

## SCME 222 Physical Chemistry and Thermodynamics

Second Semester, Academic Year 2023-2024

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*. 8<sup>th</sup> 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*. 2<sup>nd</sup> Edition, Oxford University Press: Oxford, 2014.
3. Chang, R.; Goldsby, K. A., *Chemistry*. 12<sup>th</sup> Edition. McGraw-Hill: New York, 2016.

### Course Timetable for Lectures

<b>Date</b>	<b>Topics</b>	<b>Instructor</b>
Jan 8, 2024	Natural processes; Second Law of Thermodynamics; First Law of Thermodynamics	Sirirat
Jan 15, 2024	Gas expansion; Entropy	Sirirat
Jan 22, 2024	Internal energy, enthalpy and heat capacity; Measuring entropy; Gibbs energy	Sirirat
Jan 29, 2024	Chemical changes: standard states, enthalpies of formation, entropy and Gibbs energy changes; The Master Equations	Sirirat
Feb 5, 2024	Chemical potential: mixing of ideal gases, reacting mixtures, definition, variation; Equilibrium constants	Sirirat
Feb 12, 2024	Chemical equilibrium: conditions and variations; Applications: chemical and biological systems	Sirirat
Feb 19, 2024	Microscopic basis of entropy: entropy and distributions; Phase equilibria: phase diagrams, equations of a phase boundary	Sirirat
Feb 26, 2024	Revision	Sirirat
March 4-8, 2024	<i>--- Midterm Exam ---</i>	
Mar 11, 2024	<b>Macromolecules and aggregates:</b> determination of size and shape, structure, and dynamics, and self-assembly	Rakchart
Mar 18, 2024	<b>Macromolecules and aggregates:</b> determination of size and shape, structure, and dynamics, and self-assembly	Rakchart
Mar 25, 2024	<b>Molecules in motions:</b> molecular motion in gases, molecular motion in liquid, diffusion.	Rakchart
Apr 1, 2024	<b>Molecules in motions:</b> molecular motion in gases, molecular motion in liquid, diffusion.	Rakchart
Apr 8, 2024	<b>The rate of chemical reaction:</b> The rate of reaction, integrated rate laws, temperature dependent of reaction rate, elementary reaction, unimolecular reaction.	Rakchart
Apr 22, 2024	<b>The kinetics of complex reaction:</b> chain reactions, polymerization kinetics, photochemistry	Rakchart
April 29- May 10, 2024	<i>--- Final Exam ---</i>	