SYLLABUS Fall semester 2026-2027 academic years on the educational program "7M05320 – Chemical physics"

Discipline's title	Indepen dent work of	Lectu					Number of		
	dent	res (L)	Practical to (PT)			raining Labor		t work of student with teacher (IWST)	
Chemical physics and kinetics		15		30		-	5	7	
Type of course	Academic course information Types of lectures Typ			_			Form of final control		
Practical	Review	, discussi	ion	S		CS	6	oral	
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				e cour					
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)					
chemical physics and kinetics, composition and characteristics of active centers, parameters of spectroscopy methods LO 2. determine the kinetic parameters of chemical physics processes LO 3. determine the composition and characteristics of free radicals and active centers LO 3. determine the composition and characteristics of free radicals and active centers LO 3. determine the composition and characteristics of free radicals and active centers LO 3. determine the composition and characteristics of free radicals and active centers LO 3. determine the composition and characteristics of free radicals and active centers LO 3. determine the composition and characteristics of radicals and active centers LO 3. determine the composition and characteristics of radicals and active centers LO 3. determine the composition and characteristics of radicals and active centers				ad models composition and nters, parameters experimental data physics processes nemical kinetics inposition of free characteristics of					
LO 4. analyze the relationship between the composition of active centers and theirs kinetic characteristics LO 5. to evaluate the basic processes of chemical physics				ID 4.1. formulate requirements for the active centers ID 4.2. explain the mechanism of the chemical physics process ID 5.1. choose the best methods for study of chemical physics processes ID 5.2. provide the material in the form of a					
Chemical Physics: Physical chemistry: Structure of metter					1				
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 Literature: Califano S. Pathways to Modern Chemical Physics. Springer, 2012. — 293 p. Saito K. Chemical Physics of Molecular Condensed Matter. Springer Nature Singapore Pte Ltd., 2020. — 228 p. Battaglia F., George T.F. Fundamentals in Chemical Physics. Kluwer Academic Publishers, 1998 320 p. Мансуров З.А., Онгарбаев Е.К., Кудайбергенов К.К. Химическая физика: учеб. пособие Алматы: Қазақ ун-ті, 2015. — 417 с. Мансуров З.А., Оңғарбаев Е.Қ., Құдайбергенов К.К. Химиялық физика: оқу құралы Алматы: Қазақ ун-ті, 2018. — 389 б. Internet-resources: https://books.google.kz/books/about/Introduction_to_Chemical_Physics.html?id=40k0AAAAIAAJ&red ir_esc=y 									
	Practical Pj F "Vwtu{pdgm'Ucdke ej go aucd{1999B o ce +77096742557 Expected Le As a result of studying W LO 1. demonstrate the chemical physics and keharacteristics of active spectroscopy methods LO 2. determine the physics processes LO 3. determine the physics processes LO 4. analyze the rela of active centers and the Chemical Physics; Phy Advanced Chemical Physics; Physics Saito K. Chemical 2020. — 228 p. 3. Battaglia F., Georg 320 p. 4. 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Chemical Physics of Madvanced Chemical Physics of Madvanced Chemical Physics of Mattagenesis and their skinetic of the processor of th	Practical Review, discussive jg of aucd words will be able to: LO 1. demonstrate the knowledge gained in chemical physics and kinetics, composition acharacteristics of active centers, parameters physics processes LO 2. determine the kinetic parameters physics processes	Practical Review, discussion Pj F 'Wwu{pdgm\u00fcdkv} ej go aucd \u00e4\u00fc999B o ckt\u00e4w +77096742557 Academic presentation of th Expected Learning Outcomes (LO) As a result of studying the discipline the undergracy will be able to: LO 1. demonstrate the knowledge gained in the fielth chemical physics and kinetics, composition and characteristics of active centers, parameters of spectroscopy methods LO 2. determine the kinetic parameters of chephysics processes LO 3. determine the composition and characteristics free radicals and active centers LO 4. analyze the relationship between the composition and characteristics free radicals and active centers LO 5. to evaluate the basic processes of chemical plus of active centers and theirs kinetic characteristics LO 5. to evaluate the basic processes of chemical plus characteristics of Advanced Chemical Physics Literature: 1. Califano S. Pathways to Modern Chemical Physics 2. Saito K. Chemical Physics of Molecular Conde 2020. — 228 p. 3. Battaglia F., George T.F. Fundamentals in Chemical Physics of Mahcypob 3.A., Ohrapбaeb E.K., Kydaŭбepre Aлматы: Қазақ ун-ті, 2015. — 417 c. 5. Мансуров З.А., Оңгарбаев Е.К., Құдайберген Алматы: Қазақ ун-ті, 2018. — 389 б. Internet-resources: 1. https://books.google.kz/books/about/Introduction_teir_esc=y 2. https://books.google.kz/books/about/Pathways_to	Practical Review, discussion s	Practical Review, discussion solving task	Type of course Practical Review, discussion Pj F "Wwu[pdgmtUclds" ej go aucd{ v999B o chttw +77096742557 Academic presentation of the course Expected Learning Outcomes (LO) As a result of studying the discipline the undergraduate will be able to: LO 1. demonstrate the knowledge gained in the field of chemical physics and kinetics, composition and characteristics of active centers, parameters of spectroscopy methods LO 2. determine the kinetic parameters of chemical physics processes LO 3. determine the composition and characteristics of free radicals and active centers LO 4. analyze the relationship between the composition of active centers and theirs kinetic characteristics LO 5. to evaluate the basic processes of chemical physics LO 5. to evaluate the basic processes of chemical physics LO 5. to evaluate the basic processes of chemical physics LO 5. to evaluate the basic processes of chemical physics Literature: 1. Califano S. Pathways to Modern Chemical Physics. Springer, 2012.—2 2. Saito K. Chemical Physics of Molecular Condensed Matter. Springer Na 2020.—228 p. 3. Battaglia F., George T.F. Fundamentals in Chemical Physics. Kluwer Andrah: Kasak yh-ri, 2015.—417 c. 5. Mancypob 3.A., Ohrapбaeb E.K., Kyдaйбергеноb K.K. Химиялық физ Алматы: Қазак yh-ri, 2015.—417 c. 5. Mancypob 3.A., Ohrapбaeb E.K., Kyдaйбергеноb K.K. Химиялық физ Алматы: Қазак yh-ri, 2018.—389 6. Internet-resources: 1. https://books.google.kz/books/about/Introduction_to_Chemical_Physics.htmire.esc=y 2. https://books.google.kz/books/about/Pathways_to_Modern_Chemical_Physics.htmire.esc=y 2. https://books.google.kz/books/about/Pathways_to_Modern_Chemical_Physics.htmire.esc=y 2. https://books.google.kz/books/about/Pathways_to_Modern_Chemical_Physics.htmiresc=y-y-yanamatal-yan	Practical Review, discussion solving tasks 6 Pj F 'Wwu[pdgmtUcdla' ej go awcd (1999В o ckrtw +77096742557 Academic presentation of the course Expected Learning Outcomes (LO) As a result of studying the discipline the undergraduate will be able to: LO 1. demonstrate the knowledge gained in the field of characteristics of active centers, parameters of spectroscopy methods ID 1.1. explain the basic physics and kinetics, composition and characteristics of active centers, parameters of spectroscopy methods ID 2.1. calculate of kinetic theysics processes ID 1.2. describe the confree radicals and active centers ID 2.2. describe the micropy methods ID 2.1. calculate of kinetic theysics processes ID 2.2. describe the confree radicals and active centers ID 3.1. determine the corradicals and active centers ID 3.1. determine the corradicals and active centers ID 3.2. calculate the kinetic free radicals and active centers ID 3.1. determine the corradicals and active centers ID 3.2. calculate the kinetic free radicals and active centers ID 4.2. explain the micropy methods ID 4.3. expl	

Academic policy of	Academic Behavior Rules:						
the course in the	All students have to register at the MOOC. The deadlines for completing the modules of the online course						
context of	must be strictly observed in accordance with the discipline study schedule.						
university moral	ATTENTION! Non-compliance with deadlines leads to loss of points! The deadline of each task i						
and ethical values	indicated in the calendar (schedule) of implementation of the content of the curriculum, as well as in th						
	MOOC.						
	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 yerdos.ongarbayev@gmail.com.						
Evaluation and	Criteria-based evaluation:						
attestation policy	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:

Week	Topic name	LO	ID	amo	Maxi	Form of	The
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				of	score	e	lesson
				hou		Assessmen	/ platform
				rs		t	
		Module			Г	I	
1	L.1 Collision theory. The exchange of energy in a collision of particles. Elastic collisions.	LO 1	ID 1.1.	1			Video lecture in MS Teams
1	PT 1 Basic concepts of chemical kinetics.	LO 2	ID 2.1.	2	15		Webinar
	Experimental methods for studying the kinetics of						in MS Teams
	chemical reactions						
2	L.2 Inelastic Collisions. Vibrational energy	LO 1	ID 1.2.	1			Video lecture
	exchange. Nonequilibrium chemical reactions						in MS Teams
2	PT 2 Kinetics of unilateral reactions in closed	LO 2	ID 2.1.	2	15		Webinar
	systems. Part 1						in MS Teams
3	L.3 Basic concepts of chemical kinetics	LO 1	ID 1.2.	1			Video lecture
							in MS Teams
3	PT 3 Kinetics of unilateral reactions in closed	LO 2	ID 2.1.	2	15		Webinar
	systems. Part 2						in MS Teams
3	IWSP 1 Consultation on the implementation of	LO 1	ID 1.1.				Webinar
3	IWS1						in MS Teams
3	IWS 1. From the life of free radicals	LO 2	ID 2.1.		12	Presentatio	
_			-			n	
4	L.4 Mass action law for reactions on the surface of	LO 1	ID 1.2.	1			Video lecture
	a solid						in MS Teams
4	PT 4 Methods for determining the order of the	LO 2	ID 1.1.	2	15		Webinar
	reaction. Integral methods for determining the						in MS Teams
	order of a chemical reaction	Madel	<u> </u>				
5	L.5 Breakdown of molecules into radicals.	Module LO 1	ID 1.1.	1		I	Video lecture
3	L.3 Dieakdowii of inolecties into radicals.	LUI	וועו.ו.	1			in MS Teams
5	PT 5 Methods for determining the order of the	LO 3	ID 3.2.	2	15		Webinar
	reaction. Differential methods for determining the		110 3.2.	2	13		in MS Teams
	order of a chemical reaction						III IVIS I Callis
5	IWSP 2 Consultation on the implementation of	LO 1	ID 1.1.				Webinar
	IWS2	LOI	10 1.1.				in MS Teams
5	IWS 2 The complex world of elementary acts of	LO 3	ID 3.1.		13	Presentatio	m was reams
	chemical reactions		110 J.1.		13	n	
اا		101	TD 1.1		100		
5	MT 1	LO 1	ID 1.1.		100		X 7' 1 1
6	L.6 Breakdown of free radicals	LO 1	ID 1.1.	1			Video lecture
							in MS Teams

PT 6 Kinetics of complex chemical reactions. Part 1.0 2 11 2.1. 2 15 in MS Teams								
To L.7 Crossed molecular beams. Statistical and jet LO 1 ID 1.2. 1 in MS Teams MS Tea	6	PT 6 Kinetics of complex chemical reactions. Part	LO 2	ID 2.1.	2	15		
PT 7 Kinetics of complex chemical reactions. Part 1.0 2 110 2.1 2 115 115 116 116 117 116	7		LO 1	ID 1.2.	1			Video lecture
Residence Resi	7	PT 7 Kinetics of complex chemical reactions. Part	LO 2	ID 2.1.	2	15		Webinar
No. PT 8 Influence of temperature on the rate of chemical reactions. Part 1 No. No	8		LO 1	ID 1.1.	1			Video lecture
Chemical reactions. Part 1 NWS 3 "Photo" of a chemical reaction LO 1 NWS 3 "Photo" of a chemical reaction LO 3 NWS 3 "Photo" of a chemical reaction LO 3 NWS 3 "Photo" of a chemical reaction LO 4 NWS 3 "Photo" of a chemical reaction PT 9 Lo 1 No Video lecture in MS Teams Module III Lo 1 No Video lecture in MS Teams No Lo 1 No Video lecture in MS Teams No Lo 1 No Video lecture in MS Teams No Lo 1 No Video lecture in MS Teams No Lo 1 No Video lecture in MS Teams No Lo 1 No L	8		LO 3	ID 3.2.	2	15		Webinar
IWS3 "Photo" of a chemical reaction LO 3 ID 3.2. 12 Presentatio			LO 1	ID 1.1.				
Solution PT 9 Influence of temperature on the rate of chemical reactions. Part 2 I.O. 1 ID.1.2. 1 ID.1.2 ID.1.2 ID.1.2 ID.1.2 ID.1.3 ID.1.2 ID.1.3 ID.1.2 ID.1.2 ID.1.3 ID.1.3 ID.1.3 ID.1.4 ID.1.5		IWS3	LO 3	ID 3.2.		12	Presentatio	in MS Teams
9 PT 9 Influence of temperature on the rate of chemical reactions. Part 2 Module III	8							
Chemical reactions. Part 2	9	L.9 Raman laser spectroscopy	LO 1	ID 1.2.	1			
Note	9		LO 4	ID 4.1.	2	15		
In In In In In In In In			Module	III				
The theory of active collisions LO 4 LO 4 LO 4 LO 4 LO 4 LO 5 LO 5 LO 6 LO 6 LO 6 LO 6 LO 6 LO 6 LO 7 L	10	L.10 Electronic - non-adiabatic reactions			1			
IWS4 X-ray electronic spectroscopy and its application in chemistry LO 3 ID 3.2. 13 Presentation n MS Teams	10		LO 4	ID 4.1.	2	15		Webinar
application in chemistry 10 MT (Midterm Exam) 11 L.11 Femtochemistry 12 L.12 Femtochemistry 13 PT 11 Thermodynamic aspect of the activated complex theory 14 L.12 Femtosecond spectroscopy methods 15 PT 12 Approximate methods of chemical kinetics. Bodenstein's stationary principle. Part 1 16 L.13 Dynamics of the transition state during chemical transformation 17 PT 13 Approximate methods of chemical kinetics. LO 3 ID 3.2. 2 IS Webinar in MS Teams 18 L.13 Dynamics of the transition state during chemical transformation 19 PT 13 Approximate methods of chemical kinetics. Bodenstein's stationary principle. Part 2 10 L.14 Kinetics of ultrafast chemical reactions 11 L.14 Kinetics of solid-phase reactions. Part 1 LO 2 ID 2.2. 2 IS Webinar in MS Teams 12 L.15 Ultra-low temperatures and cold atoms 13 L.15 Ultra-low temperatures and cold atoms 14 L.15 Ultra-low temperatures and cold atoms 15 L.15 Ultra-low temperatures and cold atoms 16 LO 5 ID 5.1. Webinar in MS Teams 17 PT 15 Kinetics of solid-phase reactions. Part 2 LO 5 ID 5.1. Webinar in MS Teams 18 PT 15 Kinetics of solid-phase reactions. Part 2 LO 5 ID 5.1. Webinar in MS Teams 18 PT 16 Kinetics of solid-phase reactions. Part 2 LO 5 ID 5.1. Webinar in MS Teams 18 PT 18 Consultation on the implementation of IWS6 Low-temperature processes in chemistry LO 5 ID 5.1. IN Security in MS Teams	10		LO 1	ID 1.1.				
10 MT (Midterm Exam) LO 1 ID 1.1. 100	10		LO 3	ID 3.2.		13		
L.11 Femtochemistry	10		LO 1	ID 1.1.		100		
The image of the activated complex theory LO 3 LO 3 LO 3 LO 3 LO 3 LO 4 LO 5 LO 5 LO 6 LO 6 LO 6 LO 6 LO 7	11		LO 1		1			
12 L.12 Femtosecond spectroscopy methods LO 1 ID 1.1. 1 Video lecture in MS Teams 12 PT 12 Approximate methods of chemical kinetics. Bodenstein's stationary principle. Part 1 LO 1 ID 1.1. Use formula in MS Teams 12 IWSP 6 Consultation on the implementation of IWS5 L.13 Dynamics of the transition state during chemical transformation 13 L.13 Dynamics of the transition state during chemical transformation 13 PT 13 Approximate methods of chemical kinetics. Bodenstein's stationary principle. Part 2 LO 4 ID 4.2. 2 15 Webinar in MS Teams 14 L.14 Kinetics of ultrafast chemical reactions LO 1 ID 1.1. 1 Video lecture in MS Teams 14 PT 14 Kinetics of solid-phase reactions. Part 1 LO 2 ID 2.2. 2 15 Webinar in MS Teams 15 L.15 Ultra-low temperatures and cold atoms LO 1 ID 1.1. 1 Video lecture in MS Teams 15 L.15 Ultra-low temperatures and cold atoms LO 1 ID 1.1. 1 Video lecture in MS Teams 16 PT 15 Kinetics of solid-phase reactions. Part 2 LO 2 ID 2.1. 2 15 Webinar in MS Teams 17 PT 15 Kinetics of solid-phase reactions. Part 2 LO 2 ID 2.1. 2 15 Webinar in MS Teams 18 IWSP 7 Consultation on the implementation of IWS6 IWS6 Low-temperature processes in chemistry and technology LO 5 ID 5.2. I3 Presentatio IMS Teams	11		LO 3	ID 3.2.	2	15		Webinar
PT 12 Approximate methods of chemical kinetics. Bodenstein's stationary principle. Part 1 LO 1 ID 1.1. Webinar in MS Teams	12		LO 1	ID 1.1.	1			Video lecture
12 IWSP 6 Consultation on the implementation of IWS5 IWS 5 Potential surfaces and chemical reactions LO 3 ID 3.2. 12 Presentatio ID 1.1. I	12		LO 3	ID 3.1.	2	15		Webinar
12 IWS 5 Potential surfaces and chemical reactions LO 3 ID 3.2. 12 Presentatio n	12	IWSP 6 Consultation on the implementation of	LO 1	ID 1.1.				Webinar
L.13 Dynamics of the transition state during chemical transformation	12	1	LO 3	ID 3.2.		12		III IVIO TOMINO
13 PT 13 Approximate methods of chemical kinetics. Bodenstein's stationary principle. Part 2 L.14 Kinetics of ultrafast chemical reactions LO 1 ID 1.1. 1 Video lecture in MS Teams	13		LO 1	ID 1.1.	1		11	
14 L.14 Kinetics of ultrafast chemical reactions LO 1 ID 1.1. 1 PT 14 Kinetics of solid-phase reactions. Part 1 LO 2 ID 2.2. 2 15 Webinar in MS Teams 15 L.15 Ultra-low temperatures and cold atoms LO 1 ID 1.1. 1 Video lecture in MS Teams PT 15 Kinetics of solid-phase reactions. Part 2 LO 2 ID 2.1. 2 15 Webinar in MS Teams PT 15 Kinetics of solid-phase reactions. Part 2 LO 2 ID 2.1. 2 15 Webinar in MS Teams IWSP 7 Consultation on the implementation of IWS6 IWS 6 Low-temperature processes in chemistry and technology LO 5 ID 5.2. 13 Presentatio no Presentatio no Presentation of no Presentation no Presentat	13	PT 13 Approximate methods of chemical kinetics.	LO 4	ID 4.2.	2	15		Webinar
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PT 15 Kinetics of solid-phase reactions. Part 2 LO 2 ID 2.1. 2 15 Webinar in MS Teams IWSP 7 Consultation on the implementation of IWS6 IWS 6 Low-temperature processes in chemistry and technology LO 5 ID 5.1. Webinar in MS Teams IWS 6 Low-temperature processes in chemistry and technology	15	L.15 Ultra-low temperatures and cold atoms	LO 1	ID 1.1.	1			Video lecture
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Head of the Department Lecturer

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