

1 Information on the subject

Generally speaking, respiration is used to mean the lung activity and all processes associated with it. During inhalation, air flows into the body through the mouth or nose and passes via the pharynx into the windpipe (trachea). There it is cleaned by tiny hairs called cilia. When the inhaled air reaches the lungs, the oxygen is “filtered” out of it in air sacs (alveoli). As a result, the alveoli fill up and expand. The thorax rises in order to make room for the lungs. The oxygen is now transported to tissues and cells through blood vessels. The carbon dioxide produced in the tissues and cells is then returned to the lungs via the blood and finally exhaled. The lung contracts again and the thorax falls.

We have selected the following experiments to illustrate these breathing mechanisms:

- Experiment 1: Wind slalom course
- Experiment 2: Straw suction exercise
- Experiment 3: Measuring your chest
- Experiment 4: Measuring exhaled air
- Experiment 5: Different ways of breathing
- Experiment 6: We make a model of the lungs

2 Information about classroom work

The objectives of these experiments are first making children consciously aware of the respiration process, and second the introduction to the scientific method of working through experiments and the documentation of observations and results.

A suitable approach for implementation in the classroom is having the students carry out these experiments at separate stations. Sufficient time should be scheduled so that all the children can go through each station in pairs and can thus obtain their own findings through conscious action and experience. To this end, we advise that teachers set up each experiment at several stations so that all students can be occupied at the same time. The making and testing of the model of the lungs could also be carried out in groups or in the class as a whole, since in this case the visual result is sufficient for imparting knowledge.

2.1 Experiment 1: Wind slalom course

Students blow a cotton ball around a slalom course made up of seven small cones set up on a table. They experience blowing as part of the respiration process (exhalation) and identify everyday situations where blowing is necessary (e.g., for cooling hot food or drinks, relieving injuries, blowing out candles, removing dust/fluff).

2.2 Experiment 2: Straw suction exercise

Students pick up peas with a straw and transfer them in this way from one bowl to another. In doing so, they learn about suction as part of the respiration process (inhalation) and identify everyday situations where sucking in is necessary (e.g., drinking with a straw or from a bottle).

2.3 Experiment 3: Measuring your chest

Students measure their chests with a tape measure during normal breathing and when breathing in deeply. They consciously learn that their thorax goes up and down during respiration.

2.4 Experiment 4: Measuring exhaled air

In this experiment, students blow into a bottle filled with water, which itself is standing upside-down in a bowl of water. The water is forced out of the bottle by the exhaled air. With this experiment, children can measure their lung volume in a state of rest and after a short phase of exertion.

2.5 Experiment 5: Different ways of breathing

Students will simulate hiccupping, yawning, coughing, sneezing, and laughing and be consciously aware of what happens with their breathing.

- When **hiccupping**, we breathe in rapidly several times in succession with short, choppy breaths.
- When **yawning**, we breathe in deeply once.
- When **coughing**, we breathe out in several short, spasmodic bursts.
- When **sneezing**, we breathe out once with a short, explosive breath.
- When **laughing**, we breathe in and out rapidly.

2.6 Experiment 6: We build a model of the lungs

Students build a model of the lungs out of a plastic bottle and balloons. The model can be used to illustrate the function of the lungs.

3 List of materials per station

- 7 small cones, e.g., from the children's game "Headache" by Hasbro or large tokens
- 1 cotton ball
- 1 drinking straw
- 3 balloons
- 2 household rubber bands
- 1 Y-shaped tube connector
- 2 bowls (one empty, one containing 3 peas)
- 1 large bowl of water
- 2 plastic bottles (one 0.5 l, one 1.5 l)
- 2 lengths of garden hose (about 20 cm and 50 cm long) or drinking straws
- 1 plastic tube (about 10 cm)
- 1 tape measure
- Modeling clay
- Scissors
- Tape

3.1 Other information

Re. Experiment 4: Measuring exhaled air:

For hygiene reasons, clean the hose after use by each student. Also make sure that the students do not overexert themselves when blowing.