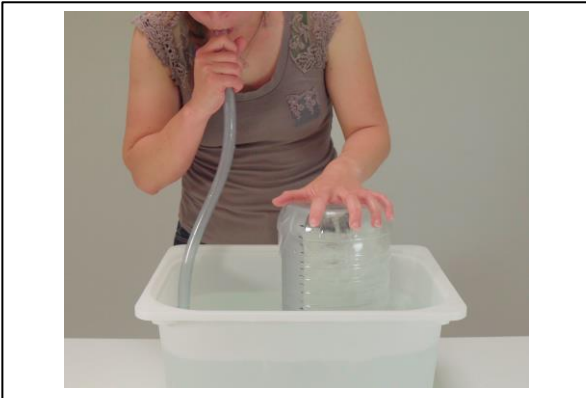


Lung Capacity



Key words

- Lungs
- Spirometer
- Breathing
- Volume measurement

The science behind

Introduction

In the experiment we made a simple spirometer that measures the volume of exhaled air. With it we measured the capacity of our lungs – how much air can we exhale with one exhalation.

Explanation

Spirometer is a device that measures the flow of air or the volume of exhaled or inhaled air. Some are simple and measure the volumes we exhale during the examination; others consist of precise and sensitive sensors that measure air flow. This test measures lung function and capacity.

In our experiment the air that displaces the water from the bottle is the air that was in our lungs.

Difference in measured volumes: Normal results for a spirometry test vary from person to person and are based on age, height, sex, fitness and living area. The largest volumes are measured in adults, not obese, tall males, who live at higher altitudes.



Differences between the breathing volume of children and adults exists also. The average total lung capacity of an adult human male is about 6 litres of air. The volume of air moved into or out of the lungs during a normal breath is approximately 500 ml per inspiration. The average human respiratory rate is 30–60 breaths per minute at birth, decreasing to 12–20 breaths per minute in adults.

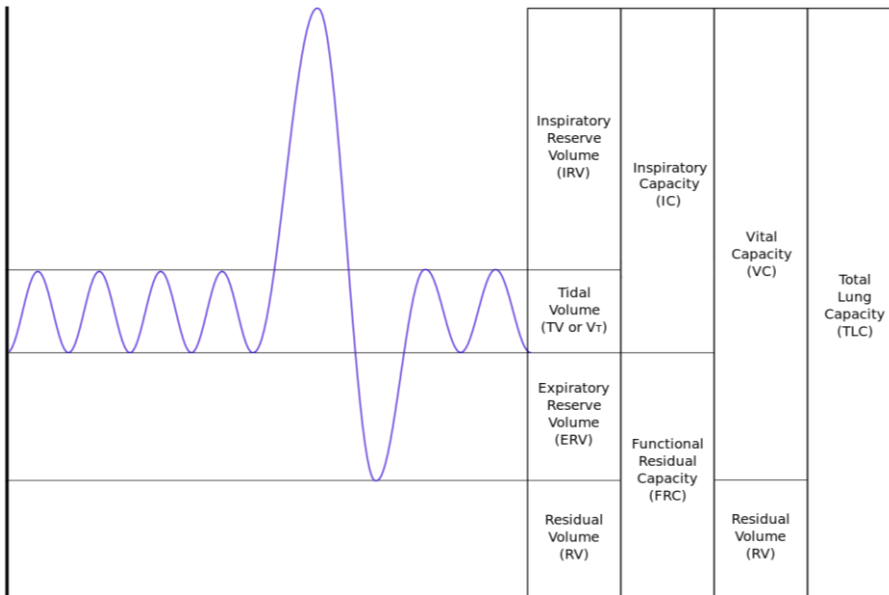
What are your results – how much air can you exhale at once? This is vital capacity of your lungs. And how much air do you exhale while you breath normally? This is your tidal volume.

Lung volumes

Lung volumes and lung capacities refer to the volume of air in the lungs at different phases of the respiratory cycle. In the bottom picture we can see different volumes.

Tidal breathing is normal, resting breathing. **The tidal volume** is the volume of air that is inhaled or exhaled in only a single such breath (in the picture the small waves present tidal breathing).

When we inhale all the air we can, we reach the **Inspiratory capacity** and fill our lungs with as much of the air as we can (In the picture, the peak of the big wave represents the maximum inhale). When we exhale to the maximum, the volume of the air we can exhale consist from the tidal volume and **expiratory reserve volume** (In the picture, the bottom peak of the big wave presents the maximum exhale). Together with the inspiratory reserve volume constitute the **Vital capacity** of the lungs. A certain amount of air is always present in our lungs and is not involved in breathing. This volume is called **Residual volume** and it cannot be measured with spirometry, while all the others volumes can be measured or calculated.



Picture Source: [Lung volumes - Wikipedia](#)

Everyday life

The lungs are an organ that belongs to the respiratory system. They are conical in shape and lie above the right or left arch of the diaphragm. Between the right and left lung wings is a space called the interstitium (mediastinum), where the heart, oesophagus, trachea and large blood vessels and nerves lie. The right lung wing is lower and wider and consists of three lobes, the left lung wing is higher and narrower and from two lobes. Doctors use a stethoscope to listen to your breathing as usual examination method when deciding for diagnosis, if you are ill or for medical check-up.



Human respiration: The human body emits carbon dioxide and receives oxygen through the lungs. The purpose of respiration is the exchange of gases between air and blood in the lungs. There are two stages in respiration. Inhalation is the suction of air into the lungs, followed by exhalation, which is the expulsion of air from the lungs. Inhaled air contains the most nitrogen and almost 21% oxygen and 0,04% carbon dioxide, while exhaled air contains about 16% oxygen and 4% carbon dioxide. Exhaled air is also warmer and more humid.

Spirometry is a non-invasive test that basically involves measuring air and is the most commonly used method for measuring and assessing lung capacity and function. It is a very important investigation in diagnosing and assessing various disease states. The lungs allow us to breathe and have limited space to store the air we inhale and then exhale. The reduced volume of exhaled or inhaled air on examination using spirometry can give us important information about lung health and can tell us if we are suffering from any disease, such as asthma, chronic obstructive pulmonary disease (COPD) and other conditions that affect breathing. It may also be used periodically to monitor your lung condition and check whether a treatment for a chronic lung condition is helping you breathe better.

On the pictures you can see different types of spirometers to perform spirometry test.

