

CO₂ concentration in the classroom with Cobra SMARTsense



Biology

Human Physiology

Respiration



Difficulty level

easy



Group size

2



Preparation time

10 minutes



Execution time

45+ minutes

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Teacher information

Application

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CO₂ in the classroom

Carbon dioxide (CO₂) gives discussion material for several lessons in the present time. The main focus is on the topic covered by CO₂ accelerated climate change and the reduction of the CO₂ emissions.

Besides these important climatic conditions, the CO₂-content in the air but also the general condition. In a confined space with many people, the air feels very quickly "used up".

Other teacher information (1/4)

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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 CO₂-concentration in a room and can be measured.

Other teacher information (2/4)

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Learning objective



The students should realize that their breathing is CO₂-content in the air, especially in a closed room.

Tasks



Students should use the Cobra SMARTsense CO₂-Sensor to measure the CO₂-content in a classroom at different times of the day.

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 CO₂ 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%)

Safety instructions

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

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Student Information

Motivation

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CO₂ 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 (CO₂). This CO₂ we breathe out. Thus the content increases CO₂ in the classroom while the oxygen level is decreasing.

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

Tasks

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Measure the CO₂ 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

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

Set-up (1/2)

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The Cobra SMARTsense and measureAPP are required for the measurement of the carbon dioxide content. The app can be downloaded for free from the App Store - QR codes see below. Check whether Bluetooth is activated on your device (tablet, smartphone).



measureAPP für Android
Betriebssysteme



measureAPP für iOS
Betriebssysteme



measureAPP für Tablets / PCs mit
Windows 10

Set-up (2/2)

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Structure of the experiment

- Activate Bluetooth on the mobile device.
- Switching on the "Cobra SMARTsense CO₂" sensor by pressing the power button.
- open measureAPP and sensor "CO₂Select "".
- 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 CO₂

Procedure

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Performing the measurement

- The measured values are displayed after switching on and connecting the Cobra SMARTsense CO₂ 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.

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Report

Task 1

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In what quantities do which substances occur in the air?

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

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

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

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

Task 2

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

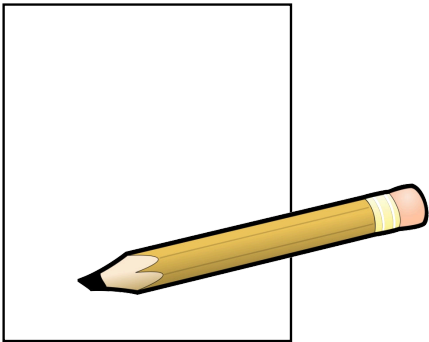
 True Wrong Check

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

Task 3

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

 Solutions Repeat