

SCME 222 Physical Chemistry and Thermodynamics

Second Semester, Academic Year 2021

Faculty of Science, Mahidol University

Student Group	Materials Science and Nano-Engineering	
Class Schedule	<i>Mondays, 9:30-12:30 (lectures)</i> <i>Online (Microsoft Teams, Google Meet, Line group) and On-site (if possible)</i>	
Instructors	<i>Dr. Sirirat Kumarn</i>	<i>(sirirat.kum@mahidol.ac.th)</i>
	<i>Assoc. Prof. Dr. Rakchart Traiphol</i>	<i>(rakchart.tra@mahidol.ac.th)</i>

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 10, 2022 *(10:00-13:00)	Natural processes; Second Law of Thermodynamics; First Law of Thermodynamics	Sirirat
Jan 17, 2022	Gas expansion; Entropy	Sirirat
Jan 24, 2022	Internal energy, enthalpy and heat capacity; Measuring entropy; Gibbs energy	Sirirat
Jan 31, 2022	Chemical changes: standard states, enthalpies of formation, entropy and Gibbs energy changes; The Master Equations	Sirirat
Feb 7, 2022 *(10:00-13:00)	Chemical potential: mixing of ideal gases, reacting mixtures, definition, variation; Equilibrium constants	Sirirat
Feb 14, 2022	Chemical equilibrium: conditions and variations; Applications: chemical and biological systems	Sirirat
Feb 21, 2022	Microscopic basis of entropy: entropy and distributions; Phase equilibria: phase diagrams, equations of a phase boundary	Sirirat
Feb 28 to March 4, 2022	-- <i>Midterm Exam</i> --	
Mar 7, 2022	Molecular interactions: Electric properties of molecules, Interactions between molecules, Gases and liquids	Rakchart
Mar 14, 2022	Macromolecules and aggregates: determination of size and shape, structure, and dynamics, and self-assembly	Rakchart
Mar 21, 2022	Macromolecules and aggregates: determination of size and shape, structure, and dynamics, and self-assembly	Rakchart
Mar 28, 2022	Molecules in motions: molecular motion in gases, molecular motion in liquid, diffusion.	Rakchart
Apr 4, 2022	Molecules in motions: molecular motion in gases, molecular motion in liquid, diffusion.	Rakchart
Apr 11, 2022	The rate of chemical reaction: The rate of reaction, integrated rate laws, temperature dependent of reaction rate, elementary reaction, unimolecular reaction.	Rakchart
Apr 18, 2022	The kinetics of complex reaction: chain reactions, polymerization kinetics, photochemistry	Rakchart
April 25, 2022	Student Presentation and Revision	Rakchart
May 2-13, 2022	-- <i>Final Exam</i> --	