



СИЛАБУС ДИСЦИПЛІНИ «Chemistry: physical and colloid»

Ступінь вищої освіти - Bachelor
 Спеціальність 202 Plant protection and quarantine
 Освітня програма « Plant protection and quarantine »
 Рік навчання 2, семестр 3
 Форма навчання full-time
 Кількість кредитів ЄКТС 4
 Мова викладання English

Лектор курсу

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Сторінка курсу в eLearn

<https://elearn.nubip.edu.ua/course/view.php?id=1792>

ОПИС ДИСЦИПЛІНИ

(до 1000 друкованих знаків)

The development of the agro-industrial complex requires the training of specialists with knowledge of basic sciences and able to use all the possibilities of modern science to solve current problems, introduce advanced technologies to protect plants from pests and the negative impact of the environment. The course of physical and colloid chemistry aims to give a clear idea of the theoretical and experimental foundations of science, defining its special role as an interdisciplinary science that synthesizes knowledge of related fields of chemistry, physics, biology and other natural sciences. Physical chemistry studies the relationship between physical phenomena that accompany chemical transformations and, making extensive use of theoretical and experimental methods of physics and chemistry, generalizes the actual material of different sections of chemistry, reveals the general laws of chemical reactions. Colloid chemistry studies the physicochemical properties and behavior of highly dispersed and macromolecular systems that are widespread in the environment.

СТРУКТУРА КУРСУ

Тема	Години (лекції ї/лабораторні, практичні, семінарські)	Результати навчання	Завдання	Оцінювання
Module 1. Chemical thermodynamics. Chemical kinetics				
1. Introduction, Subject, Methods, Features and Importance Of Thermodynamics. Basic concepts – a system, parameters, state functions, a composition, a process. Thermodynamic state. Application of the first law of thermodynamics.	3/5	Know the subject and objectives of physical and colloid chemistry of chemistry, prospects for its development, the importance of practical activities of specialists; Know the basic concepts in physical chemistry, the laws of thermodynamics, Hess's law and its consequences.	Delivery of laboratory work. Writing tests. Performing independent work (including e-learning) The solution of the problem.	Up to 5 points for laboratory work, up to 2 points for tests and up to 2 points for independent work, up to 1 point for solving problems

<p>Hess's law-formulation, consequences. Thermal and physicochemical processes - heats of formation, heat of combustion. Kirchhoff's law—dependence of the reaction enthalpy on temperature, integral and differential form. The second law of thermodynamics. Reversible thermodynamic processes. Maximum work. Heat capacity. Formulation of the second thermodynamic law. Entropy. Analytical expression of the second thermodynamic law. Statistical interpretation of entropy. Thermodynamic potentials</p>		<p>Be able to calculate the thermal effect of a chemical process Understand and analyze the fundamental possibility or not the possibility of a certain chemical reaction; Understand the variety of ways to convert energy in living organisms Apply mechanisms and patterns of energy conversion in biological systems</p>		
<p>1. Formal kinetics. Basic concepts - rate, order, molecularity. The main postulate of kinetics. Kinetic equations of irreversible reactions under static conditions - zero-order, first-order and second-order reactions. Method, for chemical reactions rate determination. Kinetics of complex reactions - reversible, parallel and consecutive reactions. Steady- state method. Dependence of of the chemical reaction rate constant k on the temperature. Arrhenius equation. Activation energy - definition, calculations. Collision theory. Transition-state theory. Theories application to the calculation of the rate constant of chemical processes. Chemical equilibrium</p>	2/5	<p>Know the basic concepts and basic postulates of chemical kinetics Be able to determine the order of the chemical reaction and the concentration of substances at any time since its inception; Analyze the effect of temperature on the rate of chemical reaction. Determine the activation energy of a chemical reaction; Use the main factors influencing the course of chain, photochemical and heterogeneous reactions.</p>	<p>Delivery of laboratory work. Writing tests. Performing independent work (including e-learning) The solution of the problem..</p>	<p>Up to 5 points for laboratory work, up to 2 points for tests and up to 2 points for independent work, up to 1 point for solving problems</p>

Module 2. Solutions. Electrode processes.				
3. Colligative properties of the solutions. Ebullioscopy and Cryoscopy. Solutions of non-electrolytes. Raoult's law. Osmosis. Osmotic pressure. Electrolyte solutions. Arrhenius electrolytic dissociation theory. The main provisions of the theory of strong electrolytes. Activity. Activity coefficient.	2/2	<p>Know the laws of Raoult, know the theory of electrolytic dissociation of Arrhenius, the main provisions of the theory of strong electrolytes. Prepare solutions of different concentrations; Be able to determine and calculate the freezing and boiling points of solutions of non-electrolytes and electrolytes. Determine and analyze the osmotic pressure of non-electrolyte and electrolyte solutions. Calculate the activity of electrolyte solutions; Determine the electrolytic dissociation constants Distinguish the processes of turgor, plasmolysis in cells Understand osmotic phenomena and osmoregulation in living systems Apply the nature of osmosis to reveal the essence and understand the mechanisms of many processes in biology</p>	<p>Delivery of laboratory work. Writing tests. Performing independent work (including e-learning) The solution of the problem.</p>	Up to 5 points for laboratory work, up to 2 points for tests and up to 2 points for independent work, up to 1 point for solving problems.
4. Ionic product, K_w . Hydrogen and hydroxyl indicators. Buffer solutions	1/4	<p>Know about the ionic product of water and the dependence of ionic product of water on temperature. Be able to calculate and experimentally determine the pH of solutions. Be able to prepare buffer solutions, analyze the factors on which the pH of buffer solutions depends, find the buffer capacity of solutions. Use the value of acidity in biological processes</p>	<p>Delivery of laboratory work. Writing tests. Performing independent work (including e-learning) The solution of the problem.</p>	Up to 5 points for laboratory work, up to 2 points for tests and up to 2 points for independent work, up to 1 point for solving problems.
5. Electrical conductivity of solutions. Electrode processes	2/4	<p>Know the concept of electrical conductivity of solutions. Be able to determine the concentration of solutions by</p>	<p>Delivery of laboratory work. Writing tests. Performing independent work (including e-learning)</p>	Up to 5 points for laboratory work, up to 2 points for tests and up to 2 points for independent

		<p>conductometric and potentiometric titration</p> <p>Apply methods for determining electrical conductivity to analyze the salt content in solutions, soil and moisture in agricultural products</p> <p>Understand the processes of interconversion of chemical and electrical energy.</p> <p>Be able to schematically write and calculate the EMF of a galvanic cell</p>	The solution of the problem.	work, up to 1 point for solving problems
Module 3. Surface phenomena and disperse systems				
<p>6. Adsorption - definition, types of adsorption, distinguishing criteria.</p> <p>Main adsorption dependencies - isotherms, isosteres, isobars. Adsorption heats - determine the isosteric adsorption heat determination. Capillary condensation. Adsorption on solid adsorbent - isotherms of the Langmuir, Freundlich and BET. Adsorption on liquid surface - peculiarities. Gibbs adsorption isotherm. Surface tension and parachor. Surfactants – Shishkovsky's equation, Traube's rule.</p>	3/4	<p>Know the basic concepts of colloid chemistry, classification of dispersed systems and surface phenomena.</p> <p>Understand and analyze adsorption processes, Be able to influence the passage of ion exchange processes; select effective adsorbents for selective adsorption.</p> <p>Be able to schematically write the structure of the micelles of lyophobic sol</p> <p>Use the processes of adsorption, electrokinetic phenomena in agricultural practice</p>	<p>Delivery of laboratory work.</p> <p>Writing tests.</p> <p>Performing independent work (including e-learning)</p> <p>The solution of the problem.</p>	<p>Up to 5 points for laboratory work, up to 2 points for tests and up to 2 points for independent work, up to 1 point for solving problems</p>
<p>7. Colloidal chemistry as a science. Colloidal systems - classification, methods of preparation and purification.</p> <p>Structure of lyophobic and lyophilic colloids. Optical properties - scattering, adsorption, opalescence. Ultra-microscopy, nephelometry, turbidimetry. Color of colloids. Molecular-kinetic properties -</p>	2/6	<p>Know the methods of obtaining and purifying colloidal solutions.</p> <p>Analyze the factors influencing the stability of colloidal systems</p> <p>Understand the concept of coagulation, peptization</p> <p>Be able to coagulate colloidal solutions.</p> <p>Select the most effective stabilizers and coagulants</p> <p>Understand the processes of swelling of</p>	<p>Delivery of laboratory work.</p> <p>Writing tests.</p> <p>Performing independent work (including e-learning)</p> <p>The solution of the problem.</p>	<p>Up to 5 points for laboratory work, up to 2 points for tests and up to 2 points for independent work, up to 1 point for solving problems</p>

osmosis, sedimentation. Brownian motion. Einstein and Smoluhovsky's formula. Electro kinetic properties. Electrical double layer. Stability of coagulation. Coagulation of colloidal solutions by electrolytes. Electro - kinetic phenomena - electrophoresis, electro-osmosis. Polymer solutions.		polymers, use these processes in agricultural practice		
Total 1 sem				70
exam				30
Total				100

ПОЛІТИКА ОЦІНЮВАННЯ

Політика щодо дедлайнів та перескладання:	Роботи, які здаються із порушенням термінів без поважних причин, оцінюються на нижчу оцінку. Перескладання модулів відбувається із дозволу лектора за наявності поважних причин (наприклад, лікарняний).
Політика щодо академічної доброчесності:	Списування під час контрольних робіт та екзаменів заборонені (в т.ч. із використанням мобільних девайсів).
Політика щодо відвідування:	Відвідування занять є обов'язковим. За об'єктивних причин (наприклад, хвороба, міжнародне стажування) навчання може відбуватись індивідуально (в он-лайн формі за погодженням із деканом факультету)

ШКАЛА ОЦІНЮВАННЯ СТУДЕНТІВ

Рейтинг здобувача вищої освіти, бали	Оцінка національна за результати складання екзаменів заліків	
	екзаменів	заліків
90-100	відмінно	зараховано
74-89	добре	
60-73	задовільно	
0-59	незадовільно	не зараховано