NATURE-BASED SOLUTIONS LEARNING SCENARIO

Title

WHAT IS OZONE AND WHY IS IT SO IMPORTANT?

OZONE „DETECTOR“, DO IT YOURSELF

Author(s)

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Abstract

Ozone is a protective layer for Planet, is one of the most important constituents of the atmosphere. The occurrence of ozone holes and ground-level ozone is a problem of environmental protection.

On the Internet, found an interesting method of making the indicators for ozone in the form of "strips" that measured the concentration of ground-level, that is "bad" ozone.

This method is interesting for students so I decided to allow them to make their own "ozone detector."

With own made "ozone detector" students will measure ozone in area where they live, and thus will cover more or less the whole area of Labin and check the work of "ozone detector," and simultaneously collected data on the presence of ground-level ozone at some locations that we can compare with data in our county on the web site published http://iszz.azo.hr/iskzl/

Keywords

ozone, UV-B rays, ozone holes, ground-level ozone, ozone detector, environmental protection

Introduction (leave this section as it is)

"Nature-based solutions (NBS) are solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes, and seascapes, through locally adapted, resource-efficient and systemic interventions. Nature-based solutions must therefore benefit biodiversity and support the delivery of a range of ecosystem services." *https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions_en*

To use this Learning Scenario more effectively, teachers are encouraged to:

- Check out the list of recent EU publications on Nature-Based solutions
- Read about Nature-based solutions: Transforming cities, enhancing well-being (also available as a PDF)
- Contact local NBS practitioners or scientists working in their area (they can be found through Oppla).
- Use the "Ask Oppla" service to request help in case of any technical/scientific question on NBS.

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Overview

Table of summary	
Subject	Chemistry, mathematics, biology, physics, geography, environmental protection, informatics.
Topic	1. Understanding NBS, 2. Climate mitigation and adaptation, 3. Public health, well-being and air quality, 4. Participatory planning and governance.
Age of students	16 - 18 years old
Preparation time	2 - 6 hrs to prepare activities
Teaching time	**5 lessons (45 min) & 10 days for field work** **Activities:** 1. Introducing NBS 2. Introducing activities (ozone) 3. O_3 sensor construction 4. O_3 field measurement 5. Presentation of results 6. Action resulting from the discussion: " WHAT IS OZONE AND WHY IS IT SO IMPORTANT?"
Online teaching material	**Lesson 1: Example scientific papers:** pt.slideshare.net/askapinaki/ozone-depletion-60104307 What is ozone? https://geography.name/what-is-ozone-and-why-is-it-so-important/ What Is Ozone and Why Is It So Important? www.youtube.com/watch?v=JBVvV2Wh1MI&t=51s&ab_channel=ShikshaAbhiyan What is ozone and how does it affect any ecosystem? https://www.ciwf.org.uk/factory-farming/environmental-damage/http://meteo.hr/kz/modeliranje/Studija_CAFE_14_12_2012.pdf **Lesson 2: Students presentations** https://prezi.com/mluk5_c2xyg-/uputa-za-izradu-prezi-prezentacije/ https://support.microsoft.com/hr-hr/office/osnovni-zadaci-pri-stvaranju-prezentacije-programa-powerpoint-efbbc1cd-c5f1-4264-b48e-c8a7b0334e36 **Lesson 3 & 4: How to build O_3 a sensor & O_3 sensor construction** https://cohlife.org/wp-content/uploads/How-to-Make-Ozone-Test-Strips.r.pdf How to Make Ozone Test Stripshttp://www.chemistryland.com/CHM107Lab/Exp03_DetectOzone/OzoneLab/OzoneLab.htm **Lesson 5: results of field measurement** https://smszepce.info/files/ms_excel.pdf http://iszz.azo.hr/iskzl/ https://narodne-novine.nn.hr/clanci/sluzbeni/2005_11_133_2466.html **Lesson 6:** QUIZ:Ozone and Greenhouse Effect https://quizizz.com/admin/quiz/568bfab39a21ad401acecd96/ozone-and-greenhouse-effect

Table of summary	
Offline teaching material	APPLIANCES: Dehumidifier, Microwave, Digital hygrometer, GPS ACCESSORIES: filter paper, scissors, rulers, cups, burners, containers with stopper, bottle spraying. CHEMICALS: starch, potassium iodide, deionized water
NBS resources used	https://www.think-nature.eu/

License

Integration into the curriculum

In the fourth grade of secondary schools with a four-year program of Chemistry according to the Curriculum for the subject of Chemistry for primary schools and gymnasiums in the Republic of Croatia

the content of learning and teaching is conceived in five thematic areas that reflect the idea of a modern approach to learning chemistry, in context: - Electromagnetic radiation and substances, Colloid chemistry, Chemistry of selected biomolecules, Materials Science and Environmental Chemistry.

Environmental chemistry is an important part of general education, it contributes to the quality of life of modern man and the sustainable development of man's immediate environment and the planet as a whole.

In the subject Chemistry, **cross-curricular** topics are also realized, especially Learning how to learn, **Sustainable development**, Use of information and communication technology, Health and Personal and social development.

- chemistry, experiential learning or learning by discovery starts from asking problems or questions, and by one's own activity one draws conclusions and finds solutions within the subject contents,
- mathematics, analysis, calculation, presentation and interpretation of data,
- biology, ozone and living organisms,
- physics, the structure of the atmosphere,
- geography, determining geographical coordinates – GPS,
- environmental protection, the importance of ozone layer protection,
- informatics, IT knowledge needs to be integrated into chemical content in order to facilitate the solution of chemical problems, data processing and display, and access to information.

Aim of the lesson

Gaining experiences that will arouse curiosity, positive attitude and interest in chemistry and science, understanding the principles of scientific and ethical approach to research and problem solving, acquisition of metacognitive knowledge as a prerequisite for developing independence, self-confidence, innovation, responsibility and creativity.

Outcome of the lesson

- Understand what NBS means.
- Elaborated discussion and findings via presentations and teamwork on how to protect the environment.

Trends

- Students and their needs are at the centre of the learning process.
- Learning materials: shift from textbooks to web resources and open source books.
- STEM Learning: increased focus on Science, Technology, Engineering, Mathematics subjects
- in the curriculum.
- Outdoor Education: learning outside of the school building in the “real” environment
- Collaborative Learning: a strong focus on group work.
- Peer Learning: students learn from peers and give each other feedback.
- Assessment: the focus of assessments is shifting from "what you know" to "what you can do."
  http://www.allourideas.org/trendiez/results

21st century skills

- Information Literacy – reading a scientific paper and selecting the most important information.
- Collaboration – working in the groups.
- ICT (Information, Communications, and Technology) Literacy – creating a self-made O3 detector.
- Communication – discussions with other students.
- Critical Thinking and Problem Solving – looking for a solution to the problem.
- Flexibility and Adaptation – finding a solution that will be possible to adapt at school, forexample with small budget.
- Creativity and Innovation – what we an do to protect our envorement.

http://www.p21.org/our-work/p21-framework .

Activities

Describe here in detail all the activities during the lesson and the time they require. Remember, that your learning scenario needs to relate to nature-based solutions. If you are using any external documents, please scroll to the end of the document and add them to the Annex. Add more rows to the table if needed.

Name of activity	Procedure	Time
	Lesson 1.	
Introduction & Group work	Introducing NBS Introducing: **WHAT IS OZONE AND WHY IS IT SO IMPORTANT?** **OZONE „DETECTOR“, DO IT YOURSELF** The class is divided into 6 groups of 4 students (according to place of residence what is important for field measurements).	10 min
	The teacher gives each group a task to which they must look for the answer on the Internet: **Group work:** **GROUP 1. VINEŽ** - What is ozone, formula and structure of the molecule? **GROUP 2. LABIN** - Where is ozone in the atmosphere? **GROUP 3. RABAC** - What is the role of ozone in the atmosphere? **GROUP 4. RAŠA** - Where is “bad” ozone formed in the atmosphere? **GROUP 5. PLOMIN** - What are the causes of "bad" ozone **GROUP 6. KATARINA** - How does “bad” ozone affect the environment and living organisms?	15 min
	Students present their answers, other students listen, take notes and ask questions if something is not clear to them.	20 min
	Lesson 2.	
LAB WORK	**PREPARATION OF "OZONE DETECTOR" (Annex 1.)** The teacher gives instructions for making an ozone detector. Each group receive the necessary accessories and materials on a tray.	15 min
	At the end of the work, the students clean the utensils and the work place and return the trays to the teacher.	45 min
	Lesson 3. & Lesson 4.	
FIELD WORK	**DETERMINATION OF OZONE (Annex 2.)** **DATA ANALYSIS AND PRESENTATION (Annex 3.)** Each group prepares a ppt presentation.	10 days
	Lesson 5.	
GROUP WORK	**PRESENTATION OF RESULTS** **MAKING A GRAPH OF COMPARISON OF ALL LOCATIONS**	30 min (6 x 5 min) 15 min

Name of activity	Procedure	Time
Lesson 6.		
DISCUSSION & CONCLUSION	**Students study the final graph and get involved in discussion:** In what location does “bad” ozone most often occur? What is the possible reason? Are the permitted values exceeded? What should be done to reduce the amount of “”bad” ozone?	20 min
QUIZ	**What we learned and whether we found the answer to the question” WHAT IS OZONE AND WHY IS IT SO IMPORTANT?”** self-assessment	20 min 5 min

Assessment

Students will check the acquired knowledge with an online quiz and self-assess.

QUIZ: Ozone and Greenhouse Effect

https://quizizz.com/admin/quiz/568bfab39a21ad401acecd96/ozone-and-greenhouse-effect

Student feedback

All students should fill out the questionnaire:

1. What does NBS mean to you?
2. Have you heard about it earlier?
3. Does it change the way you think about nature and the climate?
4. Would you like to implement NBS in your surroundings?
5. Was the lesson interesting for you?
6. Do you like to explore in a group? Whay?
7. What were the 3 key messages you take home from the lessons?
8. Would you change anything in the coursework? What ?

Teacher’s remarks

Considering the COVID-19 pandemic, the learning scenario can be adapted to online learning.

The third session - O_3 sensor construction it can be replaced by the teacher preparing test strips and sending them to students for fieldwork

About the NBS project (leave this section as it is)

The NBS MOOC, coordinated by European Schoolnet (EUN), is part of the NBS pilots initiated and funded by the European Commission Directorate-General for Research and Innovation. The LS and MOOC are based on the EC-funded Learning Scenarios developed by EUN (www.eun.org) with the support of PPMI (www.ppmi.lt/en), and organised with the support of VO EUROPE (https://www.vo-group.be/en). The MOOC is also supported by Scientix, funded from the European Union’s H2020 research and innovation programme – project Scientix 4 (Grant Agreement N. 101000063). The content is the sole responsibility of the organiser and it does not represent the opinion of the European Commission (EC), and the EC is not responsible for any use that might be made of information contained.

Find out more about nature-based solutions: https://ec.europa.eu/research/environment/index.cfm?pg=nbs

Annex

Annex 1:

PREPARATION OF "OZONE DETECTOR" – LAB WORK

- Measure 100 mL distilled water and put it to the beaker.
- Add 1 1/4 tsp. starch.
- Heat the mixture on the hot plate, while stirring with the glass rod, until it thickens and clears. Remove the container from the hot plate.
- Add 1/4 tsp. potassium iodide, while stirring. Allow the solution to cool and thicken to a paste.
- Filter paper put on the glass plate, then use the brush to apply paste evenly to both sides of the paper.
- Place the glass plate in a microwave oven set at maximum power for 60 seconds.
- Cut the filter paper into 1 x10 cm strips.
- Seal the strips, immediately, in clogged container. Store them in a dark place.

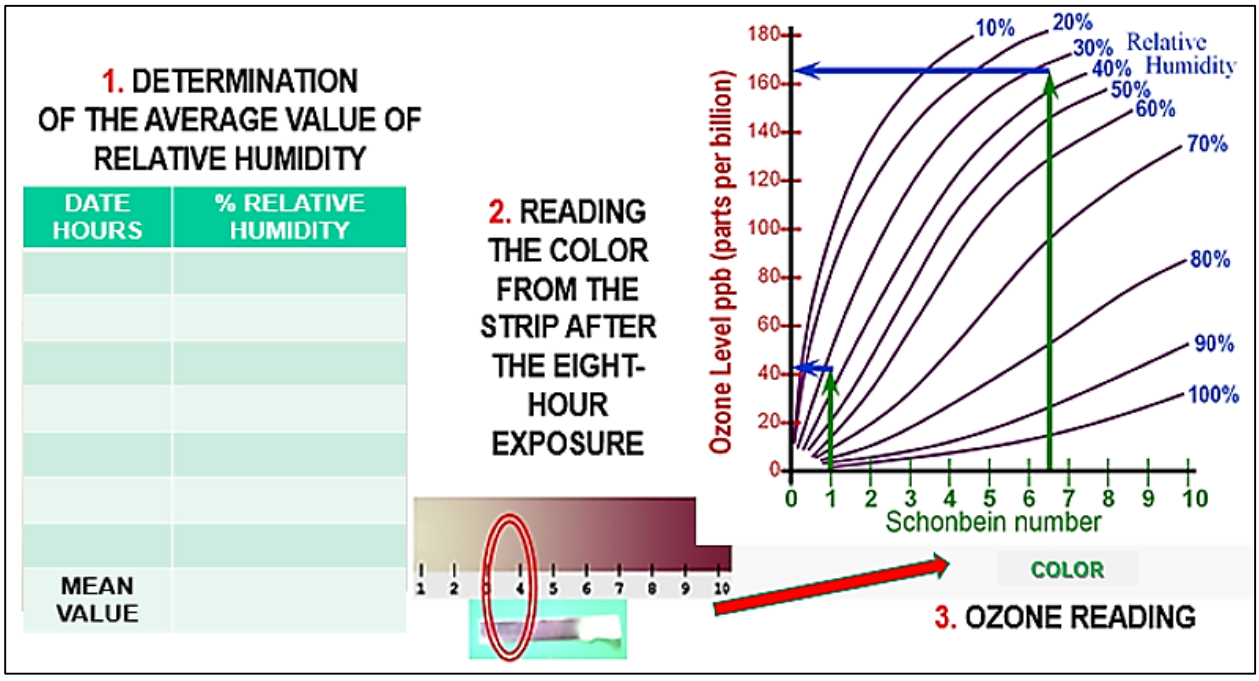
Annex 2:

DETERMINATION OF OZONE - FIELD MEASUREMENT

- **OZONE DETECTOR EXPOSURE**

The prepared strip was moistened with deionized water and exposed for 8 hours in a shaded place. The measurement is repeated for seven days for the accuracy of the data.

- **DETERMINATION OF THE AMOUNT OF OZONE**

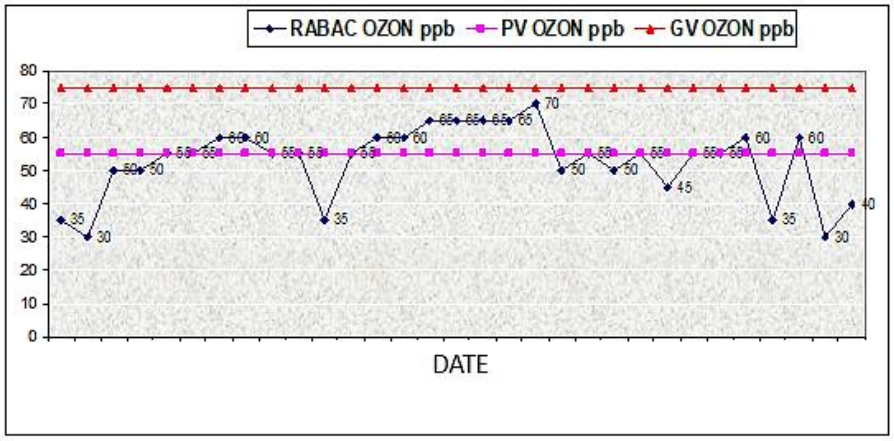


Annex 3:

HOW TO DISPLAY RESULTS

- The group determines the GPS coordinates of its location,
- Each member of the group enters his results in a table from which a consolidated table of the whole group is made and a graph of the mean values of the amount of ozone for that location.

LOCATIONS	LATITUDE	LONGIT.	ELEV.
1.VINEŽ			
2.LABIN			
3.RABAC			
4.RAŠA			
5.PLOMIN			
6.KATARINA			



- In the school students compares the results of all groups and makes a graph