A MYSTERY OF DISAPPEARED FLOWERS

Where is the hidden treasure?

Boy Scouts David and Grace had an important mission. In March they were tasked with hiding a treasure in a forest for their younger friends. They thought of a trail which started at the clubhouse than went across the town and over a footbridge to the forest. The younger mates were supposed to follow azimuth instructions and descriptions of environment. David and Grace chose a beautiful hiding place for the treasure. They hid it into an old tree stump which was surrounded by ornaments made of flowers in blossom of various colours: white anemone, purple fumewort and yellow lesser celandine. Unfortunately, there was a heavy rain few days before the treasure quest and the footbridge to the forest was damaged by flooded stream. The Scouts had to postpone their trailing. The footbridge has not been repaired until the end of May. Then, finally, the junior Scouts could go and find the treasure. They followed the instructions. At the end of the trail where they were supposed to find an old tree stump surrounded by colourful ornaments of flowers, they got into trouble. There were no flowers at all. **Where and why they disappeared?**

1. How does the deciduous broad-leaved forest look like in the spring? What can you see there? What colours does it have? How does it smell?

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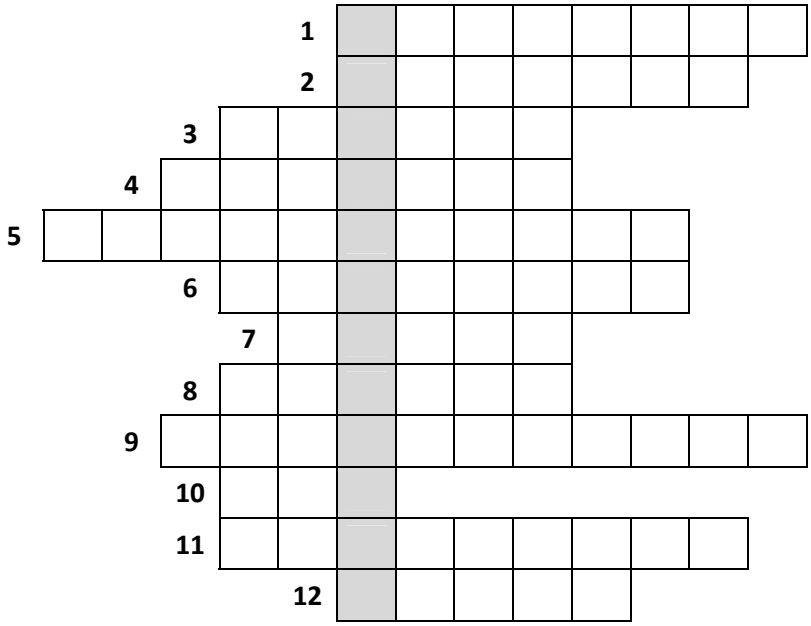
2. Solve the crossword.



1) An early spring bulbous plant with white bell-shaped flowers.
2) A leafstalk.
3) A large tract of land covered with trees and underbrush.
4) The day when daytime and night are of approximately equal duration.
5) A state of inactivity and low intensity of metabolism in endotherm animals.
6) A tree with large, usually fragrant, early spring flowers and an aromatic bark, much cultivated for ornament.
7) The first spring month.
8) The ovule-bearing or seed-bearing female organ of a flower.
9) A measure of the warmth or coldness of an object or substance.
10) The most favourite insect of Winnie-the-Pooh.
11) trees or shrubs that lose their leaves seasonally
12) A spring flower for which the Netherlands is well-known.

Explain the term in the solution.

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Useful to remember:

1. What are the vital gases for plants?

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2. What are the names of plant processes written in following overall reactions? What is their role?

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

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

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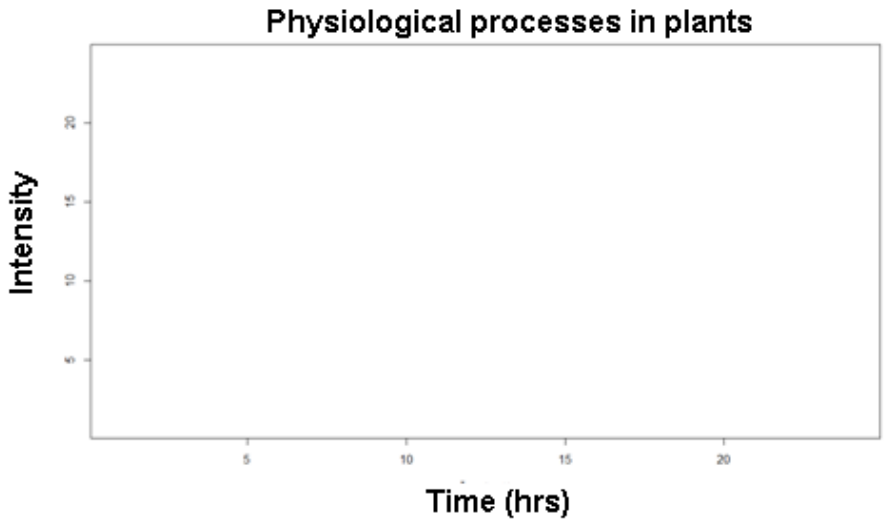
3. How do you think that intensities of photosynthesis and respiration change during the day? Plot the intensity curves on the following graph. Assumptions: May (temperature during the night is not lower than 5°C), North Temperate Zone.



Experiment

Task: Explore an effect of various light conditions on the intensity of photosynthesis.

Before you start your experiment

1. Design the experiment and describe the variables which you are going to measure. Discuss your plan with the teacher.

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2. How can you simulate in the school lab the natural shade caused by trees?

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3. What are your expectations about changes of concentrations of CO_2 a O_2 in variable light conditions?

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4. Explain the biological evidence of the changes.

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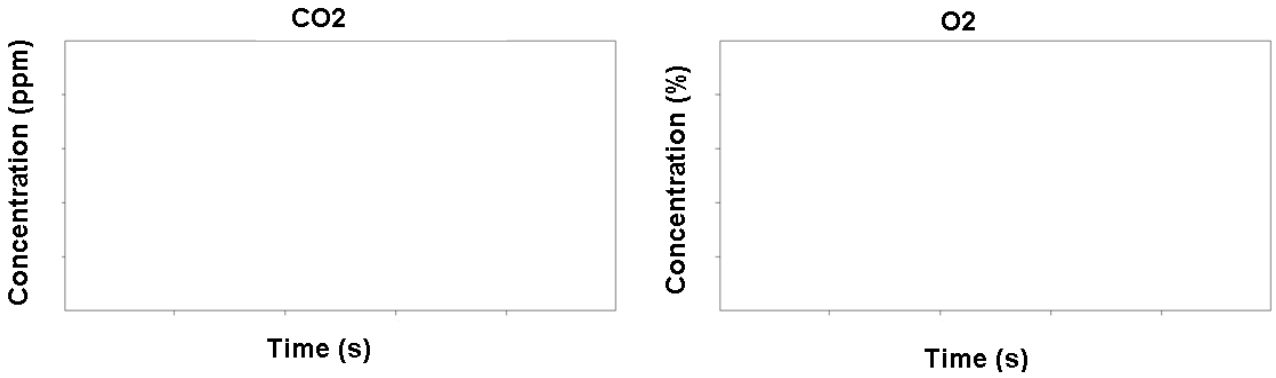
5. Draw your expectation into these graphs. Don't forget to mark the light conditions on the x-axis.



Materials and devices:

- O_2 Gas Sensor + connector
- CO_2 Gas Sensor + connector
- Data logger or computer with appropriate software
- Experimental bottle with two holes for sensors
- Fresh green plant leaves
- Lamp
- Beaker with water
- Shading material
- Aluminium foil

Procedure:

1) Connect the CO_2 and O_2 Gas Sensors to the computer and open the interface for sensors.
2) Put the leaves into the experimental bottle and insert the sensors into the holes as shown in Fig. 1. The O_2 Gas Sensor has to be in upright position all the time, otherwise it could be damaged. Turn on the light source. In case the light source produces also heat put the beaker with water between the light source and bottle (Fig. 1).

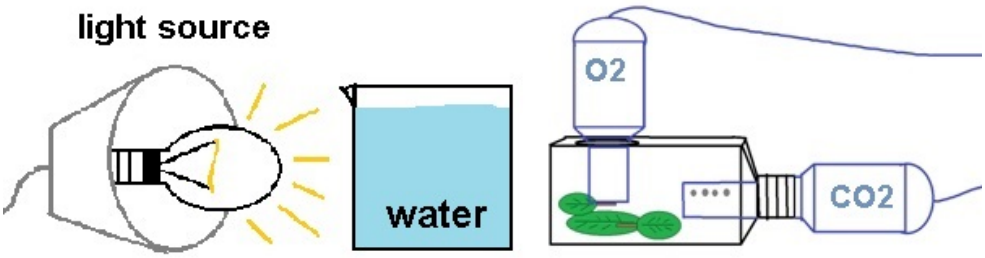


Fig. 1: Apparatus for measuring changes in concentration of CO_2 and O_2 (Bílá, J).

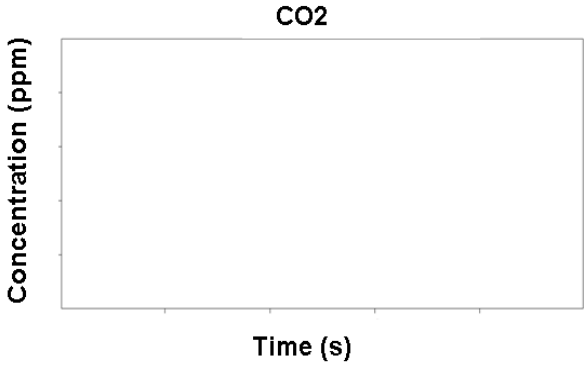
3) Wait five minutes for the sensors to equilibrate.
4) Start data collection. Collect the data for 15 minutes.

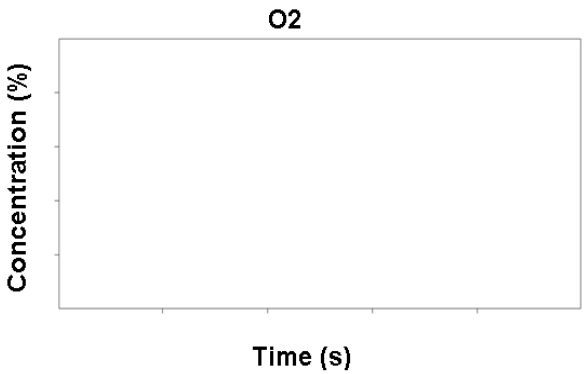
5) Write down the actual time, i.e. exact time that has elapsed since the beginning of data collection.
6) Hide the apparatus with shading material. The light source is still on. Collect the data for further 15 minutes.
7) Write down the actual time.
8) Wrap the experimental bottle with aluminium foil so that no light can get inside.
9) Collect the data for the last 15 minutes. Then, stop the collecting.
10) Save your data.
11) Read the production/consumption of gasses for each phase of experiment out of the graphs:
    a. Determine a 600 s (10 min) long phase of every part of the experiment (i.e. light – shadow – darkness) identically for both gasses. The beginning of each phase place ca. 2-5 minutes after the starting points of data collection (that is the time of sensors' equilibration).
    b. Count the difference between the beginning and the end of each phase. Write the result down in the following table.
12) Clean and dry the experimental bottle.

Data:

Write your data into the following table. Count the mean of the whole class for both gasses in all conditions. Then, draw the shape of the curve of measured data to the empty graphs. Don't forget to mark on the horizontal axis also the conditions of measurement.

		Light	Shade	Dark
CO_2 (difference in ppm)	Our value			
	Mean of the class			
O_2 (difference in %)	Our value			
	Mean of the class			





Conclusions

1. How did the concentrations of CO_2 a O_2 change in various conditions?

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2. Do your expectations match with the measured data? If not, what is the reason?

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3. What is the biological evidence of the measured data?

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4. What seasons does a plant from temperate deciduous forest like the most? How is it in other seasons?

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5. In the spring, you can see a lot of colourful flowers in deciduous forests. Some of the herbs are so abundant that it looks like a coloured carpet. Can you recognize the most beautiful flowers of the spring?

   Match the photos with the right names:

   1) Common snowdrop (*Galanthus nivalis*)
   2) Lesser celandine (*Ficaria verna*)
   3) Wood anemone (*Anemone nemorosa*)
   4) Yellow anemone (*Anemone ranunculoides*)
   5) Hollow root/ stagger weed (*Corydalis cava*)
   6) Early Dog-violet (*Viola reichenbachiana*)
   7) Spring Snowflake (*Leucojum vernum*)
   8) Common lungwort (*Pulmonaria officinalis*)

(Foto: Potůčková A., 2010)

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(Foto: Bílá J., 2014)

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(Foto: Pospíšilová M., 2014)

(Foto: Šemberová K., 2012)