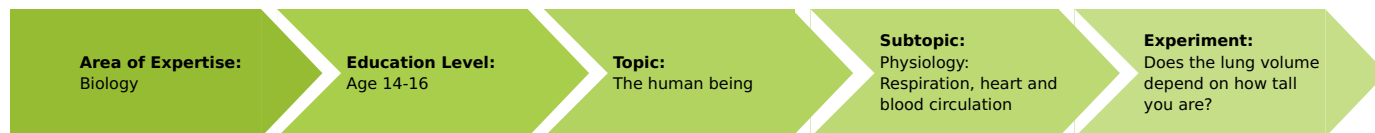


Does the lung volume depend on how tall you are?

(Item No.: P8001260)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



30 Minutes

Recommended Group Size



2 Students

Additional Requirements:

- iPad or Android tablet

Experiment Variations:

- Alternatively, use a PC with measureLAB (14580-61)
- Alternatively, use a Cobra4 Mobile-Link (12620-10)

Keywords:

Vital lung capacity, Medical survey

Teacher information

Introduction

Principle

The aim of this experiment is to determine the dependence of lung volume on height and to present it in a graph. We recommend that you use the introductions to experiments P8001060 and P8001160 here as they also deal with vital capacities. Volumes which have already been determined in experiments I and II can be used here for the determination of vital capacities, or they can be newly determined.

The dependency of lung volume on height is linear. It is presented here in the form of a straight line equation (which is only specific for the particular student group). As this equation is the final result of the experiment, it is necessary to have this equation determined so that the students can clearly understand that the lung volume is not gender dependent but is height dependent (and also weight, nonsmoker/ smoker etc. dependent). The lung volumes can be additionally plotted against the weights of the students examined.

The finding has relevance in sports physiology to exclude a possible factor of why men are faster runners than women - lung volume is not the reason.

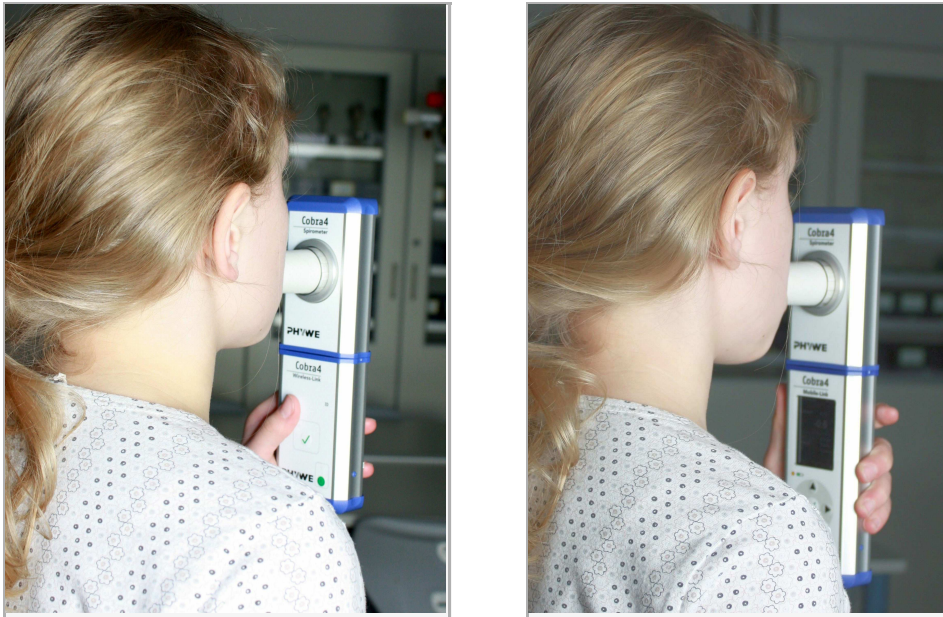


Fig. 1: Using the spirometer to determine various measured values
(left: measurement by using Cobra4 Wireless/USB-Link, on the right: Cobra4 Mobile-Link)

Tasks

- Use the spirometer to determine your vital capacity in litres. Collect together your data and the data of all other tested students in your group.
- Determine the correlation between vital lung capacity, body height and gender.

Equipment

Experiment with iPad or Android tablet

Position No.	Material	Order No.	Quantity
1	Cobra4 Wireless/USB-Link incl. USB cable	12601-10	1
2	Cobra4 Sensor-Unit Spirometry, Pulmonary volume and Wind Speed	12675-00	1
3	Disposable turbine with cardboard-mouthpiece, set of 50 (for Cobra4 Sensor-Unit Spirometry)	12675-11	1
4	USB charger for Cobra4 Mobile-Link 2 and Wireless/USB-Link	07932-99	1
5	Measuring tape, l = 2 m	09936-00	1
Additional material:			
	Android-Tablet or iPad		1
	PHYWE measure App		

Android

iPad



Experiment with PC

Position No.	Material	Order No.	Quantity
1	Cobra4 Wireless/USB-Link incl. USB cable	12601-10	1
2	Cobra4 Sensor-Unit Spirometry, Pulmonary volume and Wind Speed	12675-00	1
3	Disposable turbine with cardboard-mouthpiece, set of 50 (for Cobra4 Sensor-Unit Spirometry)	12675-11	1
4	USB charger for Cobra4 Mobile-Link 2 and Wireless/USB-Link	07932-99	1
5	Software measureLAB	14580-61	1
6	Measuring tape, l = 2 m	09936-00	1
Additional material:			
	PC		1

Warning information

Caution!

The apparatus used is not a medical measuring instrument. The measured values obtained with it are only to be used to provide an understanding of spirometry. Deviations in measured values between students or from the values given in the figures which are used here as examples are not to be considered to be a pointer to a possible illness. A pulmonary function test which is carried out by a physician is the only means of obtaining a medically relevant diagnosis.

Notes on procedure

Make sure that the students carry out the experiment in the standing position, as this is a necessary condition of the experiment. The behaviour of the lungs with regard to volume is different when sitting to when standing. Should some students stand up and others sit down, this would cause an unnecessary difficulty in comparing the values for different tested students.

Further to this and for reason of hygiene, ensure that each student uses an unused, originally packaged cardboard mouthpiece and a new FlowMir turbine for the experiment. Please make it clear to the students how they are to breathe in and out for the determination of the various measured values should this not be clear to them from the text.

Does the lung volume depend on how tall you are?

(Item No.: P8001260)

Introduction

Principle and task

Principle

In this experiment, you are to determine if lung volume is dependent on gender or on how tall you are. For this, you are first to measure your vital capacity (VC) using a spirometer. Following this, you are to separate the measured values into two groups, one for males and the other for females, and take the average measured volume value for each group.

Lung volumes differ from person to person. They are dependent on age, fitness, lung disorders and other factors. In this experiment you are to find out if the height or gender of a person influences the vital capacity.



Fig. 1: Using the spirometer to determine various measured values

Tasks

1. Use the spirometer to determine your vital capacity in litres. Collect your data and the data of all other tested students in your group.
2. In the following part of the experiment you are to measure your height in centimetres, so that a discussion can be held on the connection between how tall you are (or gender) and vital capacity. Measure how tall you are in centimetres.

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Set-up and procedure



Set-up

- Plug the spirometer unit onto the Cobra4 Wireless-Link unit.
- Take a turbine out from its packaging and insert it into the opening of the spirometer unit with a brief and gentle turning movement.
- Take a new cardboard tube from its original packaging and plug it into the turbine.
- The resulting apparatus should now be as shown in the Figure 1.

Procedure

The following experiments are all to be carried out in a standing position so that the results of all persons can be compared.

Procedure I

- Start PHYWE measure App  and switch on the Cobra4 Wireless-Link. The sensor is detected automatically.
- Select the Cobra4 Sensor-Unit Spirometry in PHYWE measure App . The measurement automatically shows the volume as a function of time.

Measurement 1: Standing up, breathe in and out normally a few times.

- Now breathe in as much air as you can.
- Bring the spirometer mouth piece into your mouth so that it is air-tightly surrounded by your lips. No air is to escape through your nose so, if necessary, pinch your nostrils together.
- Start the measurement.
- Forcefully press out as much of the previously inhaled air as possible.
- Measure the volume in litres of the exhaled air as your vital capacity (**VC**).
- Stop and save the measurement.




Fig. 2: Display of the measurement data for determining VC

Procedure II

- Stand upright and measure how tall you are (in centimetres).

Result and evaluation

Results

1. What is your vital capacity in litres? For this, you can examine the graph using the survey tool .

VC =



2. How tall are you in centimetres?

Height =

Evaluation

1. Collect the data of all students who carried out the test and create an Excel spreadsheet with which the lung volume as a function of body height can be presented.
2. Create a diagram "Lung volume as a function of body size".
3. Determine the lung volume of a person of the same age who is 205 cm tall.

Example:

Height /cm	Volume /l	Height /cm	Volume /l
150	5.5	181	6.3
152	5.3	184	5.9
155	5.6	185	6
163	5.8	188	6.5
164	5.8	190	6.1
169	5.6	192	6.3
170	5.9	195	6.4
174	5.4	198	6.5
178	6	181	6.3

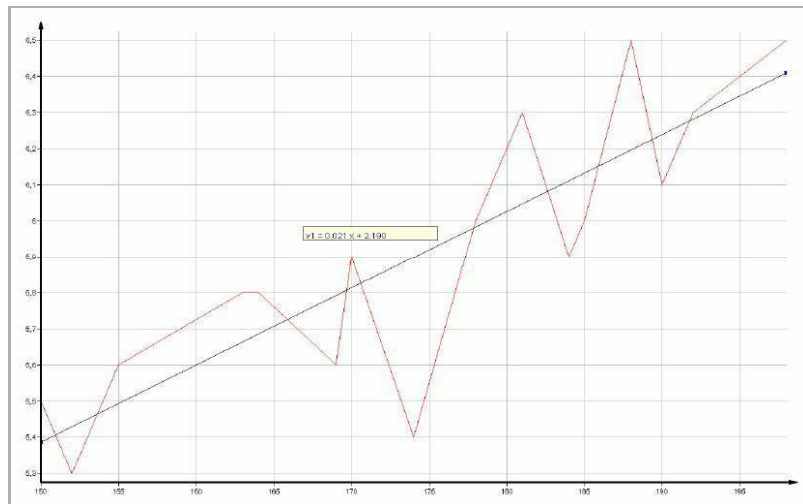


Fig. 4: Plot of volume against height and the straight line equation

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- The resulting apparatus should now be as shown in the Figure 1.

Procedure

The following experiments are all to be carried out in a standing position so that the results of all groups can be compared.

Procedure I

- Start PHYWE measureLAB  and switch on the Cobra4 Wireless-Link. The sensor is detected automatically.
- Select the Cobra4 Sensor-Unit Spirometry in PHYWE measureLAB . All pre-settings required for directly recording the measurement readings are now loaded. The measurement automatically shows the volume as a function of time.

Measurement 1: Standing up, breathe in and out normally a few times.

- Now breathe in as much air as you can.
- Bring the spirometer mouth piece into your mouth so that it is air-tightly surrounded by your lips. No air is to escape through your nose so, if necessary, pinch your nostrils together.
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- Forcefully press out as much of the previously inhaled air as possible.
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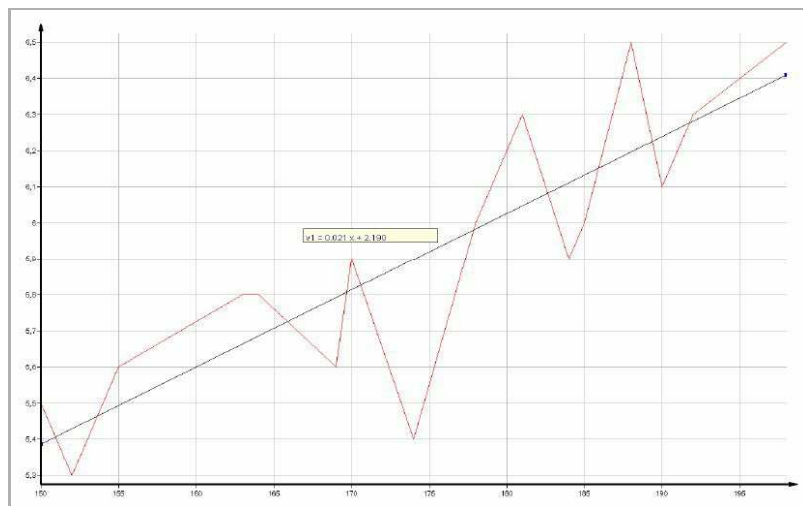


Fig. 4: Plot of volume against height and the straight line equation