AL-FARABI KAZAKH NATIONAL UNIVERSITY

Faculty of Chemistry and Chemical Technology

Department of chemistry and technology of organic matters, natural compounds and polymers

SYLLABUS

For the discipline of **Modern problems of organic chemistry** to the speciality "6M060600-Chemistry"

General information:

Faculty of Chemistry and Chemical Technology. Chair of chemistry and technology of organic matters, natural compounds and polymers

Name of program – Master program

Prerekvisits: Analysis of medical drugs on the basis of organic compounds using of new methods.

Information about lecture: Dr. Bates Kudaibergenova Malikovna – PhD

Dr.Bates Kudaibergenova Malikovna working with natural polymer composite. According to results have been published 40 publication and 3patents.

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Politics of course

- Activity during research work;
- Preparation for study.

Program of course

Characteristic of course: Study of modern problems of organic compounds. Use the modern physical and chemical methods obtained more significance for identification of complicated biological activity substances and materials. Using this methods can decide a problem of qualitative and quantitative analysis different synthetic and natural object.

The aim of course – Study of modern problems of organic chemistry using of new physical and chemical methods and creature of medical preparation in the wide spectrum of medical-biological purpose.

Interaction task – systematical approach of methods of analysis of organic substances.

Knowledge and ability after passing of course: The future specialists in study of this course have to know about modern state introduction of physical-chemical method. And they have to be able study of organic compound by the physical-chemical methods.

Methodology: Lecture, Seminar, Discussion and oral presentation.

Materials for obligatory learn: supplementary data

Materials for supplementary reading: supplementary data

Schedule of lectures

Week	Schedule of lectures	Lecture	Seminar	SWM
1.	**Lecture.** The current state of the theory of organic structure. Classification reactions and reagents. Basicity, nucleophilicity, electrophilicity, acidity. Electronic effects in organic molecules. Factors	**2**		**SWM-1.** Krebs cycle. The compounds with multiple chiral centers.

	determining the reactivity of the molecules. Resonance theory. **Practical exercises.** Modern ideas about the nature of chemical bonds. Hybridization of the carbon and nitrogen atoms. Electronegativity of atoms and groups.		**1**	
2.	**Lecture.** The properties of molecules and intermolecular forces. The theory of displacement of electron pairs. Inductive and mesomeric effects in static and dynamic systems. **Practical exercises.** Hyperconjugation as intermolecular σ, π-perturbation. Perturbation of molecular orbitals.	**2**	**1**	
3.	**Lecture.** The concept of the mechanism of organic reaction mechanism. The reaction mechanism of radical substitution. Alkyl radicals, the structure and the basic methods of generating. Detection and determination of the structure of free radicals. **Practical exercises.** Oxidation and reduction of free radicals. Chain mechanism and its key stages. Stable Radicals triphenylmethane series. Diradicals and their role in photochemical reactions.	**2**	**1**	**SWM -2.** The compounds with multiple chiral centers. Stereochemistry of heterocycles.
4.	**Lecture.** Nucleophilic substitution at saturated carbon atoms. Factors affecting the stability of carbocations, the explanation of the stabilizing effect of the substituents. **Practical exercises.** Nonclassical carbocations. Preparation of carbanions in solution (superbasic media). Factors affecting the stability of carbanions.	**2**	**1**	
5.	**Lecture.** Mechanisms SN1 and SN2. Experimental evidence. Factors affecting the mechanisms of nucleophilic substitution. Ion pairs in the process of unimolecular nucleophilic substitution. Stereochemistry. Border area. Theory of single-electron shift. Other SN-mechanisms. **Practical exercises.** Stereochemistry. The spatial	**2**	**1**	**SWM -3.** Conformational features of secondary cycles. The conformation of the macrocycles

	structure of organic molecules. Spatial interaction of unbound atoms and groups. The concept of molecular conformation. Conformation and configuration of the molecules.			
6.	**Lecture.** Elimination reaction (E1 E1sB, E2). Stereochemistry of E2-elimination. Orientation of the double bond in the elimination product. Competition elimination and substitution. **Practical exercises.** Transition state theory. Potential energy hypersurface, coordinate and energy profile of the reaction. Thermodynamic parameters of activation.	**2**	**1**	
7.	**Lecture.** Electrophilic substitution at saturated carbon atoms. The leaving group. Mechanism of electrophilic substitution. Nucleophilic assistance. Reactions of carbon acids. **Practical exercises.** Mechanisms SEi, SE1 (N).Trans effect. Reactions with heterolytic cleavage of the carbon-carbon bond.	**2**	**1**	**SWM -4.** Asymmetric synthesis and catalysis. The asymmetric reduction of the carbonyl group.
8.	**Lecture.** Types of mechanism of electrophilic aromatic substitution. Isomeric σ-complexes. Classification of substituents. Orientation as a reflection of the properties of σ-complex. **Practical exercises.** Orientation as a reflection of the properties of the original arena. π-donating substituents and the π-acceptor substituents. The ratio of ortho-and para-isomers.	**2**	**1**	
9.	**Lecture.** Nucleophilic aromatic substitution. Anionic σ-complexes in the reactions SNAr. Stabilising groups and nucleophiles. **Practical exercises.** Intramolecular 1.2 complexes. Rearrangement and intramolecular nucleophilic substitution. Photochemical reactions SNAr.	**2**	**1**	**SWM -5.** Asymmetric synthesis and catalysis. Asymmetric alkylation of the carbonyl group.
10.	**Lecture.** Oxidation □-complexes. Interaction □-complexes with electrophiles. Bartoli reaction.	**2**		

	Kinetics and tele-substitution. Vicarious nucleophilic substitution. Dimroth rearrangement type **Practical exercises.** Correlation equations, the principle of linearity of the Gibbs free energy. Hammett and Taft equation. Communication parameters of the correlation equations with the reaction mechanism.		**1**	
11.	**Lecture.** Cyclic reactions. General characteristics of pericyclic reactions. The theory of pericyclic reactions. The theory of electrocyclic reactions. Cycloaddition reactions. **Practical exercises.** Four-electron cycloaddition reactions. Electrocyclic reaction.	**2**	**1**	**SWM-6.** Reaction of amino acids in vivo. The biological role of esters.
12.	**Lecture.** Intramolecular rearrangements. Cyclic transition. **Practical exercises.** Aromaticity of the transition state. Diels-Alder reaction. Cycloaddition.	**2**	**1**	
13.	**Lecture.** Nucleophilic rearrangement to electron-carbon atom. Rearrangement of the Wagner-Meerveynai related processes. The rate of migration of different groups. **Practical exercises.** Nucleophilic rearrangement to electron nitrogen atom. Nucleophilic 1,2-rearrangement.	**2**	**1**	**SWM-7.** Synthesis of esters and ethers of monosaccharides. The oxidation of aldoses to aldonic acids, aldonic acids lactonization. Synthesis of monosaccharides by Kilian Fischer and degradation by Will-Ruff. Munoz as chiral synthons in the preparation of various biologically active substances (antibiotics, alkaloids, etc.).
14.	**Lecture.** Electrophilic rearrangement. Mechanism of electrophilic rearrangements. Single-electron shift in electrophilic rearrangements. Thermal radical rearrangement. **Practical exercises.** Rearrangement of Hoffmann.. Rearrangement of free radicals.	**2**	**1**	
15.	**Lecture.** Some new ideas about the mechanism of tautomeric transformations. Keto-enol	**2**		**SWM-8.** Solution of task

	tautomerism. Imine-enamine tautomerism. Tautomerism in diazole. **Practical exercises.** Tautomerism in pyridines and pyridones. Tautomerism in nucleic acids		**1**	

Information about estimate, explanation of requisite work for each estimate:

№	Type of course and work of students	Количество, %
1.	Assimilation of task on lecture	15
2	Carrying-out of task	15
3.	Results of self work of Master students	15
4.	Checking by discussion	15
	total	60
6.	Exam	40
	All:	100

Lecture _____Kudaibergenova B.M.
(signature)