# Plants and oxygen

## Can plants be dangerous in a bedroom?

Jane and Sue are friends and they have not met each other for a long time. Both of them love flowers and plants, especially Sue has apartment full of plants; they are everywhere, in the living room, in the bedroom, in the kitchen. When Sue came to visit Jane, Jane had no flowers in the bedroom. When Sue asked about it, Jane explained immediately: “In the dark at night, flowers do not produce oxygen, in contrary, flowers consume it. Hence, sleeping people cannot breathe very well and sleep is not very good. And, if the windows are closed, people can be in danger.” Can it be true?

**You can help Sue to decide either to remove all plants from her bedroom to support her healthier sleep, or to let it be as it is. Is the idea of Jane, based on the widespread superstition handed down for generations, stupid and baseless?**

### What you might need to know

Plants, like humans, consume oxygen and produce carbon dioxide. This phenomenon in the case of plants, as well as of humans, is called breathing (*respiration*). However, plants are able to produce oxygen. This phenomenon is called ***photosynthesis***. The process occurring in the plant (respiration or photosynthesis) depends on presence of light. When a sufficient amount of light is around the plant, photosynthesis occurs primarily as a more efficient process; in the dark environment, respiration is the ongoing process. During photosynthesis, plants consume carbon dioxide and produce glucose (which is then used as the main building material for the construction of their bodies) and oxygen. Whole process can be summarized in this equation:

$$6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$$

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1. Calculate the volume of gaseous oxygen, which is produced during photosynthesis under normal conditions from 18 mL of water?

2. How can you indicate that the reaction proceeds?

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## Before you start your experiment:

1. The presence of carbon dioxide and water as reactants is necessary for photosynthesis. Nevertheless, two other factors are also essential for the process - one is a physical quantity, the second is a chemical compound.
   Hint: *Why does not photosynthesis take place in fungi and yeast, although their composition is otherwise virtually identical to plants?*
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2. What factors affect the rate of photosynthesis and why?
   *The physical factor is especially important. What parameter can be different in this factor?*
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3. If you want to monitor the respiration of plants, you should know its basics. What is it and what is the chemical equation for this process? We can help you saying that, in the course of the process, glucose and oxygen are consumed (hence, they are the reactants).
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## Explore the world around: simulate the conditions in Sue's bedroom

1. To decide if Jane theory was right, you have to draw the experiment carefully. One or more experiment(s) should be carried out in reasonable time (not more than 60 minutes!) and with available equipment. Beside standard laboratory equipment you can use variety of sensors, such as pH sensor, conductivity sensor, carbon dioxide, dissolved oxygen, nitrate sensor, temperature sensor. Give reasons for your choice:

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Sensor 1: _____

Reason: _____

Sensor 2: _____

Reason:_____

2. Design your experiment. Make a prediction and explain in details, how you plan to prove it.

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Hypothesis and verification:_____

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3. Design the experiment apparatus in the easiest way. Two sensors should be used. Draw your suggestion down.

Apparatus:

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4. Perform the experiment and write down the data carefully. Write down your precise procedure.

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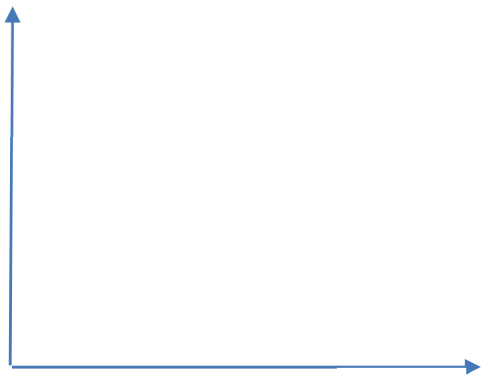
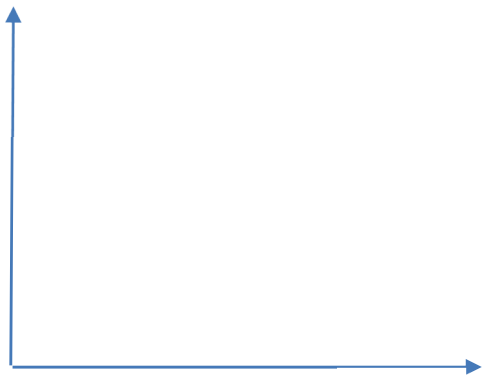
## Evaluate measured data

1. Draw measured data and graphs – do not forget to name axes correctly:





Note: You have to use same units to compare the measured data (each sensor has different units). You should know that 1 % = 10 000 ppm.

2. Describe and explain the measured data (= interpret the results):

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3. What kind of data do you have to compare in graphs to get an answer to Sue's question?

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4. What else can influence the process? If you are getting unexpected results, try to explain what can cause it. Where could you make a mistake?

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## Conclusions:

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## Communicate your results

Write Sue a letter where you explain the given problem. Justify the answer properly so that Sue can explain Jane the results about plants in bedroom.

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**Now, you have enough of experience and knowledge to answer the following questions:**

1. One car produces 1 kg of carbon dioxide per 100 kilometers. How many trees would be needed at the same time to consume all the carbon dioxide from one car? (Note that tree has about 100,000 leaves).

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