

Taras Shevchenko National University of Kyiv

Physics Department

Course description

**Molecular Physics**

**Level: Language: Duration: Occurrence:**

Bachelor Ukrainian 1 semester 2nd semester

**Credits: Total Hours: Lectures: Seminars:**

6 180 60 hrs 120 hrs

**Description of Course Work and Examinations**

Module-rating system, results are estimated on a 100-point scale. The course contains 2 midterms 30 pts/90 min each, an exam on high-difficulty problems for 10 pts/180 min, and a final exam for 30 pts/120 min.

**Prerequisites**

Mathematical Analysis (1st semester), Mechanics (1st semester)

**Syllabus**

***Thermodynamics:*** Thermodynamics quantities and measurements (Temperature, Volume, Pressure), Work, heat and heat capacity (including calculating C for different processes), First Law of thermodynamics, Isoprocesses in thermodynamic systems and in ideal gases, Polytrope, Cyclic processes and mechanisms that utilize them, Second Law of thermodynamics and its alternatives, Carnot cycle, its features, realization, Carnot theorem, the biggest coefficient of performance, Reverse Carnot cycle, Absolute temperature and its measurement, Conditions for the equilibrium state of the systems, Entropy, Third Law of thermodynamics and its consequences, Negative absolute temperatures, Degrees of freedom for multiatomic molecules

***Real gases:*** Virial expansion, Isothermic processes in real gases, van der Waals equation; its properties, Thermodynamic potentials; chemical potentials, Maxwell relations and their applications

***Advanced thermodynamics:*** Energy dissipation and generation of entropy, Kinetic theory of the transfer process, Brown motion, Molecular dynamics of a polymer chain

***Phase shifts thermodynamics:*** Crystalic bodies, Liquids, Classification of phase shifts, Clapeyron-Klausius equation, Phase diagrams, Critical point, Metastable phases,

***Surface processes:*** Surface tension, Young-Laplace formula, excessive pressure under the curved surface, Conditions of equilibrium for the systems with boundaries, Thermodynamics of the surface processes,

***Kinetic theory of gases:*** Intermolecular potentials and interactions, Ideal gas law, The mean, the root mean square, and the most probable speed, Maxwell formula, DeBroigle length for gas molecules and the criterion of the applicability of classical model of ideal gas, Boltzman distribution, Hibbs distribution, Kinetic theory perspective on entropy,

**Literature**

1. I.E.Irodov *A collection of tasks on the general physics.* 2001 Saint-Petersburg, ISBN 5-8114-0319-4
2. L. А. Bulavin *Molecular Physics*. 2006 Kyiv. ­ 567 p. ­ ISBN 9-66­34-6­223-­Х

**Lecturer/seminarian**

Associate Professor Dmytro Gavrushenko/ Associate Professor Artyom Chumachenko