CHEM 106: Basic Inorganic Chemistry
Spring 2021
Loyola University Chicago

Course Description

This course is a lecture, discussion and laboratory course for chemistry majors and is a continuation of CHEM 105. Specific areas addressed are: properties of solutions, kinetics, equilibrium, chemical thermodynamics, and electrochemistry. Historical and current developments in chemistry as well as real problems that chemists address will be incorporated into the course. The laboratory involves the techniques and procedures of inorganic synthesis and analysis.

The emphasis of this course is on understanding content and principles and is not focused on memorizing and replicating algorithms. This means that students must foster problem solving skills, their ability to make claims based on evidence, and effectively communicating their thoughts and ideas. It is not enough to know *what* happens in chemistry, the student must also be able to explain *why* it happens.

Course Prerequisites

Successful completion (C- or better) in CHEM 105 and MATH 118 or equivalent.

Required Resources

(1) Brown, T. L., et. al (2017). *Chemistry: The Central Science, 14th ed (with MasteringChemistry).* Pearson Prentice Hall. ISBN 978-0-13-455212-5.
(2) Enrollment in this course on MasteringChemistry.com. Course ID: DAUBENMIRECHEM106SPRING21
(3) Moog, R.S. & Farrell, J.J. (2017). *Chemistry: A Guided Inquiry, 7th ed.* John Wiley & Sons, Inc. ISBN 978-0-13-455212-5 (paperback) or 978-1-119-29950-9 (e-text)
(4) *Sakai Connection*, sakai.luc.edu

Class Meeting Times and Locations

CHEM 106-002 (Discussion)	Tuesdays, 9:45-10:35 a.m.	Zoom via Sakai
CHEM 106-003 (Discussion)	Tuesdays, 11:30-12:20 p.m.	Zoom via Sakai
CHEM 106-001 (Lecture)	Tues./Thurs., 1:15-2:30 p.m.	Zoom via Sakai
CHEM 106-004 (Lab)	Wednesdays, 12:10-2:55 p.m.	Zoom via Sakai
CHEM 106-005 (Lab)	Wednesdays, 4:10-6:55 p.m.	Zoom via Sakai

The Team Supporting Your Learning

	Office Hours	*Office*	*Phone (office)*	*Phone (mobile)*	*Email*
Patrick L. Daubenmire, Ph.D, Associate Professor, Course Instructor	Th: 2:30-3:30 pm & by appt.	FH 415	773.508.8248	630.336.4180	pdauben@luc.edu
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Connection to the "Hungers" of Loyola University's Transformative Education
This course seeks to assist each student in fostering hungers associated with the University's model of transformative education[1]. The study of introductory chemistry can assist in development of the specific hungers below:

- A *Hunger for Integrated Knowledge* – by building an understanding of a variety of chemical concepts and applying them to problems in many contexts.
- A *Hunger for a Moral Compass* – by examining the variables, benefits, and detriments that exist at the interface of applied science, technology, environment, and society.
- A *Hunger for a Global Paradigm* – by understanding that chemistry is a human endeavor and it resides in the tension between helping and harming life.

Instructional Format – Process Oriented Guided Inquiry Learning (POGIL)
This course will not follow a traditional lecture format for delivery of course content and skill development. Instead this course will capitalize on students' current prevailing ideas and thoughts about sets of data or presented models. Then, through guided questions about the presented information, students, working in small groups, discuss ideas and come to consensus about answers to questions. These ideas are further developed in questions that force application of the agreed upon concepts. The instructor is the guide on this journey, pointing out areas that are particularly relevant or that may need attention, and redirecting students when necessary. This format is designed based on the idea that knowledge cannot be directly transmitted from one person to another. Instead, knowledge must be built by the learner his or herself based on their own experiences and in dialog and discussion with others.

Four key ideas about learning have emerged from current research about how people learn. These include:

1. Constructing our own understanding based on our prior knowledge, experiences, skills, attitudes, and beliefs.
2. Following a learning cycle of exploration, concept formation, and application.
3. Discussing and interacting with others.
4. Reflecting on progress and assessing performance.

All of these ideas are incorporated into the design of POGIL in order to help students learn both discipline content and key process skills simultaneously, POGIL is built on this research base with the principles that most students learn best when they are:

1. Engaged and thinking in the classroom and laboratory.

[1] http://www.luc.edu/transformativeed/

2. Drawing conclusions by analyzing data, models, or examples and by discussing Ideas.
3. Working together in self-managed teams to understand concepts and to solve problems.
4. Reflecting on what they have learned and on improving their performance.
5. Interacting with an instructor as a facilitator of learning and peer as collaborating in building understanding of the chemistry content.

To support this research-based learning environment, POGIL uses learning teams, guided-inquiry activities to develop understanding, questions to promote critical and analytical thinking, problem solving, reporting, metacognition, and individual responsibility. These components are the tools for developing process skills and the mastery of discipline content and will use a blend of venues between face-to-face and online environments.

You will work together in learning teams through a series of ChemActivities (CA) modules. The modules are designed to help you acquire knowledge and develop understanding through guided inquiry - examining data, models, or examples followed by responding to critical thinking questions (CTQ). Generally, data are presented before a theoretical explanation, whereby the CTQ lead the student through the thought processes which results in the building of a certain theoretical model. This is what makes these modules guided-inquiry. Exercises & Problems are included to reinforce the concepts being presented.

For the ChemActivities (CA) modules, you will be placed into groups of 3 or 4 students with the following designations within each group: Manager, Recorder, Technician, & Present.

The roles you may have throughout the semester when working in groups include:

- *Manager*: The student in this role ensures that the group is functioning efficiently and progressing within the time frame set by the instructor. This student is not a supervisor, but a full participant. Additionally, this student monitors the participation of all group members to make sure all ideas have been heard.

- *Recorder*: The student in this role transcribes the agreed upon responses of the group to questions and problems. The recorder is not solely responsible for doing the work, but is responsible for accurately recording the results of the group's work. There will be times during the semester when the group's answer(s) to certain questions will be collected. The recorder submits these responses.

- *Technician*: The student in this role primarily handles calculations and the management of equipment for the group. If special operating instructions are needed for an instrument during an activity, the technician is the point person for these applications and will be trained as necessary.

- ❖ *Presenter*: The student in this role represents the group during all class discussions or during inter-group interactions. Similarly to the recorder, the presenter's responses should accurately reflect the results of the work of the group.

Supplemental Instruction (SI) Availability
There are Supplemental Instruction (SI) study sessions available for this course. SI sessions are led by an SI leader, who is a student that has recently excelled in the course. Session attendance is open to all and is voluntary, but extremely beneficial for those who attend weekly. Times and locations for the SI session can be found here: www.luc.edu/tutoring. Students who attend these interactive sessions find themselves working with peers as they compare notes, demonstrate and discuss pertinent problems and concepts, and share study and test-taking strategies. Research shows students whom regularly attend sessions have higher grades at the end-of-the-semester and more deeply understand course concepts than those who do not. Students are asked to arrive with their Loyola ID, lecture notes, and textbook.

Academic Honesty
Academic honesty is an expression of interpersonal justice, responsibility and care, applicable to Loyola University faculty, students, and staff, which demands that the pursuit of knowledge in the university community be carried out with sincerity and integrity. The School of Education's Policy on Academic Integrity can be found at: http://www.luc.edu/education/academics_policies_integrity.shtml. For additional academic policies and procedures refer to: http://www.luc.edu/education/academics_policies_main.shtml

Accessibility
Students who have disabilities which they believe entitle them to accommodations under the Americans with Disabilities Act should register with the Services for Students with Disabilities (SSWD) office. To request accommodations, students must schedule an appointment with an SSWD coordinator. Students should contact SSWD at least four weeks before their first semester or term at Loyola. Returning students should schedule an appointment within the first two weeks of the semester or term. The University policy on accommodations and participation in courses is available at: http://www.luc.edu/sswd/

Harassment (Bias Reporting)
It is unacceptable and a violation of university policy to harass, discriminate against or abuse any person because of his or her race, color, national origin, gender, sexual orientation, disability, religion, age or any other characteristic protected by applicable law. Such behavior threatens to destroy the environment of tolerance and mutual respect that must prevail for this university to fulfill its educational and health care mission. For this reason, every incident of harassment, discrimination or abuse

undermines the aspirations and attacks the ideals of our community. The university qualifies these incidents as incidents of bias.

In order to uphold our mission of being Chicago's Jesuit Catholic University-- a diverse community seeking God in all things and working to expand knowledge in the service of humanity through learning, justice and faith, any incident(s) of bias must be reported and appropriately addressed. Therefore, the Bias Response (BR) Team was created to assist members of the Loyola University Chicago community in bringing incidents of bias to the attention of the university. If you believe you are subject to such bias, you should notify the Bias Response Team at this link: http://webapps.luc.edu/biasreporting/

Safety
Students must adhere to proper safety protocols and practices when conducting classroom activities and laboratory investigations. A separate agreement describing these practices must be signed before a student may participate in coursework.

Course Evaluation
Grades will be assigned in the course according to the following sources:

Table 1. Grade Criteria

Criteria	Maximum Percent Value
CHEM 105 – Lecture, Lab, Discussion (4.0 credits)	
participation, group responses, and reports	5 %
online quizzes, dynamic study modules, & homework sets	10 %
laboratory preparation & weekly reports	10 %
Tests	25 %
laboratory problem reports & calibrated peer review	20 %
final exam	30 %

Participation, group responses and reports will be an important part of the class. This work will be a combination of individual and group work. Students must be present during class sessions in order to receive credit for these assignments. The two lowest scores on these assignments will be dropped from your course evaluation.

Online quizzes will be administered via *MasteringChemistry* on roughly a weekly basis. Content from the previous sessions (whole class and small group) will be the source of

material on each quiz. The two lowest quiz scores will be dropped from your course evaluation. Quizzes will be available for a window of time on the dates indicated below. They are also timed, which means that one you begin you have 20 minutes to complete the quiz. Missed quizzes do not have the option to be made-up.

Dynamic Study Modules mini assessments that help you hone in on what you know in a topic area and what still needs to be learned. The modules will assess your knowledge and only show questions they still need to practice. Late assignments will not be accepted.

Online Homework Sets will be assigned weekly. Submitted responses must be the result of your individual work and effort. The two lowest homework sets scores will be dropped from your course evaluation.

Laboratory Preparation & Weekly Reports will be a regular part of weekly laboratory work. Pre-laboratory assignments are to be completed prior to each laboratory session, and the written weekly lab report is due by the beginning of the next lab session. The two lowest scores in this category will be dropped from your grade evaluation.

Written Reports to Laboratory Problems will be assigned at two different points in the semester. These problems will require students to use skills and ideas developed in prior laboratory activities in order to formulate an acceptable solution and full written report to communicate results effectively.

Calibrated Peer Review (CPR) is online writing and critical thinking process in which students, once trained, provide personalized feedback to other students on written work. This process will be used with the full written reports.

Tests will be administered twice during the course. Each will primarily reflect the content and concepts developed during prior class sessions. The multiple choice will be administered via the *Masteringchemistry* platform, and like the quizzes, will be available only during your discussion time, and will be timed at 50 minutes. The free response portion of the tests will be administered during the lecture time and will be delivered on paper.

The *Final Exam* will be designed to assess students comprehensive knowledge of concepts and skills developed during the work of the semester.

Missed or late assignments will not be accepted for unexcused reasons. To decide if reasons are excused, instructors may ask for documentation or other verification and their decision about an excuse is final.

Table 2. Proposed Grading Scale

92.00% or greater	A
91.99% - 90.00%	A-

89.99% - 88.00%	B+
87.99% - 82.00%	B
81.99% - 80.00%	B-
79.99% - 78.00%	C+
77.99% - 72.00%	C
71.99% - 70.00%	C-
69.99% -68.00%	D+
67.99% - 60.00%	D
59.00%-0.00%	F

Loyola University Absence Policy for Students in Co-Curricular Activities:
Students missing classes while representing Loyola University Chicago in an official capacity (e.g. intercollegiate athletics, debate team, model government organization) shall be allowed by the faculty member of record to make up any assignments and to receive notes or other written information distributed in the missed classes. Students should discuss with faculty the potential consequences of missing lectures and the ways in which they can be remedied. Students must provide their instructors with proper documentation (develop standard form on web) describing the reason for and date of the absence. This documentation must be signed by an appropriate faculty or staff member, and it must be provided as far in advance of the absence as possible. It is the responsibility of the student to make up any assignments. If the student misses an examination, the instructor is required to give the student the opportunity to take the examination at another time. (https://www.luc.edu/athleteadvising/attendance.shtml)

Practices for Success
Supporting claims with evidence, making applications, solving and analyzing problems, and using chemical principles to explain phenomena are critical skills in the field of chemistry. The development of these skills is not without some frustration, but it carries the reward of deepening one's ability to think critically and solve problems in any field. To do this, one may have to assess, evaluate, and possibly revise approaches to learning. The use of targeted, guiding questions, regularly scheduled work, and strategic study plans can greatly assist the learning of chemistry. With such a focus, hopefully any frustration will quickly turn to appreciation and fascination for the relevance and connectedness of chemistry in your life and within the world around you. Solving and analyzing problems is the most important feature of this work. If, at any time, you need assistance framing such plans for your work in chemistry, please do not hesitate to ask the instructor.

Norms of Course Proceedings
The classroom is to be a safe place to question and explore ideas. Student and teacher voices are important to this work. Collegial disagreement can be a healthy part of this process, but must always include respect for all members of the class.

Course activities will be designed to help students reach the goal of learning chemistry content and developing thinking skills. This will more often driven by the use of data and reasoning to discover concepts and solutions rather than the identification and exchange of chemical facts and algorithms.

Class sessions will begin and end on time. All students should attend class regularly and participate in class discussions. Multiple absences could affect one's ability to learn chemistry during this semester. Anticipated absences should be discussed with the instructor two class days before the absence. Proper documents may be requested to verify the reason for any absence. This is particularly relevant to days missed that include an in-class assessment for which a student is asking for a make-up.

Cell phones and the use of texting devices should be used in appropriate and professional manner. These devices should not distract other participants in the course.

Email messages among students in the course should also be respectful, appropriate, and professional. Response time to email messages is acceptable within 48 hours.

Completed course assignments must be submitted at the beginning of the class session or by the time specified on the due date. Late assignments may not be accepted without proper verification of reasons.

Course Repeat Rule
Students are allowed only THREE attempts to pass Chemistry courses with a C- or better grade. The three attempts include withdrawals (W). After the second attempt, the student must secure approval for a third attempt. Students must come to the Chemistry Department, fill out a permission to register form or print it from the Department of Chemistry & Biochemistry website: http://www.luc.edu/chemistry/forms/ and personally meet and obtain a signature from either the Undergraduate Program Director, Assistant Chairperson, or Chairperson in Chemistry. A copy of this form is then taken to your Academic Advisor in Sullivan to secure final permission for the attempt.

Recording of Zoom class meeting
In this class software will be used to record live class discussions. As a student in this class, your participation in live class discussions will be recorded. These recordings will be made available only to students enrolled in the class, to assist those who cannot attend the live session or to serve as a resource for those who would like to review content that was presented. All recordings will become unavailable to students in the class when the course has concluded. *Students will be required to turn on their cameras at the start of class. Students who have a need to participate via audio only must reach out to me to request audio participation only without the video camera enabled.* The use of all video recordings will be in keeping with the University Privacy Statement shown below.

Privacy Statement

Assuring privacy among faculty and students engaged in online and face-to-face instructional activities helps promote open and robust conversations and mitigates concerns that comments made within the context of the class will be shared beyond the classroom. As such, recordings of instructional activities occurring in online or face-to-face classes may be used solely for internal class purposes by the faculty member and students registered for the course, and only during the period in which the course is offered. Students will be informed of such recordings by a statement in the syllabus for the course in which they will be recorded. Instructors who wish to make subsequent use of recordings that include student activity may do so only with informed written consent of the students involved or if all student activity is removed from the recording. Recordings including student activity that have been initiated by the instructor may be retained by the instructor only for individual use.

Table 3. Proposed Semester Topics & Schedule[2]

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
Week 01: Jan 18-24	Discussion & Class Sessions	Introduction to Chemical Equilibrium	14.1, 14.2, & Chapter 15 (BLBMW); CA 34-36 (Moog & Farrell)	*Homework #01* (due by 11:59 pm CST on Monday, Jan. 25)
	Lab Session 01	Intro to Lab Safety in Lab Labster: Demo	Labster	Laboratory Safety (Labster)
Week 02: Jan 25-31	Discussion & Class Sessions	Chemical Equilibrium cont.	Chapter 15 (BLBMW); CA 37-39 (Moog & Farrell)	*Homework #02* (due by 11:59 CST pm on Monday, Feb. 01)
	Lab Session 02	*Lab #01* – Recrystallization: Dissolve your solid and precipitate your crystals	Labster via Sakai	

[2] The schedule of topics is approximate. Depending on class needs, some topics may need more time, and we will adjust the schedule accordingly. Test and exam dates, however, do not change. The content of those assignments, though, will be adjusted to align with any schedule changes.

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
Week 03: Feb 01-07	Discussion & Class Sessions	Acids, Bases, & Equilibrium	Chapter 16 (BLBMW); CA 40-43 (Moog & Farrell)	*Homework #03* (due by 11:59 pm CST on Monday, Feb. 08) *Quiz #01* (timed, and due by 11:59 pm CST on Tuesday, Feb. 02)
	Lab Session 03	*Lab #02* – HPLC	Labster via Sakai	
Week 04: Feb 08-14 (no class on Feb. 11, first semester break)	Discussion & Class Sessions	Continuation with Acid-Base Equilibria	Chapter 16 (BLBMW); CA 44 & 45 (Moog & Farrell)	*Homework #04* (due by 11:59 pm CST on Monday, Feb. 15)
	Lab Session 04	*Lab Problem #01*	Sakai assignment	Problem completed by 11:59 pm on Fri., Feb. 19
Week 05: Feb. 15-21	Discussion & Class Sessions	*TEST #01* (Tuesday, Feb. 16 Discussion & Lecture); Continuation with Acid-Base Equilibria	Chapter 16 (BLBMW); CA 44 & 45 (Moog & Farrell)	*Homework #05* (due by 11:59 pm CST on Monday, Feb. 22)
	Lab Session 05	*Calibrated Peer Review Problem #01*	Lab Manual, p. 81	Reviews completed by 11:59 pm on Tues., Feb. 23
Week 06: Feb. 22-28	Discussion & Class Sessions	Additional Aspects of Aqueous Equilibria	Chapter 17 (BLBMWS)	*Homework #06* (due by 11:59 pm CST on Monday, Mar. 01)
	Lab Session 06	*Lab #03* – Equilibrium	Labster via Sakai	

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
Week 07: Mar 01-07	Discussion & Class Sessions	The Electrochemical Cell & Cell Voltage	Chapter 20 (BLBMWS); CA 46-49 (Moog & Farrell)	*Homework #07* (due by 11:59 pm CST on Monday, Mar. 08) *Quiz #02* (timed, and due by 11:59 pm CST on Tuesday, Mar. 02)
	Lab Session 07	*Lab #04* – Acids and Bases	Labster via Sakai	
Week 08: Mar 08-14 (no class on Mar. 09, second semester break	Discussion & Class Sessions	The Electrochemical Cell & Cell Voltage	Chapter 20 (BLBMWS); CA 46-49 (Moog & Farrell)	*Homework #08* (due by 11:59 pm CST on Monday, Mar. 15)
	Lab Session 08	*Lab #05 – Advanced* Acids and Bases	Labster via Sakai	
Week 09: Mar 15-21	Discussion & Class Sessions	Chemical Thermodynamics & Entropy	Chapter 19 (BLBMWS); CA 50-54 (Moog & Farrell)	*Homework #09* (due by 11:59 pm on Monday, Mar. 22) *Quiz #03* (timed, and due by 11:59 pm on Tuesday, Mar. 16)
	Lab Session 09	*Lab Problem #02*	Sakai assignment	Problem completed by 11:59 pm on Tues., Mar. 23

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
Week 10: Mar. 22-28	Discussion & Class Sessions	Chemical Kinetics	Chapter 14 (BLBMW); CA 55-58 (Moog & Farrell)	*Homework #10* (due by 11:59 pm on Monday, Mar. 29)
	Lab Session 10	*Calibrated Peer Review Problem #02*	Sakai assignment	Reviews completed by 11:59 pm on Fri., Apr. 02
Week 11: Mar. 29-Apr. 04	Discussion & Class Sessions	*TEST #02* (Tuesday, Mar. 30; Discussion & Lecture); Chemical Kinetics cont.	Chapter 14 (BLBMW); CA 59-60 (Moog & Farrell)	*Homework #11* (due by 11:59 pm on Monday, Apr. 05)
	Lab Session 11	*Lab #06 – Fermentation: Optimize bio-ethanol production*	Labster via Sakai	
Week 12: Apr. 05-11	Discussion & Class Sessions	*Topics TBD*		*Homework #12* (due by 11:59 pm on Monday, Apr. 12)
	Lab Session 12	*Lab #07 – Redox reactions: Discover how batteries work*	Labster via Sakai	
Week 13: Apr 12-18	Discussion & Class Sessions	*Topics TBD*		*Homework #13* (due by 11:59 pm on Monday, Apr. 19) *Quiz #03* (timed, and due by 11:59 pm on Tuesday, Apr. 13)

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
	Lab Session 13	*Lab #08 – Reaction rates: the essentials*	Labster via Sakai	
Week 14: Apr. 19-25	Discussion & Class Sessions	*Topics TBD*	tbd	*Homework #14* (due by 11:59 pm on Monday, Apr. 26)
	Lab Session 14	*Lab Problem #03*	Sakai assignment	Problem completed by 11:59 pm on Tues., Apr. 27
Week 15: Apr. 26-May 02	Discussion & Class Sessions	*Topics TBD; Semester Review*	tbd	*Quiz #04* (timed, and due by 11:59 pm on Tuesday, Apr. 27)
	Lab Session 15	*Calibrated Peer Review Problem #03*	Sakai assignment	Reviews completed by 11:59 pm on Sun., May. 02
Exam Week	Friday, May 07, 1-3 pm	CHEM 106 FINAL EXAM, Zoom Classroom		