

CHEM 210: Chemical Application of Calculus and Physics, Spring 2025

Time and location: Monday 1:00-1:50 PM, GMCS-328

Instructor: Yuezhi Mao (he/him/his)

Email: ymao2@sdsu.edu

Office: GMCS 213D

Course Overview:

CHEM 210 is a 1-unit course designed to enhance students' understanding of the essential mathematical and physical concepts involved in CHEM 410A. It is intended to be taken concurrently with CHEM 410A so that the relevant materials in the latter will be reviewed in a timely manner. Concurrent enrollment in this course is *required* for 410A students who have received a grade below "C" (< 1.7) in any of the math and physics prerequisite and is also *strongly recommended for all other 410A students*. This course, in its current format, can be viewed as a guided study session focusing on solving problems that are similar to those in quizzes and exams. The problem-solving skills have turned out to be essential for students' success in CHEM 410A.

IMPORTANT NOTE: CHEM 210 is specifically designed to enhance student learning in CHEM 410A. *If you are not enrolled in 410A this semester, this course will not be suitable for you. You should register for this course ONLY when you are concurrently taking 410A.*

Student learning objectives:

At the end of this course, the students will be able to:

- Enhance their understanding of the mathematical concepts used to formulate the fundamental principles of quantum mechanics
- Efficiently solve calculus and other mathematical problems involved in physical chemistry
- Identify the mathematical formulas/equations needed to solve a given physical chemistry problem
- Describe the physical picture and the quantitative relationships that are underneath each model/example system discussed in CHEM 410A lectures
- Connect the mathematical equations and physical models to examples in chemistry
- Develop a growth mindset: tackle challenges with curiosity, view difficult concepts as brain workouts, and embrace mistakes as stepping stones to success; recognize that studying challenging subjects, like physical chemistry, is all about growth rather than a pursuit of perfection

Tentative course calendar:

Date	Content
01/27	Complex numbers; basic rules of differentiation/integration
02/03	Calculus of sine, cosine, and exponential functions
02/10	Operators and eigenvalues/eigenfunctions; normalization and orthogonality
02/17	The particle-in-a-box model and its chemical applications

02/24	Gaussian functions; quantum harmonic oscillators
03/03	Quantum mechanics for rotations in 2-D and 3-D
03/10	3-D rotation (continued); hydrogenic atoms
03/17	Hydrogenic atoms (continued); electronic configuration of many-electron atoms
03/24	Spin states of two electrons; spin-orbit coupling; atomic term symbols
03/31	Spring break (no class)
04/07	B-O approximation; VB theory; MO theory for homonuclear diatomic molecules
04/14	MO theory for heteronuclear diatomic molecules; Hückel theory
04/21	General concepts in molecular spectroscopy; rotational spectra
04/28	Calculations involved in vibrational spectra
05/05	Franck-Condon principle; vibrational fine structure of electronic spectra

Grading scheme:

There is no homework or exams in CHEM 210. *The grading for this course will be entirely based on attendance and participation.* There are a total of 14 meetings. **Each meeting takes up one point: 0.5 (attendance) + 0.5 (participation).** On-time attendance is required for students to receive full attendance credits, whereas partial attendance credit will be given to students who show up but are significantly late. After each meeting, all students will need to upload the pictures of their worksheet on Canvas, based on which the participation score will be given.

Expectations on the submitted work: The students should show some work by themselves during the class, as well as notes they took for the problems that the instructor went over on the whiteboard. The student can leave some problems blank if the instructor did not get a chance to talk about them. However, it is strongly recommended to go through all the problems on the handout after class, especially after the answer key is posted.

The letter grades will be assigned as follows:

Points	Grade	Points	Grade
12.5-14	A	6	C
11	A-	5	C-
10	B+	4	D+
9	B	3	D
8	B-	2	D-
7	C+	<2	F

Add/Drop Procedure: The add/drop deadline is **February 3, 2025**. Please refer to <https://registrar.sdsu.edu/students/registration> for full details. Starting from the 3rd class on Feb. 10, you must be an enrolled student to attend this class.

Essential student information:

For essential information about student academic success, please see the [SDSU Student Academic Success Handbook](#).

- SDSU provides disability-related accommodations via the Student Ability Success Center (sascinfo@sdsu.edu | sdsu.edu/sasc). Please allow 10–14 business days for this process. Please note that accommodations are not retroactive, and that the instructor cannot provide accommodations based on disability until an accommodation letter is received.
- Class rosters are provided to the instructor with each student's legal name. Please let the instructor know if you would prefer an alternate name and/or gender pronoun.