

Organic Chemistry 1: Structure and Reactivity (O000082)

Course size (nominal values; actual values may depend on programme)
Credits 5.0 Study time 150 h Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2019-2020

Offering	Language	Teaching Method	Hours
A (semester 1)	English	lecture: plenary	12.0 h
		exercises	
		seminar: coached	8.0 h
		exercises	
		lecture	24.0 h
		practicum	16.0 h

Lecturers in academic year 2019-2020

Heynderickx, Philippe KR01 lecturer-in-charge

Offered in the following programmes in 2019-2020

Programme	crdts	offering
Bachelor of Science in Environmental Technology	5	A
Bachelor of Science in Food Technology	5	A
Bachelor of Science in Molecular Biotechnology	5	A
Joint Section Bachelor of Science in Environmental Technology, Food Technology and Molecular Biotechnology	5	A

Teaching languages

English

Keywords

Organic chemistry, classes of compounds - alkanes, alkenes, alkynes, alcohols, ethers, aldehydes and ketones, carboxylic acids), aromatic compounds (5- and 6-rings), nomenclature, separation and identification techniques, addition reactions, substitutions reactions, stereoisomerism, chemical reactivity

Position of the course

After a short introduction to the relevance of organic chemistry and its daily applications the necessary terminology on chemical bonding is given. The nomenclature of the most conventional organic molecules is given with attention to their physical and chemical properties. Next, the molecular structure of carbon bonds and isomerism phenomena are discussed. The central part of the course comprises the enumeration of typical compounds classes such as alkanes, cycloalkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers and epoxides, aldehydes and ketones, carboxylic acids and derivatives, amines quaternary ammonium compounds and heterocyclic compounds. Occasionally, different mechanisms of chemical reactions, which are linked to functional groups, are explained, e.g. Fisher esterification reaction. Electrophilic addition reactions and electrophilic aromatic substitution reactions are studied as well as the basics of nucleophilic substitution reactions, S_N1 and S_N2 , and elimination reactions E1 and E2

Contents

- Theory:
 - Introduction
 - Terminology (orbitals, bonding, Lewis structure, resonance, ...)
 - Reactive intermediates (carbocation, carbanion, radical, ...)
 - Nomenclature, structure and physical and chemical properties (alkanes, cycloalkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers and epoxides, aldehydes and ketones, carboxylic acids and derivatives, amines quaternary ammonium compounds, heterocyclic compounds,
 - Stereoisomerism and chirality, conformations of alkanes

- Alkenes and alkynes: reactions (addition reactions, Markovnikov, hydroboration)
- Aromatic compounds (electrophilic substitution reactions in five- and six-membered rings)
- Substitution and elimination reactions (S_N1 and S_N2 ; E1 and E2)

2. Practical sessions:

- Theoretical exercises
- Theoretical introduction to safety and toxicology
- Theoretical explanation of the different experiments (reactions, mechanisms, safety)
- Theoretical introduction into chemical identification methods (NMR, IR, MS, UV)
- Extraction of chlorophyll from grass (separation technique)
- Distillation of alcohol from wine (separation technique)
- Synthesis of adipic acid (dicarboxylic acid)
- Synthesis of methyl-m-nitrobenzoate

Initial competences

Secondary school (high school) chemistry

Final competences

1 Knowledge

Concepts: nomenclature, molecular structure of C bonds, electrophilic addition reactions, electrophilic aromatic substitution reactions, nucleophilic substitution reactions, elimination reactions, stability of organic compounds, acid and bases.

2 Insights: relevant link between organic chemistry and every day's life and agrochemical life, detailed notion in organic molecules, with their elements, bonds, steric structure, stability, mutual interaction; elaboration of reaction mechanisms; interpretation of physical and chemical properties of functional groups; good knowledge of chemical reactivity.

3 Skills and methods: experience in organic chemistry laboratory, handling of organic compounds (safety), knowledge of safety principles, performing simple experiments and purification methods.

Conditions for credit contract

Access to this course unit via a credit contract is unrestricted: the student takes into consideration the conditions mentioned in 'Starting Competences'

Conditions for exam contract

Access to this course unit via an exam contract is unrestricted

Teaching methods

Lecture, practicum, self-reliant study activities, lecture: plenary exercises, seminar: coached exercises

Learning materials and price

Course notes (theory and exercises) and slides are available on Minerva platform

References

Dewick P. M. *Essentials of Organic Chemistry*. John Wiley & Sons.
 Hart H., Hadad C. M., Craine L. E., Hart D. J. *Organic Chemistry, A Short Course, 13th edition*. Houghton Mifflin Company.
 Solomons T. W., Fryhle C. B., Snyder S. A. *Organic Chemistry, 11th edition*. Wiley.
 Wade L. G. *Organic Chemistry, 8th edition*. Prentice Hall.
 Syllabus 'Organic Chemistry I and II' by Prof. Dr. ir. Heynderickx and the references within.

Course content-related study coaching

Professor and assistants have office hours to give a possibility for extra input/explanation/... after the scheduled course hours.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, written examination with multiple choice questions

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, written examination with multiple choice questions

Examination methods in case of permanent evaluation

Participation, assignment

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

During the first and second examination period, the periodic evaluation accounts for 50% (10/20) for the final score. The non-periodic evaluation takes up 50% (10/20). This non-periodic evaluation consists of 5% for presence and attitude (participation) during lectures and lectures for plenary exercises and coached exercises, 25% for pop-up quizzes during exercise classes, and for 20% on laboratory reports (assignment) to be made during the laboratory exercises (Practical + Group work). No telephones are allowed during classes.

A pop-up quiz is organized every exercise session and covers the previous theory classes (until previous pop-up quiz). All pop-up quizzes are scored onto 20 pts, the weighting factor is the number of theory classes, prior to the pop-up quiz, and the weighted total sum is reduced to 5 points for the final result (maximally 5/20).

All laboratory practical session reports have to be delivered to the assistant at the end of the session (unless differently announced) and they are scored onto 20 pts; the total is reduced to 4 points for the final result (maximally 4/20). The practical sessions are mandatory to attend.

If students are legally absent for a pop-up quiz due to sickness, the pop-up quiz has to be retaken during a later moment (a subsequent exercise class or during break of theory class) or during the catch-up activity week (week 13 in the semester) if a student is not present in week 12. Legal absence is justified by legal documents (doctor's note, Korean Army note...), handed in to GUGC Academic Affairs. In any other cases, the session will be scored as 0/20.

If students are legally absent for laboratory practical sessions due to sickness, practical session (or a replacing session) has to be taken during the catch-up activity week (week 13 in the semester). Legal absence is justified by legal documents (doctor's note, Korean Army note...), handed in to GUGC Academic Affairs. In any other cases, the session will be scored as 0/20.

The written examination (maximally 10/20) exists of a part open questions (maximally 8/20) and multiple choice questions (maximally 2/20).

If different courses collide in the teaching schedule for non-model trajectory students, the course from the year in which the student is enrolled has priority and no special (re) arrangements are made for this student.

Student can be granted an exemption for the practical sessions (for maximally 4/20), if they passed them the academic year before (at least 2/4). This exemption only reflects the practical laboratory sessions; the pop-up quizzes are not part of this, i.e., these have to be redone in the current academic year.

To qualify for passing, (1) both the score of the practical session needs to be higher than 2/4 and (2) the total score (= summation of the score for periodic evaluation, maximal 10 pts, laboratory reports, maximal 4 pts, and the participation and pop-up quizzes, maximal 5 pts, and score for participation) needs to be at least 10/20.

Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.

During the second examination period, the non-periodic evaluation (maximal 10 pts) cannot be retaken.

Calculation of the examination mark

5% participation (presence, attitude)

25% pop-up quizzes

20% laboratory reports (assignment)

50% written exam with open questions (maximal 8 pts) and written exam with multiple choice questions (maximal 2 pts)