CO2 concentration in the classroom with Cobra SMARTsense

Biology | Human Physiology | Respiration

Difficulty level	Group size	Preparation time	Execution time
easy	2	10 minutes	45+ minutes

This content can also be found online at:

http://localhost:1337/c/5f681cdde5cabf00039728d9

PHYWE

Teacher information

Application

PHYWE

CO_2 in the classroom

Carbon dioxide (CO_2) gives discussion material for several lessons in the present time. The main focus is on the topic covered by CO_2accelerated climate change and the reduction of the CO_2emissions.

Besides these important climatic conditions, the CO_2-content in the air but also the general condition. In a confined space with many people, the air feels very quickly "used up".

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

Other teacher information (1/4)

PHYWE

Prior knowledge

Students should have a general background knowledge of human respiration and the composition of air. A basic knowledge of photosynthesis is also useful.

Scientific principle

In a classroom many people sit together for several hours. Especially in winter, when there is little ventilation, the CO_2-concentration in a room and can be measured.

Other teacher information (2/4)

PHYWE

Learning objective

The students should realize that their breathing is CO_2-content in the air, especially in a closed room.

Tasks

Students should use the Cobra SMARTsense CO_2-Sensor to measure the CO_2-content in a classroom at different times of the day.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

Other teacher information (3/4)

Composition of the air

Component		Share in %
Nitrogen		78,02
Oxygen		20,95
Noble gases and other trace substances		<1
	Of which CARBON DIOXIDE	**0,04**

Other teacher information (4/4)

Human respiration

- When inhaling, we take in air through mouth and nose. This reaches our lungs.
- In the lungs there are larger airways (bronchi) and smaller airways (bronchioles).
- This finely ramified network divides itself further and further: at the end are the alveoli or pulmonary alveoli in which the gas exchange takes place. Here, oxygen is transferred to the blood and CO_2 is released into the air that is then exhaled.
- This changes the composition of the air.

Component of the air on exhalation	Share in %
Nitrogen	78
Oxygen	17
Carbon dioxide	4
Noble gases and trace substances	<1

Changed air composition through gas exchange in the lungs: nitrogen (78%), **Oxygen (17%)**, **Carbon dioxide (4%)**inert gases and other trace substances (1%)

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

Safety instructions

PHYWE

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

PHYWE

Student Information

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

Motivation

PHYWE

CO_2 in the classroom

In most lessons, and I'm sure you know this, someone calls "Open the window. I get very sleepy!" or a new teacher comes into the room and before the "good morning" comes a "Open all the windows immediately!".

When we breathe, we consume oxygen from the air surrounding us. In the process, we exchange oxygen for carbon dioxide in our alveoli, the air sacs of the lungs (CO_2). This CO_2 we breathe out. Thus the content increases CO_2 in the classroom while the oxygen level is decreasing.

To understand this principle, you can carry out the following experiments.

Tasks

PHYWE

Measure the CO_2 Content in your classroom at different times:

- Right at the beginning of the lesson, after you have ventilated the classroom
- After the first hour, window remained closed
- After the first hour, window tilted
- After the big break.
- After a lesson has taken place in another room (physical education, ...)
- After you've had classes in the same room all day

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	Cobra SMARTsense - CO2, 0 ... 100000 ppm (Bluetooth + USB)	12932-01	1
2	measureAPP - the free measurement software for all devices and operating systems	14581-61	1

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

Set-up (1/2)

PHYWE

For measurement with the **Cobra SMARTsense sensors** the **PHYWE measureAPP** is required. The app can be downloaded free of charge from the relevant app store (see below for QR codes). Before starting the app, please check that on your device (smartphone, tablet, desktop PC) **Bluetooth** is **activated**.

iOS

Android

Windows

Set-up (2/2)

PHYWE

Structure of the experiment

- Activate Bluetooth on the mobile device.
- Switching on the "Cobra SMARTsense CO_2" sensor by pressing the power button.
- open measureAPP and sensor "CO_2Select "".
- The measured values are displayed in ppm (parts per million) (volume fraction). 1000 ppm correspond to 0.1%.
- The sensor is calibrated outdoors by pressing the power button for 7 seconds. CO2 concentration in 2020: approx. 410 ppm. The value fluctuates seasonally by a maximum of 10 ppm and increases every year due to the combustion of fossil fuels.

Cobra SMART scythe CO_2

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

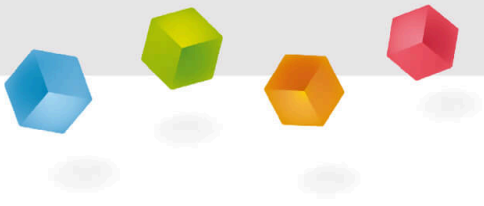
Procedure

PHYWE

Performing the measurement

- The measured values are displayed after switching on and connecting the Cobra SMARTsense CO_2 is displayed with the PHYWE measureAPP.
- Repeat the measurement according to the tasks:
  - Right at the beginning of the lesson, after the first lesson, after the big break, after a lesson in another room (gym class, ...), after you have been teaching in the same room all day, and finally just take a breath into the sensor.
- Read the value in the PHYWE measureAPP and enter it into a table in your handwritten log.

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

In what quantities do which substances occur in the air?

1. nitrogen: 78%; oxygen: 21%; noble gases and other trace substances:<1% (of which 0.04% carbon dioxide)

1. noble gases and other trace substances: 78% (of which 50% carbon dioxide); oxygen: 21%; nitrogen 1%.

1. carbon dioxide: 78 %; nitrogen: 21 %; oxygen: 1

1. oxygen: 78%; nitrogen: 21%; carbon dioxide: 1%.

Task 2

PHYWE

Poor air quality due to a high proportion of carbon dioxide in indoor air reduces the concentration and performance.

○ True ○ Wrong

Check

Plants take oxygen from the air and release carbon dioxide as a result of photosynthesis. Therefore, indoor plants do not help to improve the air in the room.

○ True ○ Wrong

Check

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

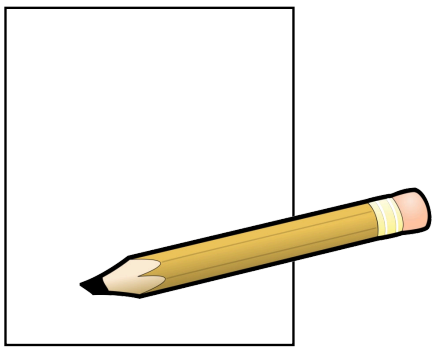
Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 3

PHYWE

Compare the different values you have measured, which you have entered in a table. Discuss at which point you felt better in your classroom and when you were less concentrated or even sleepier. Can you find a connection to the measured CO2 Recognize salary?



Slide	Score / Total
Slide 16: Components of air	0/1
Slide 17: Multiple tasks	0/2

Total amount 0 / 3

Solutions Repeat

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de