SCME 222 Physical Chemistry and Thermodynamics
Second Semester, Academic Year 2025-2026
Faculty of Science, Mahidol University

Student Group **Materials Science and Nano-Engineering**
Class Schedule *Monday, 9:30-12:30 (lectures)*
On-site (SC1-160)

Instructors *Asst. Prof. Dr. Sirirat Kumarn* *(sirirat.kum@mahidol.ac.th)*
Assoc. Prof. Dr. Rakchart Traiphol *(rakchart.tra@mahidol.ac.th)*

Course Description

Natural processes; the Second Law of Thermodynamics; the First Law of Thermodynamics; gas expansion; entropy; internal energy, enthalpy and heat capacity; measuring entropy; Gibbs energy; chemical changes; enthalpies of formation; entropy and Gibbs energy changes for reactions; the Master Equations; chemical potential of mixtures; equilibrium constants; chemical equilibrium; applications in chemical and biological systems; microscopic basis of entropy; phase equilibria; macromolecules and aggregates: determination of size and shape, structure and dynamics, self-assembly; molecules in motion: in gases and liquids, diffusion; rates of chemical reactions: the rate of reaction, integrated rate laws, temperature dependence, elementary reaction, unimolecular reaction; the kinetics of complex reaction: chain reactions, polymerization kinetics, photochemistry.

Grading Policy

Student evaluation is in accordance with the rules and regulations of the Faculty of Science, Mahidol University. Letter grades of A, B+, B, C+, C, D+, D, and F will be given based on students' weighted percentage scores, consisting of

Attendance/participation	10%
Assignments	20%
Midterm examination	35%
Final examination	35%

Recommended Textbooks

1. Atkins, P.; de Paula, J., *Physical Chemistry*. 8th Edition. Oxford University Press: New York, 2006. Or any later editions.
2. Keeler, J. H.; Wothers, P. D., *Chemical Structure and Reactivity: An Integrated Approach*. 2nd Edition, Oxford University Press: Oxford, 2014.
3. Chang, R.; Goldsby, K. A., *Chemistry*. 12th Edition. McGraw-Hill: New York, 2016.

Course Timetable for Lectures

Date	Topics	Instructor
Jan 5, 2026	Natural processes; Second Law of Thermodynamics; First Law of Thermodynamics;	Sirirat
Jan 12, 2026	Gas expansion; Entropy; Internal energy, enthalpy and heat capacity;	Sirirat
Jan 19, 2026	Measuring entropy; Gibbs energy;	Sirirat
Jan 26, 2026	Chemical changes: standard states, enthalpies of formation, entropy and Gibbs energy changes; The Master Equations;	Sirirat
Feb 2, 2026	Chemical potential: mixing of ideal gases, reacting mixtures, definition, variation; Equilibrium constants;	Sirirat
Feb 9, 2026	Chemical equilibrium: conditions and variations; Applications: chemical and biological systems;	Sirirat
Feb 16, 2026	Microscopic basis of entropy: entropy and distributions; Phase equilibria: phase diagrams, equations of a phase boundary;	Sirirat
Feb 23, 2026	Revision	Sirirat
March 2-6, 2026	**--- *Midterm Exam* ---**	
Mar 9, 2026	**Macromolecules and aggregates:** determination of size and shape, structure, and dynamics, and self-assembly	Rakchart
Mar 16, 2026	**Macromolecules and aggregates:** determination of size and shape, structure, and dynamics, and self-assembly	Rakchart
Mar 23, 2026	**Molecules in motions**: molecular motion in gases, molecular motion in liquid, diffusion.	Rakchart
Mar 30, 2026	**The rate of chemical reaction:** The rate of reaction, integrated rate laws, temperature dependent of reaction rate, elementary reaction, unimolecular reaction.	Rakchart
Apr 20, 2025	**The kinetics of complex reaction**: chain reactions, polymerization kinetics, photochemistry	Rakchart
April 27 - May 8, 2026	**--- *Final Exam* ---**	