האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

PRINCIPLES IN ORGANIC CHEMISTRY B - 71067

Last update 26-10-2015

HU Credits: 4

Degree/Cycle: 1st degree (Bachelor)

Responsible Department: biochemistry & food sciences

Academic year: 0

Semester: 2nd Semester

Teaching Languages: Hebrew

Campus: Rehovot

Course/Module Coordinator: Dr. Bilkis Itzhak

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Coordinator Office Hours: monday 15:00-17:00

Teaching Staff:

Dr. Bilkis Itzhak
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Ms. Tom Almog
Ms.

Course/Module description:

Kinetics of chemical reactions. One step and мultistep transformations. Rate limiting step. Classification of mechanisms. Nucleophilic substitution and elimination in alkyl halides and alcohls. Mechanisms Sn1, Sn2, E1 and E2. Stereospecificity of Sn2 and E2 reactions. Carbocations as key intermediates in Sn1 and E1 processes. Chemical properties of carbocations. Interaction of unsaturated compounds with electrophilic reagents. Nucleophilic addition to cabonylic compounds. Nucleophilic substitution in carboxylic acid derivatives. Carbanions. Organometallic compounds in organic synthesis. Aromatic compounds. Aromaticity. Electrophilic substitution in aromatic compounds.
Mechanism of free radical addition to unsaturated compounds. Relative stability of free radicals. Chemical properties of free radicals. Oxidation of organic compounds by molecular oxygen. Oxygen centered free radicals and their role in oxidation of organic compounds. Anti-oxidants.

Course/Module aims:

To introduce most important mechanisms of organic chemistry reactions.

Learning outcomes - On successful completion of this module, students should be able to:

Use kinetics as an instrument to elucidate reaction mechanism.
Describe the most important mechanisms in addition, elimination and substitution reactions in unsaturated organic compounds, alkyl halides, alcohols, carbonyl compounds and carboxylic acid derivatives.
Write a possible mechanism for an unknown transformation/
Explain Hammond postulate and evaluate the structure-reactivity relationships.
Establish structure of organic compound from spectral data (NMR, IR, UV-Vis, MS)

Attendance requirements(%):

100

Teaching arrangement and method of instruction: lectures, teaching laboratories and practice hours.

Course/Module Content:

10. Carbohydrates. Nomenclature. Stereochemistry and configurational notation of sugars. Cyclic hemiacetals. Anomerism. Mutarotation. Glycosides. Oxidation and reduction. Reducing sugars. Oligosaccharides. Polysaccharides.

11. Classification of organic reaction mechanisms. Nucleophilic substitution in alkyl halides. Mechanisms SN1 and SN2. Dependence of the reaction mechanism on the alkyl halide structure. SN2 mechanism: dependence of the reaction rates on the structure of the alkyl halide, nucleophilic reagent, and on the solvent polarity. SN2 as a stereospecific reaction. Solvolysis. SN1 mechanism: carbocations as key inter mediates, spatial structure of carbocations, their relative stability, rearrangements of carbocations. Dependence of the reaction rates on the structure of the alkyl halide, nucleophilic reagent, and on the solvent polarity. Racemization. Competition between SN1 and SN2 reactions.

12. Elimination in alkyl halides. Mechanisms E1 and E2. Dependence of the reaction mechanism and of the reaction rates on the alkyl halide structure, on the structure of the base, and on the solvent polarity. Saytseff rule. Competition between substitution(SN) and elimination(E) reactions.

13. Nucleophilic substitution and elimination in alcohols.

14. Mechanism of electrophilic addition to alkenes. Carbocations as key intermediates. Chemical properties of carbocations. Relative stability of carbocations and Markovnikov's rule. Specific features of bromine and chlorine addition in aqueous and non-aqueous solutions.

15. Alkynes.

16. Organometalic compounds.

17. Amines. Nomenclature. Physical properties. Preparation. Basicity. Nucleophilic reactions. Quaternary ammonium compounds.

18. Carboxylic acids Nomenclature. Physical properties. Preparation. Acidity. Nucleophilic substitution in carboxylic

acids. Esterification.
Nucleophilic substitution in derivatives of carboxylic acids (acyl halides, anhydrides,

esters, amides). Mechanism in acidic and basic
conditions. Natural occurrence of carboxylic
acids and their derivatives. Fats.
19. Aromatic compounds. Aromaticity. Nonbenzenoid aromatic compounds.
20. Electrophilic substitution in benzene: nitration, sulfonation, halogenation, alkylation
and acylation. Mechanism of the reactions.
Electrophilic substitution in mono- and
disubstituted benzenes.
21. Aromatic nucleophilic substitution. Brief survey of the mechanisms.
laboratory:
1.the use of spectralic methods (MS,IR,NMR) to detect organic compounds
2.The use of GC to detect an organic compound.
3.Detection of caffeine in black coffee, instant coffee, decaffeinated coffee, and black tea.
4.Nucleophilic substitution- SN1,SNAr,SN2, chemical kinetics- detection with spectrophotometer.

Required Reading:
1.Ervin Glotter. Introduction to organic chemistry (in Hebrew).
The Hebrew University of Jerusalem.
2.John McMurry.
Organic Chemistry, 7th edition, Thomson Learning Inc., 2008.

Additional Reading Material:
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Course/Module evaluation:
End of year written/oral examination 80 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 5 %
Reports 0 %
Research project 0 %
Quizzes 15 %
Other 0 %

Additional information:

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