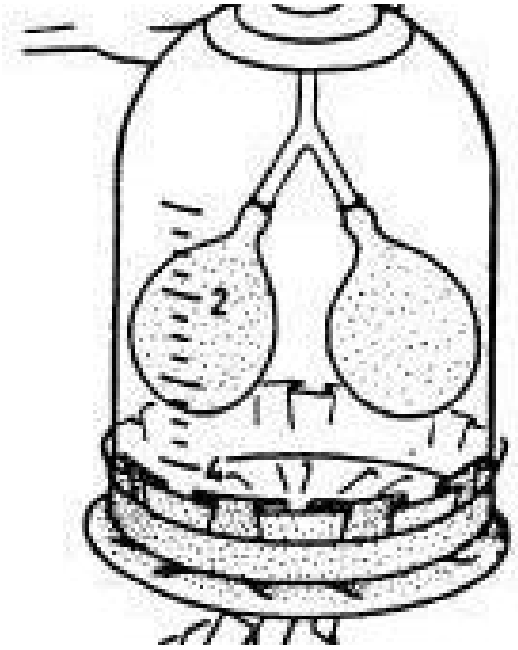
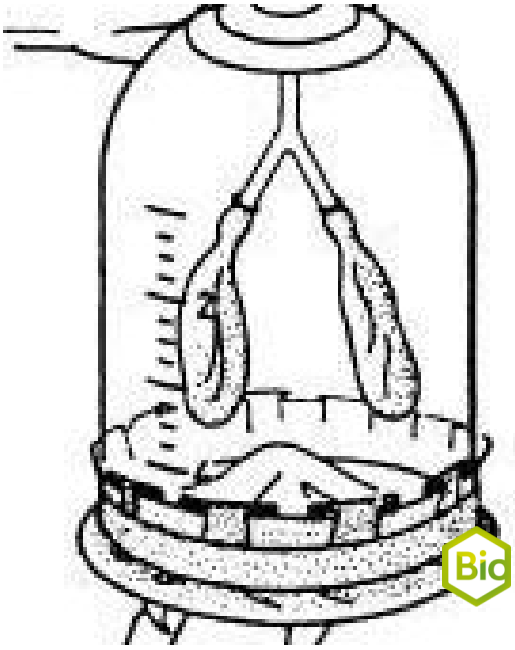
Mechanism of diaphragmatic breathing





Students will use the lung function model to explore how the diaphragmatic breathing of the human body works.

Biology > Human Physiology > Cardiovascular system

Difficulty level	Group size	Preparation time	Execution time
easy	1	10 minutes	20 minutes

This content can also be found online at:

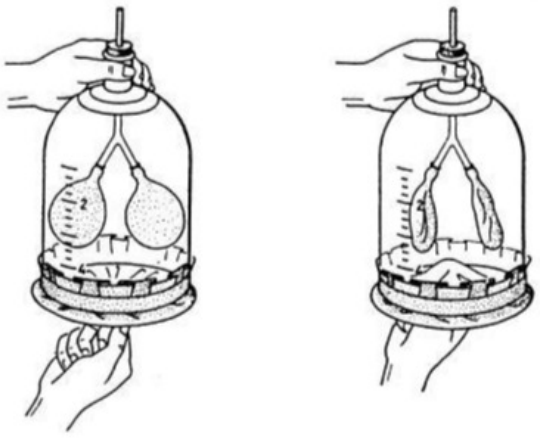
http://localhost:1337/c/6135fd42fd803000038590fa

PHYWE

General information

Application

PHYWE



Experiment setup

In this experiment, human respiration is simulated with a lung function model.

Particular attention is paid to the function of the diaphragm to show that it is essential for respiratory function.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other information (1/3)

PHYWE

Prior knowledge

Students should already be familiar with lung function and human respiration. It is also essential that they have studied the structure and function of the diaphragm.

Scientific Principle

The diaphragm determines through pressure and negative pressure whether inhalation or exhalation takes place. The test is particularly suitable as a demo test.

Other information (2/3)

PHYWE

Learning objective

Students will use the lung function model to explore how the diaphragmatic breathing of the human body works.

Tasks

Students build a lung function model that they use to take a closer look at diaphragmatic breathing.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other information (3/3)

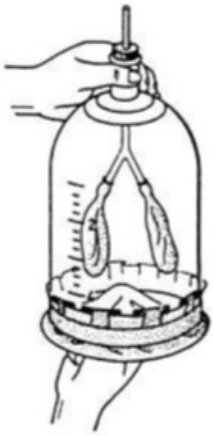
PHYWE

When the rubber blanket is pulled down, the rubber bubbles in the bell inflate (Fig. 1). If the rubber blanket is pushed up again, they collapse (Fig. 2).

If the rubber blanket is pulled downwards, the space in the bell is increased outside the rubber bubbles. A negative pressure is created, which is immediately compensated for by the inflow of air into the elastic rubber bubbles. As a result, they expand. If the rubber blanket is pressed upwards, the space in the bell jar outside the rubber bubbles is reduced. An overpressure is created which forces the air out of the elastic rubber bubbles. They collapse.

Diaphragmatic breathing follows the same principle.

1



2

Safety instructions

PHYWE

- The general instructions for safe experimentation in science lessons apply to this experiment.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Theory

PHYWE

Since the air in the lungs constantly releases oxygen to the body and exchanges carbon dioxide for it, it must be continuously renewed. This happens as follows:

The thoracic and abdominal cavities are separated from each other by a sinewy septum which, because it runs transversely, is called the diaphragm. It contains numerous muscle fibers. During inhalation, the diaphragm flattens and pushes the abdominal viscera slightly downwards and outwards. This causes the chest cavity to expand. But as the lungs always lie close against the walls of this cavity, they likewise expand, so that the air in them is greatly diluted. Then air immediately flows into the lungs through the respiratory passages, causing them to inflate like bellows. If the contraction of the diaphragm then subsides, it is pressed back into its dome-shaped initial position by the taut abdominal wall and the viscera.

This causes the chest cavity to shrink; the elastic alveoli collapse and expel the air they contain into the open air. Then the process, which consists of inhalation and exhalation, begins again.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Equipment

Position	Material	Item No.	Quantity
1	Human lungs, working model	KLA-130-140	1

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

PHYWE

Set-up and procedure

Set-up and procedure (1/2)

PHYWE

- Pull a rubber bubble over each end of the bifurcation of a Y-shaped glass tube.
- Since rubber is very difficult to slide over glass without pre-treatment, it is coated with a little glycerine beforehand to improve the sliding properties.
- The long leg of the Y-shaped glass tube is passed from below through the neck of a gas bell jar and inserted into a rubber stopper with a hole drilled through it.
- Using a rubber blanket that has a loop on one side, close the bottom opening of the bell so that the loop faces outward.
- The rubber blanket is attached to the bell with a tension ring. Finally, press the rubber stopper firmly into the neck of the bell.
- The model of the human thorax made in this way is grasped with one hand at the neck of the bell, passed through the loop with the other, and the blanket is moved up and down.

PHYWE

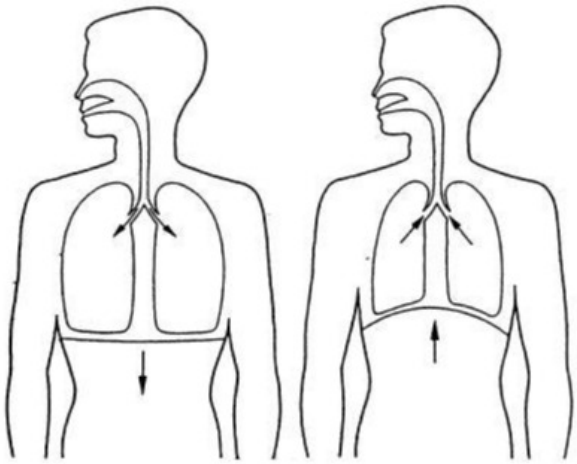
Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

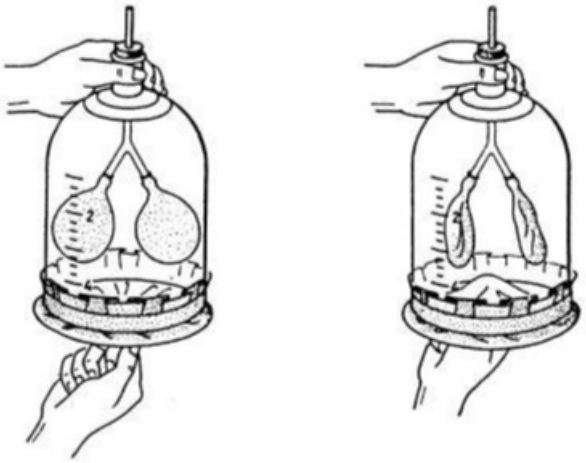
info@phywe.de
www.phywe.de

Structure and implementation (2/2)

PHYWE



The principle of diaphragmatic breathing ...



... can thus be recreated in the model.

PHYWE

Report

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 1

PHYWE

Which of the following statements about the diaphragm are correct?

- [ ] The diaphragm owes its name to its minimal size of only 5 cm in length.
- [ ] The diaphragm consists of numerous muscle fibers.
- [ ] The diaphragm separates the thoracic and abdominal cavities.
- [ ] The diaphragm is a cartilaginous body covered with many hairs that separates the chest and abdominal cavity.

Check

Task 2

PHYWE

Choose the correct statements about diaphragmatic breathing.

- [ ] In its initial position, the diaphragm is pressed into the rib cage in a dome shape.
- [ ] The lungs are closely connected to the walls of the chest cavity. When the diaphragm stretches downwards, air flows in. We breathe in.
- [ ] When inhaling, the diaphragm takes up its initial position.
- [ ] On the exhale, the diaphragm takes up its starting position.

Check

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 3

PHYWE

Choose the correct statements about breathing.

- [ ] When you breathe in, the air you breathe contains approx. 21 % oxygen and 0.4 % carbon dioxide. When exhaling, it is still 17 % oxygen and 4 % carbon dioxide.
- [ ] When you breathe in, the air you breathe contains approx. 21 % carbon dioxide and 0.4 % oxygen. When exhaled, it is still 17 % carbon dioxide and 4 % oxygen.
- [ ] During respiration, the lungs release oxygen into the body and carbon dioxide is excreted from the body.

Check

Slide	Score / Total
Slide 13: Diaphragm	0/2
Slide 14: Diaphragmatic breathing	0/3
Slide 15: Breathe	0/2

Total 0 / 7

Solutions Repeat

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de