

Course Package

Molecules & Materials – Q3

Name module	Molecules & Materials - Q3 (second-year BSc module)
Course Code	202000740
Educational programme	BSc Chemical Science and Engineering
Period	First Quartile of the second semester - Q3
Study load	15 EC
Coordinator	Jéré van Lente

Molecules & Materials			
Quartile 1	Quartile 2	Quartile 3	Quartile 4
		Characterization of Molecules& Materials Chemistry (incl. Lab course) 202100250 (4 EC)	
		Interface Science 202300163 (3 EC)	
		Organic & Bio-organic Chemistry (incl. Lab course) 202100249 (8 EC)	

Required preliminary knowledge: Basic Organic Chemistry; Basic lab skills; Calculus.

Note: this module has limited capacity. In case of much interest, students will be selected.

Please note, you need to register for the courses in Osiris 2 weeks before the start of the block!

202100250 - Characterization of Molecules& Materials Chemistry incl. Lab course

The theory course will deepen the knowledge on characterization techniques from M1 (particularly NMR), and extend to other methods, like Raman spectroscopy, chromatography, and MS, but also to physicochemical techniques for surfaces and small particles like streaming potential, dynamic light scattering, zeta potential, contact angle, and possibly others. Some of the latter techniques are commonly employed in colloid chemistry, another course that is being taught in M7.

The practicum will consist of a number of 1-afternoon experiments in which these characterization techniques are illustrated.

202300163 - Interface Science

A first glance of how molecules influence the interfaces between fluids and solids is given from a more

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physical-chemical perspective and draws a link between the physical properties of interfaces and colloidal systems, the underlying physical laws and how molecules can modify those interfaces. A link with the necessary mathematics for describing the physical properties will be drawn in a case, using Matlab.

202100249 - Organic & Bio-organic Chemistry incl. Lab course

Content Organic and Bio-organic Chemistry

The objective of this subject is to provide a broad and practical understanding of the reactivity of organic compounds based on various functional

groups, in particular the functionalities at play in biomolecules such as proteins and nucleic acids.

This course builds on the Organic Chemistry segment in Quarter 1 of the Chemical Science & Engineering bachelor.

Subject Content

1. Reactions of alkenes and alkynes (repetition from CSE M1).
2. Substitution reactions and elimination reactions of alkyl halides (repetition from CSE M1).
3. Aromaticity. Benzene and substituted benzene reactions (repetition from CSE M1).
4. Radicals.
5. Carbonyl compounds I. Nucleophilic acyl substitution.
6. Carbonyl compounds II. Aldehyde and ketone reactions.
7. Carbonyl compounds III. Carbon reactions.
8. Reactions of alcohols, amines, ethers and epoxides. Organometallic compounds.
9. Amines, Heterocyclic compounds.
10. Chemistry of sugars
11. Chemistry of amino acids, peptides and proteins
12. Catalysis
13. Chemistry of nucleic acids.

Approximately 25% of the aforementioned subject matter has already been addressed in Organic Chemistry in Quarter 1. This subject matter will now be refreshed and expanded upon.

Teaching methods: lectures, tutorial and online tools. Given the limited number of lecture hours, it is not possible to discuss all the subject matter in its entirety and in detail during the lecture. It is highly recommended to try the assignments at home in advance so that any problems that may have emerged can be addressed during the tutorial.

Content Lab Course

The practical consists of three individual assignments aligned with the lecture.

It involves a condensation reaction (carbonyl compounds), an electrophilic aromatic substitution reaction, and an enzymatically catalyzed reaction.

Each assignment involves the synthesis and purification of a compound as well as analysis of the structure and purity of the product obtained using one or more of the following techniques: ^1H NMR and IR spectroscopy, UV-Vis spectrophotometry and mass spectrometry. Procedures

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and a brief theoretical background of the synthesis can be found on Canvas.

The first practical day begins with a brief (fire) safety instruction. More elaborate instructions and general laboratory technology instructions have already been provided in Q1.

Practical work preparations entail studying (understanding) and elaborating the instructions, completing the hazardous substances information chart and requesting chemicals (and glassware). All of this must be discussed in a preliminary meeting with the assistant.

The reporting element comprises the drafting of a report, using a standard form, of two experiments and a report of the second or third experiment. In addition to the theoretical background, the report must pay enough attention to evaluation of the practical work, both in terms of synthesis and analysis.