CH276-15 Organic Synthesis and Reactivity

24/25

Department
Chemistry
Level
Undergraduate Level 2
Module leader
Martin Wills
Credit value
15
Module duration
10 weeks
Assessment
20% coursework, 80% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module builds on core concepts covered in Year 1 to understand more advanced organic reactions, expanding the synthetic and mechanistic chemistry toolbox and enabling basic design principles, based on retrosynthetic analysis, for the synthesis of simple organic molecules to be understood.

Module web page

Module aims

By the end of the module students should be able to use their knowledge to devise syntheses of simple and intermediate-level organic molecules.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

The module is split into a number of topics:
Aromatic and heterocyclic chemistry
Palladium catalysed couplings
Alkene chemistry
Oxidations and reductions
Conformational analysis
Carbonyl and enolate chemistry
Elimination reactions
Physical organic chemistry
Included will also be simple retrosynthesis and synthetic strategies, and industrial applications.

Learning outcomes

By the end of the module, students should be able to:

- Reflect on the organic chemistry encountered in year 1 from the point of view of retrosynthesis (a disconnections approach)
- Understand the reactions, including regiochemistry, in the reaction of aromatic and heteroaromatic rings.
- Understand the mechanisms and applications of palladium catalysed coupling reactions (e.g. Suzuki, Heck, Buchwald-Hartwig).
- Understand how to make cis- and trans-alkenes selectively, and how they react diastereoselectively, including Diels-Alder reactions and ozonolysis.
- Understand oxidation level and how to interconvert carbonyl compounds selectively via oxidation and reduction.
- Predict and understand the oxidation and reduction reactions of other functional groups such as alkenes.
- Be able to draw simple linear, branched and small ring alkanes using three-dimensional representations such as Newman projections and chair drawings.
- Understand factors controlling the relative energies of molecule conformations using these representations.
- Understand and predict the relative reactivity of carbonyl compounds and how they can react selectively depending on reaction conditions.
- Understand regio- and stereoselectivity in enolate formation and how they react stereoselectivity in both alkylation and aldol reactions.
- Understand the mechanistic differences in E1, E2, and E1cb reactions, including what factors determine which mechanism applies, and explain and predict the regio- and stereochemical outcome of these reactions.
- Understand the basis and uses of simple kinetic isotope effects and free energy relationships and understand how the results of these experiments can be used in determining reaction mechanisms.
- Develop simple strategies, via disconnections and retrosynthesis analysis for the synthesis of functional organic molecules.

Indicative reading list

Organic Chemistry J. Clayden, N. Greeves, S. Warren, OUP, 2012 2nd Edn [CGWW]. Further

Reading
Mechanism in Organic Chemistry R. W. Alder, R. Baker, J. M. Brown Wiley, 1971. QD 1722.A5.
The search for organic reaction pathways P. Sykes Longman, 1972.
Advanced Organic Chemistry, J. March, 4th Edn., Wiley, 1992, QD 1722.M2.

Research element

Team project in groups of 5-6 students, designing a theoretical synthetic approach to a target molecule.

Subject specific skills

Problem solving
Teamwork
Organisation
Time management

Transferable skills

Problem solving
Teamwork
Organisation
Time management

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Tutorials	3 sessions of 1 hour (2%)
Practical classes	3 sessions of 1 hour (2%)
Private study	84 hours (56%)
Assessment	30 hours (20%)
Total	150 hours

Private study description

N/A

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D

	Weighting	Study time	Eligible for self-certification
Assessment component			
Retrosynthetic and synthetic route planning	20%	30 hours	Yes (extension)

Team project in the area of molecular disconnection, retrosynthesis and literature synthetic precedent. The assessment is based on a written team report, along with personal and team self-analysis and appraisal.

Reassessment component			
Retrosynthetic and synthetic route planning			Yes (extension)

Individual project in the area of molecular disconnection, retrosynthesis and literature synthetic precedent'

Assessment component			
Examination	80%		No

- Answerbook Green (8 page)
- Students may use a calculator
- Periodic Tables

Reassessment component is the same

Feedback on assessment

Feedback on assessed work provided via Moodle. Cohort level examination feedback will be provided after the June examination period.

Past exam papers for CH276

Availability

Courses

This module is Core for:

- UCHA-4 Undergraduate Chemistry (with Intercalated Year) Variants
  - Year 2 of F101 Chemistry (with Intercalated Year)
  - Year 2 of F122 Chemistry with Medicinal Chemistry (with Intercalated Year)
- UCHA-3 Undergraduate Chemistry 3 Year Variants
  - Year 2 of F100 Chemistry
  - Year 2 of F121 Chemistry with Medicinal Chemistry
- UCHA-F110 Undergraduate Master of Chemistry (with Industrial Placement)
  - Year 2 of F100 Chemistry
  - Year 2 of F110 MChem Chemistry (with Industrial Placement)
  - Year 2 of F112 MChem Chemistry with Medicinal Chemistry with Industrial Placement
- Year 2 of UCHA-F107 Undergraduate Master of Chemistry (with Intercalated Year)
- UCHA-F109 Undergraduate Master of Chemistry (with International Placement)
  - Year 2 of F109 MChem Chemistry (with International Placement)
  - Year 2 of F111 MChem Chemistry with Medicinal Chemistry (with International Placement)
- UCHA-4M Undergraduate Master of Chemistry Variants
  - Year 2 of F100 Chemistry
  - Year 2 of F105 Chemistry
  - Year 2 of F110 MChem Chemistry (with Industrial Placement)
  - Year 2 of F109 MChem Chemistry (with International Placement)
  - Year 2 of F125 MChem Chemistry with Medicinal Chemistry
- Year 2 of UCHA-F127 Undergraduate Master of Chemistry with Medicinal Chemistry(with Intercalated Year)