

5.00 credits

30.0 h + 47.5 h

Q2

Teacher(s)	Singleton Michael ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	Notions of organic chemistry, carbon and nitrogen chemistry as targeted by LCHM1141 and LCHM1244. <i>The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.</i>
Main themes	<p>The course is divided into three major parts that complement the chemistry of carbon and nitrogen, topics covered in the first year [LCHM1141] and second year [LCHM1244, 1q] and include :</p> <ol style="list-style-type: none"> 1. the chemistry of phosphorus derivatives 2. the chemistry of sulfur and selenium derivatives 3. the chemistry of silyl derivatives <p>The first chapter will be devoted to the preparation and reactivity of compounds containing a phosphorus atom at various stages of oxidation. The synthesis of phosphines, phosphites, phosphonates and phosphine oxides will be described. The usefulness of these reagents will be illustrated by the reactions of Wittig, Horner-Emmons and Wittig-Horner (construction of C = C double bonds), the reaction of Arbuzov and Michaelis and the transformations of Mitsunobu, Mukaiyama, Appel and Grieco.</p> <p>For the second chapter, the chemical and physical properties of compounds containing one or two sulfur atoms will be presented. The synthesis of large families of sulfur compounds will be addressed through, in particular, the formation of thiols, sulfides, disulfides, sulfoxides and sulfones. The synthetic utility of these various classes of compounds will then be illustrated through large reactions, such as: C = C double bond formation (Julia and Jones-Trost removal), epoxidation (Corey-Chaykovski), substitution and cyclopropanation. The chemistry of the selenium analogues will be discussed in parallel.</p> <p>The last chapter will describe the fundamentals of the chemistry of silyl derivatives, their preparation and their advantages as protective groups of alcohol functions. The generation of silyl enol ethers will then be studied and the utility of these reagents illustrated by the preparation of kinetic and thermodynamic silyl enols and their transformations to enolates, alkylated products or corresponding aldol compounds. The aldol reaction of Mukaiyama will be examined. The preparation of vinylsilanes and allylsilanes will be described and the reactivity of these species presented. The concepts of kinetic reactivity and thermodynamic stability will be reviewed and various concepts, such as hyperconjugation, Hammond's postulate and Curtin-Hammett's principle discussed in detail. In each chapter, special attention will be devoted to the stereochemistry of the reactions presented.</p>
Learning outcomes	<p>At the end of this learning unit, the student is able to :</p> <p>In the continuity of first-year organic chemistry courses [LCHM1141] and second year [LCHM1244, 1q], particular emphasis will be placed on understanding new material through simple and illustrative examples. The new concepts will be placed in this context and will complement the knowledge previously learned. It is important to present this material in successive layers of increasing difficulty and to capitalize on the general knowledge acquired in previous courses.</p> <p>1 Particular attention will be devoted to learning the reaction mechanisms, to a fine analysis of the reactivity of the different species in presence and to the understanding of fundamental concepts such as stability and reactivity, dynamic equilibrium, selectivity and kinetics.</p> <p>With these achievements, the student should be able to offer relevant solutions to problems requiring a relatively fine knowledge of organic chemistry.</p>

Evaluation methods	<p>Practical training is an integral part of the teaching of organic chemistry and is an inseparable part of it. Participation in all practical sessions is therefore MANDATORY.</p> <p>Practical work (exit tests, output and purity of products, reports) takes place for 1/8 of the final grade.</p> <p>Any JUSTIFIED absence (justified by a medical certificate in the event of illness, or by an official document in other cases) will result in the simple cancellation of the laboratory session, without any subsequent catch-up session.</p> <p>Any NO JUSTIFIED absence will, in principle, be sanctioned by an NEGATIVE mark of 5 POINTS on the final mark, and may, depending on the degree of recidivism and the assessment of the situation by the teaching authorities, result in a mark of ZERO non-negotiable final out of 20.</p> <p>These terms and conditions are also valid for BIS students EXCEPT if they have obtained a grade of practical work equal to or greater than 10/20 (final grade), in which case they will be exempted.</p> <p>The final exam will take place for 7/8 of the final grade.</p> <p>It will only include a written test.</p>
Teaching methods	Lectures with note taking, blackboard lessons, workouts and labs
Content	<ol style="list-style-type: none"> 1. Phosphorus <ol style="list-style-type: none"> a. General properties and reactions b. Derivatives of P as nucleophiles <ol style="list-style-type: none"> i. With Halogens (R₃PX⁺) - Appel, Vilsmeier reaction ii. With other electrophiles - Arbuzov, Corey-Fuchs, Mitsunobu reaction c. Reaction of Wittig d. Horner-Wadsworth-Emmons reaction e. Corey-Winter reaction 2. Sulfur/Selenium <ol style="list-style-type: none"> a. General properties and reactions b. Thiols and Thioethers c. Sulfoxides (oxidations) d. Carbanions e. S vs Se 3. Silicon <ol style="list-style-type: none"> a. General properties and reactions b. Stabilization of carbocations/carbanions c. Si-heteroatom bonds (protective groups)
Inline resources	Essential course materials are all available on the Moodle platform : <ul style="list-style-type: none"> • Statements of exercises • Manual of practical work (laboratories)
Bibliography	Nicolas Rabasso « Chimie Organique : Hétéroéléments, stratégies de synthèse et chimie organométallique » de boeck, 2eme édition (ou 3eme)
Faculty or entity in charge	CHIM

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Bachelor in Chemistry	CHIM1BA	5	LCHM1111 AND LCHM1141	