科目ナンバリング	U-LAS13 10041 LE60				
授業科目名<英訳>	Basic Physical Chemistry (statistical mechanics)-E2 Basic Physical Chemistry (statistical mechanics)-E2	担当者所属職名・氏名	工学研究科　教授　Cathy McNamee		
群	自然科学科目群	分野(分類)	化学(基礎)	使用言語	英語
旧群	B群	単位数	2単位	週コマ数	1コマ	授業形態	講義（対面授業科目）
開講年度・開講期	2026・前期	曜時限	水2	配当学年	主として2回生	対象学生	理系向

[授業の概要・目的]

Thermodynamics is an important foundation of physics, but its intuitive understanding is not straightforward. A microscopic viewpoint is useful for an essential understanding of thermal phenomena, and this knowledge is indispensable for various advanced technologies, including nano and biotechnology. This course will cover the fundamentals of classical (non-quantum) statistical thermodynamics and provide a deep understanding and practical application of entropy and free energy, which are difficult to understand only from a macroscopic viewpoint.

[到達目標]

To understand the relationship between the macroscopic properties (entropy and free energies) and the probability distribution of microscopic states, and to be able to formulate molecular-level microscopic models for classical (non-quantum) systems, such as ideal gas, utilizing the concept of statistical ensembles.

[授業計画と内容]

1. Introduction: Foundations

2. Review of classical thermodynamics (I)
 ・Definition of concepts; Zeroth and First law of thermodynamics

3. Review of classical thermodynamics (II)
 ・Second and third laws of thermodynamics

4. Basic statistical notations
 ・Definition of statistical and probability concepts

5. Fundamental of statistical mechanics

6.The most probable distribution and the population of states

7. Molecular partition functions

8. How to obtain the mean molecular energy from molecular partition functions

9. How to use molecular information to calculate the total energy of a system

10. Derived thermodynamic function using statistical mechanics I
 ・Internal energy

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11. Derived thermodynamic function using statistical mechanics II
・Heat capacity

12. Derived thermodynamic function using statistical mechanics III
・Entropy

13. Derived thermodynamic function using statistical mechanics IV
・Helmholtz energy
・Derivation of equation of state
・Enthalpy

14. Derived thermodynamic function using statistical mechanics IV
・Gibbs energy

＜Examination＞

15. Feedback

[履修要件]

An understanding of classical thermodynamics is desirable.
Recommended courses that should be taken in advance:
Basic Physical Chemistry (thermodynamics)-E2 (or**基礎物理化学(熱力学)**)

[成績評価の方法・観点]

The grade will be evaluated as follows: final exam (70%) and assignments (30%).

[教科書]

P. Atkins, J.D. Paula 『Atkins' Physical Chemistry』 （Oxford University Press, 2014, 10th Edition）

[参考書等]

（参考書）
R.K. Pathria 『Statistical Mechanics』 （Butterworth-Heinemann, 1996, 2nd Edition.）

[授業外学修（予習・復習）等]

Students should consult additional study sources (books, internet).
Assignments will be assigned during the class. Submission of assignments outside the designated time and date will not be accepted.
The assignments must be submitted on LMS as PDF files by the due date. No late assignments will be accepted.

[その他（オフィスアワー等）]

Preferred method of communication: email

[主要授業科目（学部・学科名）]