

Introduction to sustainable chemistry 2026

Main field: Sustainable Chemistry
Course code: KZ7012

Tentative Lecture and seminar schedule for HT 2026:

Period: HT 2026, period A; Monday, August 31 until Wednesday, September 30.

Week 1 (August 31-September 4)

1. ***Introduction to the course and general concepts; August 31, 9.15-12, C516***
Introduction to the course, including the lecture and seminar schedule, course material, requirements and examination. Why is sustainable chemistry important: historical outlook and personal reflections? Definitions of sustainable chemistry concepts and systems thinking used in research and industrial practice. **Lennart Bergström**
2. ***Green and sustainable chemistry, September 1, 9.15-12, C516***
Overview of the fields of green, circular, environmental and sustainable chemistry. Introduction to the UN Sustainability development goals Examples of how environmental problems created by chemical activities can be mitigated or eliminated by the combination of legislation, technical development and changes in consumer choices.
Lennart Bergström
3. ***Green chemistry principles, September 2, 9.15-12, C516***
In depth description of the 12 principles of green chemistry with examples. Introduction of how hazard, risk, and life cycle assessments are performed, including both environmental and health aspects. Examples of sustainability assessments of industrial activities.
Lennart Bergström
4. ***Anthropogenic global warming and the role of chemistry; September 3, 9.15-12, C516***
Overview of anthropogenic causes of climate change and global warming and main sources of anthropogenic greenhouse gases and the sectors that contribute the most. Identify and outline underlying chemical processes for important greenhouse gas emissions and carbon sinks. Describe in detail the carbon footprint of important industrial activities, including cement and concrete, iron and steel, the chemical industry. Present and discuss various mitigation strategies for CO₂.
Lennart Bergström
5. ***Planetary boundaries and systems thinking; September 4, 9.15-11, C516***
Overview of the concept of planetary boundaries and a description of the nine boundaries. In depth description of the triple planetary crisis. The importance of chemistry to selected planetary boundaries, including novel entities.

Week 2 (September 7-11)

6. ***Renewable resources; September 8, 9.15-12, C516***
Overview of renewable resources, materials and bio-refineries with identification of important drivers and challenges.
Jiayin Yuan
7. ***Sustainable chemistry for renewable energy; September 9, 9.15-12, C516***

Introduce how chemistry can enable new technologies to replace fossil fuels for energy production.

Jiayin Yuan

8. ***Life cycle assessment 1: Introduction to standardization of environmental sustainability; September 10, 9.15-12, C516***

Historic background to the development of environmental sustainability. The role of EU framework programs and European action programs. The progression of environmental sustainability from only legislation to becoming a competitive advantage for an organization. Introduction for the need of standardization within sustainability to avoid green washing and how a standard is built up.

Joseph Samec

9. ***Life cycle assessment 2: Environmental management systems; September 11, 9.15-12, C516***

An overview over standards in environmental sustainability within the ISO14000 series. How the environmental management system standard(s) ISO14001/4 is built up, the PDCA cycle and the focus of making environmental sustainability a competitive advantage for an organization. The need for a measurable tool to evaluate the environmental sustainability in an organization: LCA. An introduction to the LCA standard ISO14040/4.

Joseph Samec

Week 3 (September 14-18)

10. ***Life cycle assessment 3: Goal and Scope definition September 14, 9.15-12, C516***

The goal and scope definitions are fundamental to LCA and include the following aspects: The reasons for carrying the study; limitations with the study; the audience and commissioner; decision contexts. The system boundaries include the function, reference flow and the functional unit; reference and elementary flows. The scope of what to include and exclude in the study. Multifunctional aspects of a system: how to divide burdens between products.

Joseph Samec

11. ***Circular economy and bioeconomy; September 15, 9.15-12, C516***

Presentation of the current linear economy production mode and introduction of the circular economy concept and the bioeconomy concepts. History of circular economy, examples of current and potential circular economy products and value chains. Description of the main challenges to the transformation to a circular economy: Circular Economy in the EU, and future of circular economy. Introduction of the forest industrial processes and products including the biorefinery concept and examples of potential lignocellulose-based products.

Lennart Bergström

12. ***Life cycle assessment 4: (Inventory analysis and Impact assessment) September 16, 9.15-12, C516***

Life cycle inventory (LCI), mass- and energy balances of the reference flow to fulfill the functional unit. Data quality: primary and secondary data. Normalizing reference flow to the functional unit. How to treat multifunctional aspects and recycling. Life cycle impact assessment (LCIA): how the reference flow result in elementary flows that affect the environment in selected impact categories such as climate change. Midpoint and endpoint categories and areas of protection. Interpretation will be covered.

Joseph Samec

Sustainable chemistry seminar 1 (safe and sustainable by design): September 16, 13:30-16:30 C516

Lennart Bergström

LCA seminar 1: September 17, 13-16, C516

Joseph Samec

LCA seminar 2: *September 18, 13-16, C516*
Joseph Samec

Week 4 (September 21-25)

13. *Review and Q&A. September 21, 9.15-11, C516*

Presentation of the recent EU Chemical strategy and the concept of Safe and Sustainable by design. Summary of previous lectures with possibility for questions and answers.

Lennart Bergström

Sustainable Chemistry seminar 2 (focus on mitigation of GHG emissions): *September 25 9:00-12:00, C516*

Lennart Bergström

Self-study: *September 22, 23 and 24*

Week 5 (September 28-30)

Self-study: *September 28-29*

Examination: *Written exam: Wednesday, September 30: 9:00-14:00, C516*

Contact:

Examiner and course responsible:

Lennart Bergström

Phone: +46-70-5179991

Email: lennart.bergstrom@mmk.su.se

Course assistant:

Baltzar Stevensson

Phone: +46733781473

E-mail: baltzar.stevensson@mmk.su.se

Registration:

Chemistry section & Students affairs office: Chemical practice laboratory M345

Email: chemistry@su.se