

Answer **three** questions or problems (Tasks No. 1, 2 and 3). Each of them has three options (a, b or c) of which you choose **one**. (So there are no options between the tasks, but three options in each task).

Each option is primarily based on the alternative reading materials: option a is based on seminars (handouts and discussions), option b is based on the textbook Georg Schwedt: "The essential guide to environmental chemistry" and option c based on the handout "Ympäristö luonnontiede".

However the issues and reading materials are overlapping, so pick the option of each task that you think you can answer the best. You may answer very well some questions or problems in spite of the reading materials above you have chosen.

Answer in English, Finnish or Swedish.

Task 1

- a) Compare the control technologies of nitrogen and phosphorus (nutrients) discharges from the chemical or biochemical point of view.
- b) Compare the nitrogen and phosphorus cycles
- c) Compare the atmospheric chemistry of nitrogen and sulfur.

Task 2

- a) A composting facility smells bad and the smoke of a waste incinerator is black. Explain the reasons of this kind of poor performance and give technical solutions to these problems.
- b) The behavior of heavy metals in bodies of water.
- c) The most common mode of aerosol particle diameter in the atmosphere is around $1\mu\text{m}$. Why is that? Why particles of that size are also most difficult to separate from flue gases.

Task 3

- a) Compare the problem of representativeness (edustavuus in Finnish) of samples when taking samples from soil, urban air or lake water.
- b) Compare air quality in winter time in areas, where air is heavily contaminated by emissions from coal burning, to air quality in sunny summer time in areas, where lot of automotive exhausts are.
- c) Oceans and the climate change.