CHEM 106: Basic Inorganic Chemistry
Spring 2012
Loyola University Chicago

	Instructor:	**Laboratory Assistants:**	
	Patrick L. Daubenmire, Ph. D.	Mary van Opstal	Kyle Webster
Office:	FH 415/416	FH 416	FH 106/410
Phone (office):	773.508.8248		
Phone (mobile):	630.336.4180		
Email:	pdauben@luc.edu	mtwist@luc.edu	kwebster3@luc.edu
Office hours:	Tu 2:30-3:30 W 11:00-12 noon, & by appointment	M 1-2 pm, & by appointment	
Class Meeting Times:	*Discussion* M 2:45-4:45 pm Dumbach 123	*Lecture* TuTh 1:00-2:15 pm Dumbach 233	*Lab* W 2:45-5:30 pm Flanner 305

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

The emphasis of this course is on understanding and prediction rather than memorization. This means that students must foster their problem solving skills and their ability to communicate results effectively. It is not enough to know *what* happens, the student is also expected to be able to explain *why* it happens.

Course Prerequisites
Successful completion (C- or better) in CHEM 105 and MATH 118 or higher.

Required Resources
(1) Brown, T. L., et. al (2012). *Chemistry: The Central Science, 12th ed (with MasteringChemistry).* Pearson Prentice Hall. ISBN 978-0-321-74105-9.
(2) Moog, R.S. & Farrell, J.J. (2008). *Chemistry: A Guided Inquiry, 4th ed.* John Wiley & Sons, Inc. ISBN 978-0-470-12926-5
(3) *Blackboard Connection*, blackboard.luc.edu

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 examining the variables, benefits, and detriments that exist at the interface of applied science, technology, environment, and society.

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, in small groups, discuss ideas and come to consensus about answers to questions. 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. This format is designed based on the idea that learning cannot be directly transmitted from one person to another. Knowledge must be built by the learner which results from interpretation and reflection on experiences in particular contexts, such as the chemistry classroom.

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.

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

- *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.

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 106 – Lecture, Lab, Discussion (4.0 credits)	
Quizzes & Online Homework Sets	10 %
Participation, group responses, and reports	5 %
Laboratory preparation & weekly reports	10 %
Tests	20 %
Solutions to Laboratory Problems & Lab Assessments	30 %
Final Exam	25 %

Quizzes will be administered via *MasteringChemistry* at the beginning of each week during the discussion time, specifically 2:45-3:15 pm on Mondays. 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.

Online Homework Sets will be assigned weekly. Submitted responses must be the result of your individual effort and synthesis and are due by the beginning of the first session of each week (2:45 pm on Mondays). The two lowest homework sets scores will be dropped from your course evaluation.

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.

Laboratory Preparation & Weekly Reports will be a regular part of weekly laboratory work. Pre-laboratory questions and assignments are to be completed prior to each laboratory session, and a written weekly lab report is due by the beginning of each Thursday class session (1:00 pm). The two lowest scores in this category will be dropped from your grade evaluation.

Solutions to Laboratory Problems will be assigned at four 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.

Table 2. Assessment Rubric for Solutions to Laboratory Problems (39 points total)[2]

Section	Criteria	Description & Characteristics
Introduction	Context	Report demonstrates a clear understanding of the 'big picture' and addresses the following questions: • Why is this question important/useful/ necessary in chemical analysis? • What do we know already? What problem/question is this experiment addressing?
	Accuracy & Relevance	Content knowledge described relevant to this experiment is accurate, relevant, and provides appropriate background information, including defining critical terms.
Questions & Hypothesis/es	Testable	Hypothesis/es and/or questions are clearly stated, testable, scientifically relevant and consider plausible alternative explanations where necessary.

[2] derived from Timmerman, et. al 2011

Section	Criteria	Description & Characteristics
Methods	Controls & Replication	Appropriate controls (including appropriate replication) are present and explained.
	Experimental Design	Experimental design is likely to produce salient and fruitful results. The design focuses on relevant tests for the hypothesis/es & question(s) posed.
Results	Data Selection	Data chosen are comprehensive, accurate, and relevant.
	Data analysis	Data analysis is appropriate for hypotheses tested and appears correctly performed and interpreted with relevant values reported and explained.
	Data presentation	Data are summarized in logical format. Table or graph types are appropriate. Data are properly labeled including units. Graphs are appropriately labeled and scaled. Captions, if any, are informative and complete.
Discussion	Conclusions	Conclusions are clearly and logically drawn from data provided. A logical chain of reasoning from hypothesis to data to conclusions is clearly and persuasively explained. Conflicting data, if present, are adequately addressed.
	Alternative Explanations	Alternative explanations (hypotheses) are considered and clearly eliminated in persuasive discussion.
	Limitations of design	Limitations of the data and/or experimental design and corresponding implications for data interpretation are discussed.
Connection to other knowledge		Writer provides a relevant, accurate, and reasonable discussion of how this experiment relates to other knowledge in the chemistry.
Writing quality		Grammar, word usage and organization facilitate understanding of the report.

Tests will be administered at two different points during the course. Each will primarily reflect the content and concepts developed during prior class sessions. Tests will be available for a limited timeframe online. Completed responses to tests must be returned prior to the end of this timeframe.

The *Final Exam* will be designed to assess students comprehensive knowledge of concepts developed during the work of the semester. Like the tests, the final will be available for a scheduled and limited timeframe. Completed responses to the final must be returned prior to the end of this timeframe.

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 learning 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 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 three days.

Completed course assignments must be submitted by 5:00 pm on the due date. Late assignments may not be accepted without proper verification of reasons.

Table 3. Proposed Semester Topics & Schedule

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
Week 01: Jan. 16-22	MLK Holiday	NO CLASS SESSION		
	Lecture 1.1	Orientation to CHEM 106 Transition from CHEM 105	Syllabus	
	Lab 1	*Orientation & Lab Problem #01*	Handout	Pre-laboratory assignment
	Lecture 1.2	Pre-course surveys & assessments	Various Handouts	
Week 02: Jan. 23-29	Discussion	Intermolecular Forces	Chapter 11 (BLBMW); ChemActivity (CA) 27 (Moog & Farrell)	MC Online Homework Week 01
	Lecture 2.1	Properties of Liquids	Chapter 11 (BLBMW)	
	Lab 2	Chemicals in Everyday Life	Catalyst Laboratory Experiments, p. 13-26	Lab Problem #01 Report & Pre-laboratory assignment
	Lecture 2.2	Solids	Chapter 12 (BLBMW); CAs 24 & 25 (Moog & Farrell)	Weekly Lab Report
Week 03: Jan 30-Feb 05	Discussion	MC Quiz; Introduction to properties of solutions	Chapter 13 (BLBMW); CA 32 Moog & Farrell)	MC Online Homework Week 02
	Lecture 3.1	Factors Affecting Solubility, Colligative Properties, Colloids	Chapter 13 (BLBMW)	
	Lab 3	*Lab Problem #02*	Handout	Pre-laboratory assignment

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
	Lecture 3.2	The Concept of Equilibrium	Chapter 15 (BLBMW); CA 36 & 37 (Moog & Farrell)	Weekly Lab Report
Week 04: Feb 06-12	Discussion	MC Quiz; The Equilibrium Constant	Chapter 15 (BLBMW); CA 38 (Moog & Farrell)	MC Online Homework Week 03
	Lecture 4.1	Calculating Equilibrium Constants	Chapter 15 (BLBMW); CA 39 (Moog & Farrell)	
	Lab 4	Colligative Properties	Catalyst Laboratory Experiments, p. 55-70	Pre-laboratory assignment
	Lecture 4.2	LeChatelier's Principle & the Reaction Quotient	Chapter 15 (BLBMW); CA 40 (Moog & Farrell)	
Week 05: Feb 13-19	Discussion	TEST 01		
	Lecture 5.1	The Solubility Product	Chapter 17.4 (BLBMW); CA 41 (Moog & Farrell)	
	Lab 5	Colourimetric Determination of K_{eq}	Catalyst Laboratory Experiments, p. 71-88	Lab Problem #02 Report & Pre-laboratory assignment

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
	Lecture 5.2	Characteristics and Strengths of Acids and Bases	Chapter 16 (BLBMW); CA 42 & 43 (Moog & Farrell)	Weekly Lab Report
Week 06: Feb 20-26	Discussion	MC Quiz; Weak Acid/Base Dissociation	Chapter 16 (BLBMW); CA 44 (Moog & Farrell)	MC Online Homework Week 05
	Lecture 6.1	Acids & Bases Equilibrium Constants	Chapter 16 (BLBMW)	
	Lab 6	Introduction to Qualitative Analysis	Catalyst Laboratory Experiments, p. 27-54	Pre-laboratory assignment
	Lecture 6.2	pH and Relative Acid Strength	Chapter 16 (BLBMW); CA 45 & 46 (Moog & Farrell)	Weekly Lab Report
Week 07: Feb 27-Mar 04	Discussion	MC Quiz; The Strength of Conjugate Pairs	Chapter 16 (BLBMW); CA 47 (Moog & Farrell)	MC Online Homework Week 06
	Lecture 7.1	Additional Aspects of Aqueous Equilibria	Chapter 17 (BLBMW)	
	Lab 7	Titration of Acids & Bases	Catalyst Laboratory Experiments, p. 89-104	Pre-laboratory assignment
	Lecture 7.2	Additional Aspects of Aqueous Equilibria cont.	Chapter 17 (BLBMW)	Weekly Lab Report
Week 08: Mar 05-11	SPRING BREAK – NO CLASS SESSIONS			

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
Week 09: Mar 12-18	Discussion	MC Quiz; Redox Reactions & Oxidation Numbers	Chapter 20 (BLBMW); CA 48 & 49 (Moog & Farrell)	MC Online Homework Week 07
	Lecture 9.1	The Electrochemical Cell & Cell Voltage	Chapter 20 (BLBMW); CA 50 & 51 (Moog & Farrell)	
	Lab 9	*Lab Problem #03*	Handout	Pre-laboratory assignment
	Lecture 9.2	Applications of Redox Reactions	Chapter 20 (BLBMW)	
Week 10: Mar 19-25	Discussion	TEST 02		
	Lecture 10.1	Introduction to Chemical Thermodynamics & Entropy	Chapter 19 (BLBMW); CA 52 & 53 (Moog & Farrell)	
	Lab 10	*Lab Problem #04*	Handout	Lab Problem #03 Report & Pre-laboratory assignment
	Lecture 10.2	Entropy Changes in Chemical Reactions; Gibbs Free Energy	Chapter 19 (BLBMW); CA 54 (Moog & Farrell)	Weekly Lab Report
Week 11: Mar 26- Apr 01	Discussion	Equilibrium & Thermodynamics	Chapter 16 (BLBMW); CA 55 & 56 (Moog & Farrell)	MC Online Homework Week 10

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
	Lecture 11.1	Rates of Chemical Reactions (II)	Chapter 14 (BLBMW); CA 57 (Moog & Farrell)	
	Lab 11	Solubility & Thermodynamics	Catalyst Laboratory Experiments, p. 205-116	Lab Problem #04 Report & Pre-laboratory assignment
	Lecture 11.2	Integrated Rate Laws	Chapter 14 (BLBMW); CA 58 (Moog & Farrell)	Weekly Lab Report
Week 12: Apr 02-08	Discussion	MC Quiz; Reaction Mechanisms	Chapter 14 (BLBMW); CA 59 (Moog & Farrell)	MC Online Homework Week 11
	Lecture 12.1	Reactions Mechanisms cont.	Chapter 14 (BLBMW); CA 60 & 61 (Moog & Farrell)	
	Lab 12	Rates of Reaction: rate and order of H_2O_2 decomposition	Catalyst Laboratory Experiments, p. 117-134	Pre-laboratory assignment
	Lecture 12.2	Activation Energy & Catalysis	Chapter 14 (BLBMW); CA 62 (Moog & Farrell)	Weekly Lab Report
Week 13: Apr 09-15	Discussion	EASTER HOLIDAY: NO CLASS SESSION		

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
	Lecture 13.1	MC Quiz; Class selected topics for completing the semester, options can include: • the chemistry of life • chemistry of the environment & issues of sustainability • nuclear chemistry • chemistry of nonmetals • transition metals and coordination chemistry • modern materials • others (based on students' interest)		MC Online Homework Week 12
	Lab 13	*Lab Problem #05*		Pre-laboratory assignment
	Lecture 13.2	tbd		Weekly Lab Report
Week 14: Apr 16-22	Discussion	tbd		MC Online Homework Week 13
	Lecture 14.1	tbd		
	Lab 14	*Lab Problem #06*		Lab Problem #05 Report & Pre-laboratory assignment
	Lecture 14.2	tbd		
Week 15: Apr 23-29	Discussion	MC Quiz; Post-course surveys & assessments		MC Online Homework Week 15

Date (Week)	Session	Topics	Resources & Practice	Assignments Due
	Lecture 15.1	Semester Review		Lab Problem #06 Report & Pre-laboratory assignment
	Lab 15	Final surveys & assessments; clean-up and check-out		
	Lecture 15.2	Semester Review		
Exam Week: Apr 30- May 08	Friday, May 04, 1-3 pm	FINAL EXAM, Dumbach 233		