SYLLABUS
Fall semester 2020-2021 academic years
on the educational program "8D07104-Chemical technology of inorganic substances"

Discipline's code	Discipline's title	Independent work of students (IWS)	No. of hours per week			Number of credits	Independent work of student with teacher (IWST)
			Lectures (L)	Practical training (PT)	Laboratory (Lab)		
NP 8303	Inorganic polymers	98	15	30	-	5	7

Academic course information

Form of education	Type of course	Types of lectures	Types of practical training	Number of IWS	Form of final control
Online	Elective/ Theoretical	Informational, lecture-conference	Seminar conference	4	Exam
Lecturer	Prof. Burkitbayev M.M., first vice-rector				
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Academic presentation of the course

Aim of course	Expected Learning Outcomes (LO) As a result of studying the discipline the undergraduate will be able to:	Indicators of LO achievement (ID) (for each LO at least 2 indicators)
Develop the ability to evaluate and optimize technologies for the synthesis of polymer materials based on phosphorus-containing compounds.	**LO 1** Explain the technology and methods of synthesis of inorganic polymers	**ID 1.1.** Demonstrate knowledge of the synthesis of inorganic polymeric compounds; **ID 1.2.** Know the main steps of the synthesis of inorganic polymeric compounds
	LO 2 Know the methods of Predicting and calculating conditions for preparation of inorganic polymers.	**ID 2.1.** Predict and calculate the necessary conditions for the synthesis of polymer compounds; **ID 2.2.** Create a simple scheme for the synthesis of a given inorganic polymer
	LO 3 Apply strategic analysis tools for choice raw materials for preparation of inorganic materials.	**ID 3.1.** Classify raw materials for production of inorganic polymeric compounds; **ID 3.2.** Evaluate mineral resources base of Kazakhstan for production of inorganic polymeric compounds
	LO 4 Form strategies for choice synthesis technology	**ID 4.1.** Justify the appropriateness of the chosen synthesis technology; **ID 4.2.** Be objective in analyzing the current situation of synthesis
	LO 5 Develop new methods of preparation of inorganic polymers	**ID 5.1.** Able to develop new technological schemes for obtaining inorganic nanomaterials **ID 5.1.** Make a financial calculation of developed technology.
Prerequisites	Theoretical foundations of inorganic chemistry; Inorganic chemistry; Mineral Raw Materials of Kazakhstan. Waste-free technology. Technology of inorganic acids, bases and salts	
Post requisites	Implementation of PhD thesis	
Information resources	Educational literature: 1.Charles E. Carraher, Jr. Introduction to polymer chemistry. CRC Press Taylor&Francis Group. 2013 2. V.W.Willison and L.Peck. Experiments in General Chemistry: Inquiry and Skill Building. Brooks/Cole (2009). 3.B.Stanton, L.Zhu, C.Atwood. Experiments in General Chemistry: Featuring Measurement. Brooks/Cole (2010). Internet resources: 1. Cuidi Li, Li Gao, Fangping Chen , Changsheng Liu Fabrication of mesoporous calcium silicate/calcium phosphate cement scaffolds with high mechanical strength by freeform fabrication system with micro-droplet jetting// Journal of Materials Science. November 2015, Volume 50, Issue 22, pp 7182-7191	

	2. Longgong Xia, Zhihong Liu, Pekka Antero Taskinen Experimental determination of the liquidus temperatures of the binary (SiO2–ZnO) system in equilibrium with air// Journal of the European Ceramic Society, Volume 35, Issue 14, November 2015, Pages 4005–4010 3. Chia-Tze Kao, Chi-Chang Lin, Yi-Wen Chen, Chia-Hung Yeh, Hsin-Yuan Fang,Ming-You Shie Poly(dopamine) coating of 3D printed poly(lactic acid) scaffolds for bone tissue engineering// Materials Science and Engineering: C, Volume 56, 1 November 2015, Pages 165–173 4. Ammar Z. Alshemary, Muhammed Akram, Yi-Fan Goh, Usman Tariq, Faheem K. Butt, Ahmad Abdolahi, Rafaqat Hussain Synthesis, characterization, in vitro bioactivity and antimicrobial activity of magnesium and nickel doped silicate hydroxyapatite// Ceramics International, Volume 41, Issue 9, Part B, November 2015, Pages 11886–11898 5. Wilaiwan Leenakul, Pratthana Intawin, Tawee Tunkasiri, Jetsada Ruangsuriya, Kamonpan Pengpat Preparation of ferrimagnetic BF based silicate glass system// Ceramics International, Volume 41, Supplement 1, July 2015, Pages S464– S470Mohammad, Faruq; Arfin, Tanvir; Al-Lohedan, Hamad A. Synthesis, Characterization and Applications of Ethyl Cellulose-Based Polymeric Calcium(II) Hydrogen Phosphate Composite// JOURNAL OF ELECTRONIC MATERIALS 47 (5): 2954-2963 DOI: 10.1007/s11664-018-6118-8
Academic policy of the course in the context of university moral and ethical values	**Academic Behavior Rules:** Compulsory attendance in the classroom, the impermissibility of late attendance. Without advance notice of absence and undue tardiness to the teacher is estimated at 0 points. Submission of assignments (Independent work of students, midterm control, laboratory tasks and etc.) prior to the deadlines. The violation of submission deadlines leads to the deduction of penalty points. The submitting of laboratory works is only 2 weeks after their implementation!!! **Academic values:** - Practical trainings/laboratories, IWS should be independent, creative. - Plagiarism, forgery, cheating at all stages of control are unacceptable. - Students with disabilities can receive counseling at e-mail Mukhambetkali.Burkitbayev@kaznu.kz, phone +7(727)221-11-23
Evaluation and attestation policy	**Criteria-based evaluation:** assessment of learning outcomes in relation to descriptors (verification of the formation of competencies in midterm control and exams). **Summative evaluation:** assessment of work activity in an audience (at a webinar); assessment of the completed task.

CALENDAR (SCHEDULE) THE IMPLEMENTATION OF THE COURSE CONTENT:

weeks	Topic name	LO	ID	amount of hours	Maximum score	Form of Knowledge Assessment	The Form of the lesson / platform
1	**L.1** Organic, organometallic and inorganic polymers.	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of normal consistency of cement paste.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
2	**L.1** The spread of inorganic polymers in nature. The differences between the HMC and inorganic polymers.	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of normal consistency of cement paste.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
3	**L.1** Homo chain inorganic polymers	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of setting time of cement.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
	IWSP 1 Consultation on the implementation of IWS1	LO 1	ID 1.1.	1			Offline
	IWS 1. Classification of polymer substances.	LO 2	ID 2.1.		10	Logic task	
4	**L.1** Hetero chain inorganic polymers.	LO 3	ID 3.1.	1			Offline
	PT 1 Determination of setting time of cement.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
5	**L.1** The polymeric compounds of elements of groups I and II of periodic system.	LO 4	ID 4.1.	1			Offline

	PT 1 Determination soundness of cement.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
	IWSP 2 Consultation on the implementation of IWS 2	LO 1	ID 1.1.	1			Offline
	IWS 2 Chemical bonding in polymer substances.	LO 4	ID 4.1.		15	Logic task	
	Make a structural and logical diagram of the read material	LO 1	ID 1.1.				
5	**MT 1**	LO 1	ID 1.1.		100		
6	**L.1** Polymeric compounds of elements of groups III and IV of the periodic system.	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of the mechanical properties of the cement. Bending strength	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
7	**L.1** Polymer compound V elements and VI, VII, VIII of the periodic system.	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of the mechanical properties of the cement. Bending strength	LO 5	ID 5.1.	2	15	Analysis, IW	Offline
8	**L.1** Polymer aluminum compound.	LO 1	ID 1.1.	1			Offline
	PT 1 Properties of gypsum. Determination of normal density of gypsum paste.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
	IWSP 3 Consultation on the implementation of IWS3	LO 1	ID 1.1.	1			Offline
	IWS 3 Silicates	LO 1	ID 1.1.		35	Logic task	
9	**L.1** Polycondensation reactions	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of free silicon in cement	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
10	**L.1** The polymeric silicon compound.	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of the free (ions) silicon in silica.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
	IWSP 4 Discussion of ISW 3	LO 1	ID 1.1.	1			Offline
	IWSP 5 Make a structural and logical diagram of the read material	LO 1	ID 1.1.	1			
10	**MT (Midterm Exam)**	LO 1	ID 1.1.		100		
11	**L.1** Oxysilicon acid.	LO 1	ID 1.1.	1			
	PT 1 Preparation of nitric acid: titrimetric determination of the reaction yield.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
12	**L.1** orthosilicic acid. Polycondensation of orthosilicic acid.	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of free aluminum (aluminum ions) in the clay.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
	IWSP 6 Consultation on the implementation of IWS4	LO 1	ID 1.1.	1			Offline
	IWS 4 Alumosilicates	LO 1	ID 1.1.		15	Problem task	
13	**L.1** The salts of orthosilicic acid (silicates).	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of free aluminum (aluminum ions) in the clay.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
14	**L.1** Aluminosilicate.	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of free aluminum (aluminum ions) in the clay.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline
15	**L.1** The high-temperature synthesis of aluminosilicates.	LO 1	ID 1.1.	1			Offline
	PT 1 Determination of free aluminum (aluminum ions) in the clay.	LO 1	ID 1.1.	2	15	Analysis, IW	Offline

	IWSP 7 Submission of ISW 1-4	LO 5	ID 5.1.	1	10	Problem task	Offline
	MT 2	LO 1	ID 1.1.		100		

[Abbreviations: QS - questions for self-examination; TK - typical tasks; IT - individual tasks; CW - control work; MT - midterm.

Comments:

- Form of L and PT: webinar in MS Teams / Zoom (presentation of video materials for 10-15 minutes, then its discussion / consolidation in the form of a discussion / problem solving / ...)
- Form of carrying out the CW: webinar (at the end of the course, the students pass screenshots of the work to the monitor, he/she sends them to the teacher) / test in the Moodle DLS.
- All course materials (L, QS, TK, IT, etc.) see here (see Literature and Resources, p. 6).
- Tasks for the next week open after each deadline.
- CW assignments are given by the teacher at the beginning of the webinar.]

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