Exercise L3: Introduction to stoichiometric calculations

ETH Zurich Course 701-0426-00L: Modelling Aquatic Ecosystems (Schuwirth/Reichert)

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Goals:

• Understand the concepts of stoichiometric calculations introduced in section 4.3.
• Be able to do simple stoichiometric calculations based on the chemical substance notation (with specified elemental mass fractions; section 4.3.1) and with parameterized elemental mass fractions (section 4.3.2).

Task 1: Stoichiometric calculations with given elemental composition

Derive the stoichiometry of the process “growth of algae with ammonium as the nitrogen source” assuming Redfield elemental composition of algae (see equation 4.33 for the Redfield composition). Do this by redoing the calculation leading to equation 4.35 (“growth of algae with nitrate as the nitrogen source”) with replacing $\text{NO}_3^-$ by $\text{NH}_4^+$.

Task 2: Stoichiometric calculations with parameterized elemental mass fractions

Derive the stoichiometry of the process “growth of algae with ammonium as the nitrogen source” assuming an arbitrary composition of algal biomass considering the mass fractions $\alpha_C$, $\alpha_H$, $\alpha_O$, $\alpha_N$, and $\alpha_P$ of the elements C, H, O, N and P.