

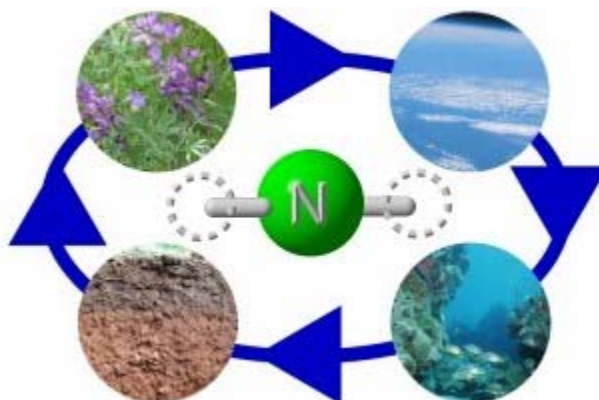
Activities

WebQuest

The Nitrogen Cycle

by: Elmar Uherek in Cooperation with Daniel Schiffbauer (chemistry teacher - Overath)

Expected time for the work with this WEB-Quest in self-contained learning: about 4 weeks in parallel to normal classes.



Introduction

The Article "research" in the ACCENT school magazine Nr. 8 (2006) describes the formation of ozone in the air close to the ground as a consequence of certain concentrations of nitrogen oxides in the atmosphere. The article "context" explains the most important branches of the nitrogen cycle. Nitrogen is found not only as the main component of our air, but also in smaller concentrations in many of its chemical compounds, either oxidised or reduced, in the atmosphere, in soils and in the biosphere. With the help of the following WebQuest you will get an overview of the nitrogen cycle and its importance in particular in the atmosphere and for the climate system.



Tasks and Objectives

Use this WebQuest in order to study the sulphur cycle. Your work will not be limited to the Internet. Experiments and experiment protocols are also required. Not all parts of the nitrogen cycle will have the same weight. In some cases basic knowledge is sufficient, in some cases you will deepen your studies of certain compounds and the respective theory. In some cases you will recognize that the nitrogen cycle cannot be regarded as isolated from other chemical compounds. Please briefly summarise during your work also processes related to nitrogen compounds in the air.

 **Procedure**

Please follow the order of tasks for the processing of topics which is given in the part "sources".

For the ESPERE pages, a forum is available (which can be used in the English and German branch). You can use it to answer your questions among each other or upon request also ask questions in the English language to the project tutor Elmar Uherek. If you don't understand something (either in the ACCENT school magazine or on the ESPERE pages) you may make respective comments and suggest improvements.

=> to the English Forum - e-mail of Elmar Uherek: euherek@esperene.net

In order to access the topics and tasks, please do the following:

1. Please read first which topic and which worksheets you should edit (information in "sources")
2. Please click the link (or type it into the address field of your browser) and you access the website of the main topic (for example: *Lower Atmosphere*).
3. On the left you can see now by the level marked in bold if you are in the **basics** level or in the advanced level (**more**). Below the units will be shown (for example: *extension & composition; greenhouse, light & biosphere; ozone and nitrogen oxides*). Please choose the respective unit.
4. Each unit has again texts and worksheets (*Ozone, nitrogen oxides, ozone smog, worksheet 1, ...*) Click on the title in the bar on the left in order to access the material you will work with. So you can go from one task to the next.

Most of the issues you need to work on are based on the ESPERE encyclopaedia. But there are also some other sources.

 **Sources**

If you click here in the online version on the links below, they will open in a new window and this page remains open all the time.

I) Nitrogen oxides and boundary layer ozone:

<http://www.atmosphere.mpg.de/enid/239.html>

Please cover all texts from Unit 3 in Basics as well as the following text:

<http://www.atmosphere.mpg.de/enid/3tc.html>

II) Nitrous oxide and ozone hole:

<http://www.atmosphere.mpg.de/enid/207.html>

Please cover the full Unit 2 in More as well as the worksheets.

<http://nobelprize.org/chemistry/laureates/1995/press.html>

Discuss the role of nitrogen compounds in the ozone depletion taking place in the stratosphere.

<http://www.atmosphere.mpg.de/enid/3tf.html>

Compare the difference between N₂O and NO₂ (see: Sources I) Nitrogen oxides and boundary layer ozone) with respect to their distribution in the atmosphere in time and space.

III) Nitrogen fertilisation and eutrophication:

<http://hollandimac.chem.rochester.edu/n2cycle.pdf>

<http://www.atmosphere.mpg.de/enid/1ve.html>

Cover the texts of Unit 2 (not the worksheets) and discuss the impact of nitrogen fertilization on the marine food web.

IV) Ammonia, ammonia salts and particles

<http://www.ext.vt.edu/pubs/bse/442-110/442-110.html>

<http://www.atmosphere.mpg.de/enid/294.html>

Please cover Unit 2 about particles in the climate system apart from the article "particles in the respiratory tract" and worksheet 2. How is particle formation related to the nitrogen cycle?

V) Nitric acid, deposition and acid rain:

Work with the following texts:

<http://www.atmosphere.mpg.de/enid/3v8.html>

<http://www.atmosphere.mpg.de/enid/3v9.html>

<http://www.atmosphere.mpg.de/enid/3vp.html>

<http://www.ns.ec.gc.ca/msc/as/acidfaq.html>

VI) Nitrate radicals and short living compounds

Inform yourself about nitrate radicals and their role in the self-cleaning of the atmosphere in the night. Test your knowledge in an online quiz:

<http://www.atmosphere.mpg.de/enid/24z.html>

<http://www.atmosphere.mpg.de/enid/3z6.html>



Presentation

Worksheets (besides multiple choice tests), experimental protocols, summaries and work progress reports should be written by hand!

Develop a work progress report (max. 5 pages). Please write down when, about what and how you informed yourself. This includes information if you worked at home, at school, alone or in pairs. Write which material you used, if it was easy to understand or not (think also why!). Make notes which additional Internet pages, books or other materials you used and list these resources at the end of your folder under "additionally used sources" with the respective date.

Apart from the work progress report your folder shall include the filled worksheets, the answers to the questions on the worksheets, the experimental protocols, possibly photos, summaries you prepared, important terms, etc.

Structure the material in a reasonable way and add a table of contents at the beginning. The folder should not include more than 40 pages.

The topics covered are relevant for your written tests. You should be able to assign the topics to the respective part of the nitrogen cycle.



Criteria for evaluation

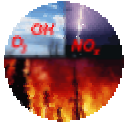
The folder is evaluated according to the following criteria:

- **Completeness:** Have all tasks been covered and listed in the folder? Did you add a table of contents? Is there a literature list?
- **Structure and clarity:** Is the folder well structured? Are summaries and protocols written in a proper and understandable way?
- **Content:** Is it obvious from your folder that you substantially dealt with the contents of the texts? Are there remarks and discussions concerning the topic? Are the contents factually correct?

Structure of the ESPERE pages:

The following scheme shows how to navigate in the four layer structure of the Climate Encyclopaedia in topics - levels - units and texts / worksheets. You may also read the page "[How to use?](#)"

Lower Atmosphere (Topic)



Basics (Level I)

Unit 1:

Ozone and nitrogen oxides

- Ozone smog (background text)

The screenshot shows the ESPERE website interface. At the top, there is a logo for 'esperere' and the tagline 'Environmental Science Published for Everybody Round the Earth'. Below this is a navigation bar with links for 'English', 'Home', 'Contact', 'Encyclopaedia', 'International', 'What is ESPERE?', and 'school magazine'. The main content area features a diagram of the atmosphere with three layers: 'Lower Atmosphere', 'Basics', and 'Ozone smog'. A central text box explains that ozone smog is a significant problem in big cities, formed through a complex process involving nitrogen oxides, ozone formation, and ozone loss. To the right, a table titled 'Choose your topic ...' lists various topics with links to 'basics' and 'more' content.

Lower Atmosphere

Basics

Ozone smog

Ozone smog is a significant problem in big cities. Ozone is formed as part of a complicated process involving nitrogen oxides, ozone formation and ozone loss. Ozone smog formation shows just how interconnected processes in the atmosphere really are.

Choose your topic ...	basics	more
Lower Atmosphere	basics	more
Upper Atmosphere	basics	more
Weather	basics	more
Clouds and Particles	basics	more
Climate in Cities	basics	more
Oceans	basics	more
Food and Climate	basics	more
People Changing Climate	basics	more

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