

SCME 222 Physical Chemistry and Thermodynamics
Second Semester, Academic Year 2022-2023
Faculty of Science, Mahidol University

Student Group **Materials Science and Nano-Engineering**

Class Schedule *Monday, 9:30-12:30 (lectures)*

On-site (SCI-157)

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 9, 2023	Natural processes; Second Law of Thermodynamics; First Law of Thermodynamics	Sirirat
Jan 16, 2023	Gas expansion; Entropy	Sirirat
Jan 23, 2023	Internal energy, enthalpy and heat capacity; Measuring entropy; Gibbs energy	Sirirat
Jan 30, 2023	Chemical changes: standard states, enthalpies of formation, entropy and Gibbs energy changes; The Master Equations	Sirirat
Feb 6, 2023	Chemical potential: mixing of ideal gases, reacting mixtures, definition, variation; Equilibrium constants	Sirirat
Feb 13, 2023	Chemical equilibrium: conditions and variations; Applications: chemical and biological systems	Sirirat
Feb 20, 2023	Microscopic basis of entropy: entropy and distributions; Phase equilibria: phase diagrams, equations of a phase boundary	Sirirat
Feb 27, 2023	Revision	Sirirat
March 7-11, 2023	<i>--- Midterm Exam ---</i>	
Mar 13, 2023	Macromolecules and aggregates: determination of size and shape, structure, and dynamics, and self-assembly	Rakchart
Mar 20, 2023	Macromolecules and aggregates: determination of size and shape, structure, and dynamics, and self-assembly	Rakchart
Mar 27, 2023	Molecules in motions: molecular motion in gases, molecular motion in liquid, diffusion.	Rakchart
Apr 3, 2023	Molecules in motions: molecular motion in gases, molecular motion in liquid, diffusion.	Rakchart
Apr 10, 2023	The rate of chemical reaction: The rate of reaction, integrated rate laws, temperature dependent of reaction rate, elementary reaction, unimolecular reaction.	Rakchart
Apr 17, 2023	The kinetics of complex reaction: chain reactions, polymerization kinetics, photochemistry	Rakchart
April 24, 2023	Student Presentation and Revision	Rakchart
May 1-13, 2023	<i>--- Final Exam ---</i>	