MEDICAL UNIVERSITY OF PLOVDIV
FACULTY OF PHARMACY
DEPARTMENT OF CHEMICAL SCIENCES

LECTURE WEEK PLAN

PHYSICAL CHEMISTRY AND COLLOID CHEMISTRY
2023/2024

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 – classification; thermodynamic variables; state and path functions; equation of state; thermodynamic process; thermodynamic 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 action of electrolytes – flocculation value. Kinetic properties of sols – Brownian motion. Electrokinetic phenomena – electrophoresis, electroosmosis and its applications.*	3
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

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