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| **Study program** Chemistry |
| **Course title** Physical Chemistry 1 (H109C) |
| **Name of lecturer/lecturers** Snežana B. Tošić |
| **Type of course** Obligatory |
| **Number of ECTS allocated** 6 |
| **Course objectives**Developing the ability to understand basic physico-chemical concepts and laws in the field of gases and thermodynamics. Training students for the application of acquired knowledge of chemical thermodynamics when interpreting and considering the equilibrium conditions of various processes. |
| **Course outcomes**The student can:- apply the ideal gas laws to the real gas state,- interpret the behavior of a real gas,- apply the knowledge of chemical thermodynamics to the consideration of energy changes in different processes and thermodynamic equilibrium in any system,- determine and process experimentally obtained data with a special emphasis on the connection between the obtained results, their mathematical relations, graphic representation, and interpretations. |
| **SYLLABUS***Lectures*Ideal gas state. Ideal gas laws. Equation of ideal gas state. Determination of molar mass based on the equation of ideal gas state. Gas and vapor densities. Determination of molar mass based on gas densities. Mixtures of gases. Laws that apply to gas mixtures. Thermal dissociation of gas. Kinetic theory of gases-equations. The principle of energy equality distribution. Laws of the ideal gas state derived based on kinetic theory. The number of collisions. Maxwell-Boltzmann distribution law. Types of gas particle velocities. Real gas condition. Equations that describe behavior of real gas. Compressibility factor. Conversion of gases into liquids. Critical values. Reduced sizes and the principle of correspondence. Transport properties of gases. Viscosity. Experimental determination of viscosity. Basic thermodynamic terms. Energy, work, and heat. Zeroth law of thermodynamics. First law of thermodynamics. Internal energy. Enthalpy. Application of the first law of thermodynamics to the ideal gas state. Joule and Joule-Thomson experiment. Heat capacity. Adiabatic processes. Reversible and irreversible processes. Thermochemistry. Thermochemical equations and laws. Thermal effects of different process. Experimental determination of heat of reaction. Effect of temperature on heat reactions. Spontaneous processes. Second law of thermodynamics. Carnot's heat engine. Entropy of reversible and irreversible processes. Entropy and balance. Entropy and probability. Entropy changes of a chemical reaction. Entropy of ions. Bond entropy. Entropy of the phase transformations. Entropy of mixing. Entropy changes of an ideal gas. The effect of temperature, volume, and pressure on entropy. Third law of thermodynamics. Gibbs and Helmholtz free energy. Gibbs equations. Maxwell's relations. Gibbs-Helmholtz equation.*Laboratory work*Determination of the molar mass of an easily volatile liquid by the Victor-Meyer method. Determination of viscosity coefficient by Ostwald viscosimeter. Determination of thermal capacity of the calorimeter. Determination of the heat of dissolution of a solid substance in water. Determination of heat of neutralization. Determination of heat of melting of ice. Checking validity of Hess's law. |
| **References**1. Mirjana Obradović, Snežana Tošić, Milan Mitić, Gasno stanje materije i hemijska termodinamika, Univerzitet u Nišu, Prirodno-matematički fakultet, Niš, 2019.2. Ivanka Holclajtner-Antunović, Opšti kurs fizičke hemije, Zavod za udžbenike i nastavna sredstva, Beograd, 2000.3. Spasoje Đ. Đorđević, Vera J. Dražić, Fizička hemija, Univerzitet u Beogradu, Tehnološko-metalurški fakultet, Beograd, 2000.4. Mirjana Obradović i grupa autora, Zbirka zadataka iz fizičke hemije, Univerzitet u Nišu, Filozofski fakultet Niš, 1995.5. Ljiljana Vračar i grupa autora, Eksperimentalna fizička hemija, Tehnološko-metalurški fakultet Beograd, 1990. |
| **Active teaching classes** | **Lectures** 30 | **Laboratory work** 30 |
| **Teaching mode** Lectures, laboratory work, consultations |
| **ASSESSMENT METHODS AND CRITERIA (Max 100 points)** |
| **Pre exam duties** | **Points** | **Final exam**  | **Points** |
| Activity during lectures | 5 | Written examination | 20 |
| Practical teaching | 15 | Oral examination | 30 |
| Teaching colloquia | 30 |  |  |
| Seminar |  |  |  |