MEDICAL UNIVERSITY OF PLOVDIV
FACULTY OF PHARMACY
DEPARTMENT OF CHEMICAL SCIENCES

LECTURE WEEK PLAN

PHYSICAL CHEMISTRY AND COLLOID CHEMISTRY
2021/2022

No	SUBJECT	Hours
1.	INTRODUCTION *Physical Chemistry – subject, methods, sub-disciplines* IDEAL AND REAL GASES *Ideal gas. Ideal gas laws. Ideal gas equation. Real gases. Real gas equation. Liquefaction of real gases* CHEMICAL THERMODYNAMICS *Basic terms (thermodynamic systems – clasification; thermodynamic variables; state and path functions; equation of state; hermodynamic process; hermodynamic equilibrium). The Zeroth Law of Thermodynamics*	3
2.	*The First Law of Thermodynamics. Energy, work and heat. The first law of thermodynamics and some simple processes.* *Thermochemistry. Basic terms. Hess's law. Enthalpy of formation and combustion. Kirchhof's law* *Second law of thermodynamics. Entropy – statistical interpretation and classical definition. Entropy changes accompanying specific processes*	3
3.	*The Helmholtz and Gibbs energies. Conditions for spontaneity and equilibrium. The Gibbs energy and chemical reactions. The concept of maximum work* *Thermodynamic potentials. Fundamental equations in TH. Dependence of Gibbs free energy of pressure and temperature. Gibbs-Helmholtz equation* *Third law of thermodynamics. Standard/Absolute entropies* CHEMICAL POTENTIAL *Partion molar quantities. Chemical potential* *Gibbs–Duhem equation*	3
4.	CHEMICAL EQUILIBRIUM *Irreversible and reversible (equilibrium) chemical reactions. Characteristics of chemical equilibrium. Equilibrium constant and law of mass action. Chemical variable. Spontaneous and nonspontaneous reactions. Equilibrium expression for homogeneous and heterogeneous systems. Le Châtelier principle and factors that affect chemical equilibrium.*	3
5.	PHASE EQUILIBRIA *Basic concepts – system, phase, component, degree of freedom. Gibbs phase rule. One-component systems. Water phase diagram. First- and second-order phase transitions. Clausius-Clapeyron equation. Two-component system phase diagrams. The lever rule* SOLUTIONS (MIXTURES)	3

	General characteristics and classification. Ideal and real solutions. Deviations from Raoult's law. Liquid mixtures with limited solubility. Colligative properties of solutions. Ebullioscopic and cryoscopic constant. Osmosis	
6.	THREE-COMPONENT SYSTEMS. EXTRACTION *Gibbs-Roseboom diagrams. Distribution of a third component in a two-phase system. Extraction. Principles and terminology of extraction* ELECTROLYTE SOLUTIONS *Definition. Quantitative indicators for dissociation. Strong and weak electrolytes. Van't Hoff Isotonic factor. Electrical conductivity. Debye and Huckel theory. Kohlrausch laws. Activity. Activity coefficient. Ion transport numbers*	3
7.	SURFACE PHENOMENA. ADSORPTION *Main adsorption dependences – isotherms, isosters, isobars. Adsorption on solid adsorbent – Langmuir, Freundlich and BET isotherms* SURFACE TENSION. ADSORPTION ON LIQUID SURFACE *Surfactants. Gibbs isotherm. Shishkovsky equation, Traube's rule*	3
8.	CHEMICAL KINETICS *Basic concepts and terminology – reaction rate, rate constant, reaction order and molecularity. Reaction mechanism. Rate law and integrated rate low. Zero-, first- and second-order reactions. Methods for determining the reaction order* DEPENDENCE OF THE RATE CONSTANT ON THE TEMPERATURE *Arrhenius equation. Activation energy. Collision theory. Transition-state theory. Kinetics of complex reactions. Parallel, successive, conjugate and chain reactions – examples*	3
9.	CATALYSIS *Catalysis. Basic terms and definitions (catalyst, catalysis, promoter, poison/catalytic poisoning). Types of catalysis. Features of catalysts and catalytic reactions – key points.* *Homogeneous catalysis* *Heterogeneous catalysis* *Enzyme catalysis*	3
10.	ELECTROCHEMISTRY *Basic terms and definitions. Relationship between cell potential and Gibbs free energy. Temperature dependence of emf. Relationship between cell potential and equilibrium constant - Nernst equation. Reversible and concentration cells . Electrolytic cells. Electrolysis. Faraday's laws of electrolysis*	3
11.	COLLOID CHEMISTRY *Colloid chemistry – basic terms and definitions. Classification, preparation and purification of colloids: dispersion and condensation methods, dialysis and ultrafiltration. Colloids formation. Structure of lyophilic and lyophobic colloids. Significance and applications*	3
12.	PROPERTIES OF COLLOID SYSTEMS. *Optical properties of colloid systems - light scattering, absorption, opalescence, Tyndal effect. Theory of Rayleigh. Ultra-microscopy, nephelometry, turbidimetry – applications. Coloring colloidal dispersion systems*	3
13.	*Properties of colloidal solutions – osmosis and sedimentation. Electrical properties of colloid-dispersed systems. Theories of Double electric layer structure – Helmholtz, Gouy-Chapman and Stern. Coagulation under the*	3

	action of electrolytes – flocculation value. Kinetic properties of sols – Brownian motion. Electrokinetic phenomena – electrophoresis, electroosmosis and its applications.	
14.	EMULSIONS *Classifications, properties, production, applications. Emulsions –properties of dilute and concentrated emulsions. Stabilization of emulsions – emulsifiers*	3
15.	*AEROSOLS – types, properties and applications. FOAMS – properties, production, destruction. Macromolecular compounds. Schulze-Hardy rule. GELS – types, properties and applications*	3

Prepared by:
Prof. K. Gavazov, PhD
Prof. Zdr. Velkova, PhD
Chief Assist. Prof . N. Milcheva, PhD

08.09.2021
Plovdiv

Prof. K. Gavazov, PhD
Head of the Department "Chemical Sciences"