

Ground level ozone

Self-Study Module

Objectives

Ground level ozone provides an example to

- learn about central aspects of air pollution and relations between different pollutants.
- study the interaction of various chemical reactions and environmental factors in a complex system.
- interpret data based on the relevant theoretical background.

Contents

- Distinction between ground level and stratospheric ozone; effects.
- Formation of ground level ozone: precursors, meteorological factors, mechanism (radical reactions), temporal and spatial variations.
- Concentration of ozone and nitrogen oxides: retrieval and interpretation of data from the internet, correlation with meteorological data.

Prerequisites

- Reaction equations.
- Structural formulae.
- For problem 2: the mole.
- For problem 3: temperature dependence of chemical equilibrium (Le Châtelier's principle) and of reaction rates.
- To provide the students with the relevant context knowledge, it is recommended to give an overview of the main air pollutants prior to the self-study module, including formation, effects, emission and immission situation. Problem 1 can be omitted then, so that computers are only needed for problem 10.

Time required

3 to 4 lessons.

Didactic and methodical suggestions

- While the students work on their own, the teacher can answer individual questions and support students as necessary.
- The last three pages contain the answers to the problems. For classes with a low level of self-discipline, it may be advisable not to distribute them to the students but to put just a few copies on a table in the classroom, which are not to be removed.
- After completing the module, pollution control measures can be discussed.

Resources

- For problems 1 and 10, the students need computers with internet access.

References

- T. E. Graedel & P. J. Crutzen, *Chemie der Atmosphäre*, Spektrum Verlag, 1994, ISBN 3-86025-204-6, Seite 160 bis 165.
- *Praxis der Naturwissenschaften - Chemie*, Heft Nr. 4/43, 1994.

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