CH167-15 Carbon and the Chemistry of Life

24/25

Department
Chemistry
Level
Undergraduate Level 1
Module leader
Mark Greenhalgh
Credit value
15
Module duration
10 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

A module focused on the fundamentals of the chemistry of carbon and how it applies to chemical biology as part of the chemistry of life.

Module web page

Module aims

To build on the fundamental knowledge acquired from the Term 1 modules to apply concepts to basic organic and biological chemistry.
The module builds on the fundamental knowledge acquired from the previous chemistry modules, specifically in terms of chemical bonding, structure, reactivity, mechanism and the names of simple functional groups. New concepts within the module apply an understanding of organic chemistry to the synthesis and chemistry of a variety of functional groups, how this can be monitored by key analytical techniques and how this applies in a biological context as part of the chemistry of life.
The content of this module will be assumed in ALL subsequent Chemistry modules. It provides all entering first year students with a common foundational knowledge of organic chemistry. This will

be achieved by a range of teaching methods, including lectures, tutorials, workshops, in-class problems and directed reading. The majority of the module content is drawn from components of A-level syllabuses. As such, most students will already be familiar with some aspects of the module syllabus, but the pattern of familiarity will be heterogeneous across the class. The primary aim of this, and the other Year 1 chemistry modules, is to equip all students with the necessary fundamental knowledge and skills to succeed in their chemistry degree at Warwick.

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.

Topic A: Organic structure, conformation and configuration

- Building on the fundamentals covered in the first Term module to discuss:
  - Drawing and naming organic molecules
  - Hybridisation
  - Bond rotation
  - Cations and anions
  - Hyperconjugation and conjugation
  - pKa
  - Stereochemistry (chirality, CIP rules, relative/absolute, achiral diastereoisomers, polarimetry)
  - Biological examples to illustrate and practice

Topic B: Drawing organic reaction mechanisms

- Curly arrows
- Identifying nucleophiles and electrophiles
- Basic mechanistic principles to guide the proposal of reaction mechanisms

Topic C: Substitution and elimination reactions

- Substitution reactions (SN1, SN2)
- Elimination reactions (E1, E2)

Topic D: Carbonyl chemistry

- The chemistry of aldehyde/ketone derivatives
- The chemistry of carboxylic acid derivatives
- Keto-enol tautomerisation
- The chemistry of enols and enolates
- Biological examples to highlight the concepts - amide bonds and enzyme catalysis, lipids and fatty acids

Topic E: The chemistry of carbon-carbon π-bonds

- Electrophilic addition to alkenes and alkynes
- Building on the fundamentals of aromaticity discussed in Module 1

- Electrophilic aromatic substitution (including regioselectivity)

Topic F: Analytical chemistry for synthesis

- Building on A-level principles, and those provided in CH155 spectroscopy lectures. Focussing on how key analytical methods (IR, mass spec, 1D NMR, polarimetry, etc.) can be used to determine the outcome of organic reactions.

Topic G: The fundamentals of chemical biology and the chemistry of life

- To include how Nature performs organic reactions, including those involving amino acids, peptides, lipids, polyketides, terpenes, steroids, oxidations and reductions.

Learning outcomes

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

- Be able to demonstrate an understanding and awareness of different reactions in organic chemistry and why & how they take place.
- Be able to demonstrate an understanding of the structure, shape, properties and reactivity of organic molecules including their acidity, mechanisms and reactions.
- Have a basic understanding of mechanisms and their stereochemical consequences of nucleophilic substitution, elimination, electrophilic additions/substitutions, oxidations and reductions.
- Have a basic understanding of mechanisms of carbonyl and enolate chemistry.
- Be able to use their knowledge of general mechanisms and reactivity to postulate mechanisms of organic reactions using curly arrows.
- Be able to use their knowledge to be able to design short syntheses of organic molecules.
- Have an appreciation for the links between structure, reactivity, synthesis and physical properties of core biological molecules (lipids, amino acids, proteins, etc) and fundamental organic chemistry concepts in the module.
- Be able to appraise the outcome of a reaction based on spectroscopic analysis (focussing on IR, 1D NMR, mass spec and polarimetry).

Indicative reading list

Essential Text (required):

- Clayden, Greeves and Warren, Organic Chemistry, Oxford, second edition 2012
  Advised texts (recommended but not required):
- Chemistry3: introducing inorganic, organic and physical chemistry, Burrows, Holman, Parsons, Pilling, Price
- Chemistry of the Carbonyl Group: A Step-by-Step Approach to Understanding Organic Reaction Mechanisms, Warren, Dickens

Interdisciplinary

Spans the boundary between chemistry and biochemistry

Subject specific skills

Problem-solving

Transferable skills

Problem-solving, use of technology and software, teamwork

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Tutorials	3 sessions of 1 hour (2%)
Work-based learning	3 sessions of 1 hour (2%)
Other activity	6 hours (4%)
Private study	108 hours (72%)
Total	150 hours

Private study description

N/A

Other activity description

Three two-hour revision sessions in Term 3

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B1

	Weighting	Study time	Eligible for self-certification
Written exam	100%		No

- Answerbook Pink (12 page)
- Students may use a calculator
- Periodic Tables

Feedback on assessment

Cohort level examination feedback provided via Moodle following the Exam Board.

Past exam papers for CH167

Availability

Courses

This module is Core for:

- UCHA-4 Undergraduate Chemistry (with Intercalated Year) Variants
  - Year 1 of F101 Chemistry (with Intercalated Year)
  - Year 1 of F122 Chemistry with Medicinal Chemistry (with Intercalated Year)
- UCHA-3 Undergraduate Chemistry 3 Year Variants
  - Year 1 of F100 Chemistry
  - Year 1 of F121 Chemistry with Medicinal Chemistry
- UCHA-F110 Undergraduate Master of Chemistry (with Industrial Placement)
  - Year 1 of F100 Chemistry
  - Year 1 of F110 MChem Chemistry (with Industrial Placement)
  - Year 1 of F112 MChem Chemistry with Medicinal Chemistry with Industrial Placement
- Year 1 of UCHA-F107 Undergraduate Master of Chemistry (with Intercalated Year)
- UCHA-F109 Undergraduate Master of Chemistry (with International Placement)
  - Year 1 of F109 MChem Chemistry (with International Placement)
  - Year 1 of F111 MChem Chemistry with Medicinal Chemistry (with International Placement)
- UCHA-4M Undergraduate Master of Chemistry Variants
  - Year 1 of F100 Chemistry
  - Year 1 of F105 Chemistry
  - Year 1 of F110 MChem Chemistry (with Industrial Placement)
  - Year 1 of F109 MChem Chemistry (with International Placement)
  - Year 1 of F125 MChem Chemistry with Medicinal Chemistry
- Year 1 of UCHA-F127 Undergraduate Master of Chemistry with Medicinal Chemistry(with Intercalated Year)