

Brooklyn College
Advanced Inorganic Chemistry CHEM 4761/CHEM 7761G – Spring 2017

Lecture Tuesdays 6:30-9:15 PM Room 1127N

Professor Maria Contel

Contact information:

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Office hours: Tuesdays: 12:00-1:00 PM; Thursdays 4:30-5:30 PM

(if you need to see me at other times, please call or email for appointment at least 24 hours in advance).
Appointments requests received during the weekend will be processed on Mondays. *I will not check emails on Saturdays and on Sundays.*

Course Description:

This course will introduce students to the contents of advanced inorganic chemistry. This course will focus on the study of symmetry and group theory, molecular orbitals, coordination and organometallic chemistry, crystalline solid state, environmental, bioinorganic and green chemistry. The laboratory course is designed to get basic training in inorganic chemistry synthesis (coordination and organometallic complexes, solid state), characterization techniques (including multinuclear NMR), bioinorganic chemistry and homogeneous catalysis. The concepts learnt in this course will be helpful for students planning to continue studying inorganic chemistry and taking other advanced courses in this discipline as well as for students planning to study other areas of chemistry.

Learning Goals:

Upon completion of the course, students should be able to:

- Predict electronic configurations, periodic trends and structures and approximate angles of molecules.
- Recognize most common point groups for a molecule and identify symmetry of orbitals and vibrations. Build qualitative molecular orbitals (MO) for small and large molecules, identify hard/soft acids and bases and predict reactivity.
- Know the fundamentals of coordination and organometallic chemistry (nomenclature, isomerism, principles of ligand field theory, MO, ligands, fundamental reactions and study of reactions mechanisms, principles of homogeneous catalysis).
- Know the principles of solid-state chemistry (ionic solids, thermodynamics of ionic crystal formation, metallic bonding, conductance of metals, silicates).
- Know the fundamentals of bioinorganic, environmental and green chemistry (representative examples of bioinorganic compounds and their actions, examples of the environmental effects of both metals and non-metals, principles of green chemistry).

Textbook:

Required:

Inorganic Chemistry, Gary L Miessler, Paul J. Fischer and Donald Tarr, 5th Ed, Pearson – Prentice Hall (2013). 4th Ed ok as well

Solutions Manual for Inorganic Chemistry (Miessler & Tarr)

Highly recommended:

- Inorganic/organic molecular models

Other Recommended books

- Inorganic Chemistry, Shriver & Atkins, 5th Edition, Freeman (2010)
- Molecular Symmetry and Group Theory, Alan Vincent, 2nd Ed, Wiley (2001)

Grading: The final grade will be determined as follows:

Grade based on 3 individual tests and 9 individual/team RAT assessments

First Peer Evaluation (non-graded): Each individual will evaluate the contributions of all the other team members by completing the quantitative and qualitative portions of the midterm peer evaluation form located at the end of the syllabus. This form will be collected on the day of test 1. The results will be disseminated anonymously to all team members by Prof. Contel.

Final Peer Evaluation (graded): At the end of the term, it is necessary for all members of this class to assess the contributions that each member of the team made to the work of the team. This contribution should presumably reflect your judgment of such things as:

Preparation - Were they prepared when they came to class?

Contribution - Did they contribute productively to group discussion and work?

Respect of others' ideas - did they encourage others to contribute their ideas?

Flexibility - Were they flexible when disagreements occurred?

It is important that you raise the evaluation of people who truly worked hard for the good of the group and lower the evaluation of those you perceived not to be working as hard on group tasks. See Final Peer Evaluation Form.

Course Evaluation

Individual Performance: 80%		Team Performance: 20%	
Individual RATs (9)	14%	Team RATs (9)	15%
Test 1	22%	Peer Evaluation	5%
Test 2	22%		
Test 3	22%		

Final course grade (based on a total of 100): 100-90 A⁺, 89-85 A, 84-80 A⁻, 79-75 B⁺, 74-70 B, 69-65 B⁻, 64-60 C⁺, 59-55 C, 54-50 C⁻, 49 or less F.

Tentative schedule and dates for the tests:

	TEST 1	TEST 2	TEST 3
Date	March 17th	April 14th	May 24th
Material covered	Units 1-3	Units 3cont-4	Units 5-7

Graphing calculators and cell phones are not allowed on exams! Pencils cannot be used to write exams. Exams written with pencil will not be graded.

Tests will be different for undergraduate and graduate students (harder for the later). RATs will be the same as all students will be distributed in teams. Graduate students and students looking for honors grade will have to complete assignments.

Issues of Courtesy: Lecture will start as scheduled, at 6:30 PM. Please arrive on time (especially on RAT or test days when the RATs or tests will be distributed immediately after class starts!), with your cell phone, pager, and/or other electronic devices turned off.

Teaching Method

This course will be using the Team-Based Learning (TBL) strategy (www.teambasedlearning.org).

TBL will increase students' understanding of course concepts by using them to solve authentic, real-world problems and help them develop their workplace learning skills. The primary course objective shifts from content transmission (lectures) to helping students learn how to use course content to solve significant problems; in fact, an important fraction of class time will be spent solving problems and making decisions. It will be done in a way that will hold teams accountable for using course content to make decisions (solve problems) that will be reported publically and subject to cross-team discussion/critique.

Overview of TBL Sequence

Phase 1 – Preparation: Students will complete specified preparatory materials (readings and assignments) for each unit.

Phase 2 – Readiness Assurance Test: On selected days, students will be given a Readiness Assurance Test (RAT). The RAT measures their comprehension and mastery of the assigned readings and helps them deepen their understanding of the course material needed to begin problem solving in Phase 3. Once the test period is over, the instructor may present a short mini-lecture to clarify concepts that are not well understood as evidenced by test scores. The purpose of Phase 2 is to ensure that students and their teammates have sufficient foundational knowledge to begin learning how to apply and use the course concepts in Phase 3. **RATS are closed book and based on the assigned preparatory material** (readings and assignments).

- **Individual RAT (iRAT):** Students individually complete a 4-7-question multiple-choice test based on the readings.
- **Team RAT (tRAT):** Following the iRAT, the same multiple-choice test is re-taken with their team. These tests use a “scratch and win” type answer card known as an IF-AT. The students develop a consensus with their teammates, and then scratch off the opaque coating hoping to reveal a star that indicates a correct answer. The team is awarded 4 points if they uncover the correct answer on the first scratch, 2 points for the second scratch, and 1 point for the third scratch. If they are incorrect with any scratch, the team needs to reconsider, discuss, and make another decision.
- **Appeals Process:** Once the team has completed the team test, they have the opportunity to fill out an appeals form. The purpose of the appeals process is to allow the team to identify questions where they disagree with the question wording or ambiguous information in the readings. The instructor will review the appeals outside of class time and report the outcome of the team appeal at the next class meeting. Only teams are allowed to appeal questions (no individual appeals).

Impact of appeals on test scores:

When an appeal is accepted on a question that a team has missed (no individual appeals will be accepted):

1. It counts. In other words, the points missed will be added to:
 - a. their team score
 - b. the score of any individual in the team who answered the same as the team
 - c. only those teams that appeal.
 2. Team member(s) who had the original correct answer will continue to receive credit on the question.
- **Feedback and Lecture:** Following the RATs and Appeal Process, the instructor provides a short, clarifying lecture on any difficult or troublesome concepts or asks for further questions to help clarify the material. On Thursdays the instructor will provide a lecture and/or go to phase 3.

Phase 3 – In-Class Activities: Students and their teams use the foundational knowledge, acquired in the first two phases, to work on specific problems that will be reported publically and subject to cross-team discussion/critique. These will be similar to problems that will appear on tests.

Promoting Individual Accountability

The Readiness Assurance Process is designed to promote individual accountability. The Readiness Assurance Process requires individuals to complete a multiple-choice test covering a set of pre-assigned readings and turn in their answers. Students are individually accountable because the individual scores count as part of the course grade. Next, during the team test (exact same test as individual), each member is invariably asked to voice and defend his or her choice on every question as the teams come to a consensus on their answers. The resulting discussions produce immediate peer dialogue/feedback that provides clear evidence of the quality of individual preparation and the importance of obtaining input from everyone on all important decisions. Third, members who are chronically unprepared almost invariably receive a low peer evaluation score.

Promoting Team Accountability

Fostering team accountability is very important. Without team accountability, neither instructor nor students know: 1) if their learning goals have been achieved, or 2) if students are taking teamwork seriously. Teams can be held accountable by carefully managing intra-team and whole-class discussions. The key is the nature of the application activity. First, team assignments must require production of a tangible output. Second, the “product” that teams are asked to create should enable both immediate feedback on the quality of teamwork and the opportunity for direct comparisons from other teams.

Accountability matters: If students fail to prepare for teamwork, then better prepared students are likely forced to “carry” their less willing and/or less able peers. Additionally, improperly managed team discussions are likely to degenerate into social events in which little if any learning occurs. Both problems can be avoided almost entirely by establishing accountability practices. The key is using assignments and practices that hold individuals and teams accountable for their contributions and behaviors. Accountability to the team occurs via immediate peer feedback and direct anonymous assessment in the peer evaluation process.

(Information about TBL adapted from *Three Keys to Using Learning Groups Effectively* by Larry Michaelsen; *Student Orientation Materials* by Dean Parmelee; and *The Essential Elements of Team-Based Learning* by Michaelsen& Sweet.)

Course Requirements

Class attendance and participation: Students are required to keep up-to-date on class readings and assignments, and to be active team members. If students miss a class, they miss whatever their team did. The team process is critical to learning, and the content of each session will be reflected on the midterm and final exams. Most teams, in real life and here, will forgive a single absence for which students have a really good reason, and be less forgiving of multiple or casual absences. More than one absence and/or tardiness will affect the course grade (two points per absence and one point for lateness). **Attendance is taken at the beginning of class and it is expected that all students will be present at the start of class.**

Brooklyn College abides to the state law regarding *non-attendance because of religious beliefs*, as expressed in page 68 of the student bulletin (available at:

http://www.brooklyn.cuny.edu/web/off_registrar/2016-17_Undergraduate_Bulletin.pdf).

As cited in the bulletin (p. 68): “The New York State Education Law provides that no student shall be expelled or refused admission to an institution of higher education because he or she is unable to attend classes or participate in examinations or study or work requirements on any particular day or days because of religious beliefs. Students who are unable to attend classes on a particular day or days because of religious beliefs will be excused from any examination or study or work requirements. Faculty must make good-faith efforts to provide students absent from class because of religious beliefs equivalent opportunities to make up the work missed; no additional fees may be charged for this consideration. “If you are unable to attend class in any occasion for religious reasons, please notify me during the first week of class to make the necessary arrangements.”

Assigned Readings: Students are expected to have completed all the readings for each class and be prepared to engage in classroom discussion and team activities regarding the assigned readings.
[Assigned readings will be posted on black board by Friday afternoon every week.](#)

Content and Tentative Schedule Lecture Course

Slides, reading assignments, selected problems and any other extra materials will be posted on Black Board. Make sure that you have access to black board and that you know how to use it.

Introduction to the course. Explanation teaching method. Formation of Teams. January 31st

Unit 1

Chapters 1-3. Introduction to inorganic chemistry. Atomic theory. Chapters 2-2-4 to 3. Periodic trends. Simple bonding theories. Jan 31st, 7thth, Feb 14th, Learning objectives: Predict electronic configurations, periodic trends and structures and approximate angles of molecules
i/tRATs: Feb 7thth, [RAT 1](#)

Unit 2

Chapter 4. Symmetry and group theory. Applications to vibrational spectroscopy.
February 14th, 21th, Feb 28th
Learning objectives: Recognize most common point groups for a molecule and identify symmetry of orbitals and vibrations.
i/tRATs: Feb 14th [RAT 2](#)

Unit 3.

Chapter 5. Molecular orbitals: general principles. Homonuclear diatomic molecules. Heteronuclear diatomic molecules. Larger molecules.
Feb 28th, March 4th, March 7th
Learning objectives: Build qualitative molecular orbitals (MO) for small and large molecules
i/tRATs: Feb 28th [RAT 3](#)

Unit 3 cont.

Chapter 6. Acid-base and donor-acceptor properties.
March, 7th, 14th
Learning objectives: Identify hard/soft acids and bases and predict reactivity
i/tRATs: March 7th [RAT 4](#)

[Test 1: Units 1-3, March 14th](#)

Unit 4.

Chapter 9-12. Coordination chemistry. Nomenclature, isomerism, coordination numbers and geometries. Electronic structure. Ligand field theory. Electronic spectra. Reactions and mechanisms.
March 21st, 28thth, April 4th, April 25th
Learning objectives: Know the fundamentals of coordination chemistry (nomenclature, isomerism, principles of ligand field theory, MO, ligands, fundamental reactions
i/tRATs: March 21st, March 28th, April 25th [RATs 5, 6 & 7](#)

[Test 2: Units 3cont-4, May 2nd](#)

Unit 5.

Chapter 13-14. Organometallic chemistry and catalysis.

May 2nd, May 9th

Learning objectives: Know the fundamentals of organometallic chemistry (counting electrons, ligands, fundamental reactions and principles of homogeneous catalysis).

i/tRATs: May 9th [RAT 8](#)

Unit 6

Chapter 7. The crystalline solid state.

May 16th

Learning objectives: Know the principles of solid-state chemistry (ionic solids, thermodynamics of ionic crystal formation, metallic bonding, conductance of metals, silicates)

i/tRATs: May 16th [RAT 9](#)

Unit 7.

Chapter 16. Elements of bioinorganic and environmental chemistry.

May 16th

Learning objectives: Know the fundamentals of bioinorganic and environmental chemistry (representative examples of bioinorganic compounds and their actions, examples of the environmental effects of both metals and non-metals)

[Tests 3: Units 5-7, Tentative May 22nd](#)

University's policy on Academic Integrity:

The CUNY Board of Trustees has adopted a policy on academic integrity that applies to all students at Brooklyn 2016-2017 Undergraduate Bulletin 64 Student Rights and College and University Rules College. Academic dishonesty is prohibited and is punishable by penalties, including failing grades, suspension and expulsion. Cheating is the unauthorized use or attempted use of material, information, notes, study aids or devices or communication during an academic exercise. Plagiarism is the act of presenting another person's ideas, research or writing as one's own. Internet plagiarism includes submitting downloaded papers or part of term papers, paraphrasing or copying information from the Internet without citing the source, and cutting and pasting from various sources without proper attribution. The full text of the CUNY Academic Integrity Policy may be found on the CUNY website. Brooklyn College's procedures for implementing the CUNY policy and other explanatory material may be found online under the "Campus Info" tab on the BC WebCentral portal.

Information about the Center for Student Disability Services:

In order to receive disability-related academic accommodations students must first be registered with the Center for Student Disability Services. Students who have a documented disability or suspect they may have a disability are invited to set up an appointment with the Director of the Center for Student Disability Services, Ms. Valerie Stewart-Lovell at 718-951-5538. If you have already registered with the Center for Student Disability Services please provide your professor with the course accommodation form and discuss your specific accommodation with him/her.

Security escort service

Escorts will be provided by public safety personnel to campus parking lots and nearby public transportation (bus and subway) for students, faculty and staff members who request them. Requests should be made about 20 or 30 minutes before an escort is needed. A security shuttle service operates on Campus Road when the campus is open, providing transportation to and from local bus stops, subway stations and the Residence Hall at Brooklyn College.

Important dates (deadlines) in Spring 2017 (undergraduate* and graduate students)**

February 3	Friday	Last day to add a course/ Last day to file for elective course Pass/Fail (* & **)
February 5	Sunday	Last day to add a course all divisions, including audits. There is no late enrollment period after this date. All course additions must be completed by this date. (* & **)
February 5	Sunday	Last day to file a Pass/Fail applications for elective courses. (*)
February 5	Sunday	Last day to drop with 25% liability charge (75% refund). (* & **)
February 12	Sunday	Last day to drop with 50% liability charge (50% refund). (* & **)
February 13	Monday	Lincoln's Birthday; College is closed. (* & **)
February 13	Monday	Last day to submit requests of change, deletion, or declaration of a major/minor/concentration to be effective in Spring 2017. (*)
February 15	Wednesday	Conversion day; classes follow a Monday schedule. (* & **)
February 15	Wednesday	Last day to file for Spring (June 1) graduation. (* & **)
February 19	Sunday	Last day to drop a course without a grade of "W". (* & **)
February 20	Monday	President's Day; College is closed. (* & **)
February 24	Friday	Deadline to Apply for the Language and Comprehensive Exams (Graduate Division). (**)
February 24	Friday	Deadline to Submit Thesis Title through Thesis Submission Online (Graduate Division). (**)
April 5	Wednesday	Language Exams (Graduate Division). (**)
April 7	Friday	Last day for undergraduate students to complete and submit any incomplete work to resolve Fall 2016/Winter 2017 INC grades. (*)
April 10-18	Monday-Tuesday	Spring recess. (* & **)
April 19	Wednesday	Course withdrawal period ends. Last day to withdraw from a class with a grade of "W". (* & **)
April 20	Thursday	Conversion day; classes follow a Monday schedule. (* & **)
May 1	Monday	Deadline for graduate students to resolve Fall & Winter INC Grades (Graduate Division). (**)
May 5	Friday	Deadline to Upload Approved Thesis via Thesis Submission Online (Graduate Division). (**)
May 18	Thursday	Last day of weekday undergraduate courses. (*)
May 19	Friday	Reading Day (* & **)
May 22-26	Monday-Friday	Weekday day/evening courses final examinations. (* & **)
May 26	Friday	End of Spring 2017 term. (* & **)
May 26	Friday	Deadline to File for Maintenance of Matriculation (Graduate Division). (**)

YOUR NAME: _____

**TEAM-BASED LEARNING
MIDTERM PEER FEEDBACK
NOT GRADED**

Team: _____

Colleague you are evaluating: _____

PART ONE: QUANTITATIVE ASSESSMENT (CHECK **ONLY ONE BOX** FOR EACH OF THESE 12 ITEMS)

COOPERATIVE LEARNING SKILLS:	NEVER	SOMETIMES	OFTEN	ALWAYS
Arrives on time and remains with team during activities				
Demonstrates a good balance of active listening & participation				
Asks useful or probing questions				
Shares information and personal understanding				

SELF-DIRECTED LEARNING:	NEVER	SOMETIMES	OFTEN	ALWAYS
Is well prepared for team activities				
Shows appropriate depth of knowledge				
Identifies limits of personal knowledge				
Is clear when explaining things to others				

INTERPERSONAL SKILLS:	NEVER	SOMETIMES	OFTEN	ALWAYS
Gives useful feedback to others				
Accepts useful feedback from others				
Is able to listen and understand what others are saying				
Shows respect for the opinions and feelings of others				

PART TWO: QUALITATIVE ASSESSMENT (FOR EACH ITEM, WRITE **AT LEAST ONE** SENTENCE, BUT **NOT MORE THAN THREE** SENTENCES)

1) What is the single most valuable contribution this person makes to your team?

2) What is the single most important way this person could alter his/her behavior to more effectively help your team?

TEAM-BASED LEARNING FINAL PEER EVALUATION GRADED

At the end of the term, it is necessary for all members of this class to assess the contributions that each member of the team made to the work of the team. This contribution should presumably reflect your judgment of such things as:

Preparation - Were they prepared when they came to class?

Contribution - Did they contribute productively to group discussion and work?

Respect of others' ideas - did they encourage others to contribute their ideas?

Flexibility - Were they flexible when disagreements occurred?

It is important that you raise the evaluation of people who truly worked hard for the good of the team and lower the evaluation of those you perceived not to be working as hard on team tasks.

Evaluate the contributions of each person in your team except yourself, by distributing 100 points among them. *Include comments for each person.*

Team #:	Points Awarded:
1. Teammate's Name: a. In what ways was your teammate MOST helpful to the team? b. In what ways could your teammate improve to be more effective?	
2. Teammate's Name: a. In what ways was your teammate MOST helpful to the team? b. In what ways could your teammate improve to be more effective?	
3. Teammate's Name: a. In what ways was your teammate MOST helpful to the team? b. In what ways could your teammate improve to be more effective?	
4. Teammate's Name: a. In what ways was your teammate MOST helpful to the team? b. In what ways could your teammate improve to be more effective?	
Your Name:	Total Points = 100

Readiness Assessment Test Appeals Instructions

Purposes of the appeals process:

1. Clarify uncertainty about your understanding of the concepts.
2. Give additional recognition and credit when “missing” a question was caused by:
 - a. Ambiguity in the reading material
 - b. Disagreement between the reading material and our choice of the correct” answer
 - c. Ambiguity in the wording of the question

Guidelines for preparing successful appeals:

Appeals are granted when they demonstrate that you understood the concept(s) but missed the question anyway or that your confusion was due to ambiguity in the reading. As a result:

1. If the appeal is based on ambiguity in the question, you should:
 - a. Identify the source of the ambiguity in the question and,
 - b. Offer an alternative wording that would have helped you to avoid the problem.
2. If the appeal is based on either inadequacies in the reading material or disagreement with our answer, you should:
 - a. State the reason(s) for disagreeing with our answer and,
 - b. Provide specific references from the reading material to support your point of view.

Impact of appeals on test scores:

When an appeal is accepted on a question that a team has missed (no individual appeals will be accepted):

1. It counts. In other words, the points missed will be added to:
 - a. their team score;
 - b. the score of any individual in the team who answered the same as the team;
 - c. only those teams that appeal.
2. Team member(s) who had the original correct answer will continue to receive credit on the question.

Readiness Assessment Test Appeal

APPEAL– RE-WRITE OF BAD QUESTION (TEAMS ONLY) – TEAM # _____

QUESTION # _____

Guidelines for preparing successful appeals:

Appeals are granted when they demonstrate that you understood the concept(s) but missed the question anyway or that your confusion was due to inadequacies in either the question or the reading material.

For appeals based on AMBIGUITY OF THE QUESTION, you should:

1. Identify the source of ambiguity in the question and,
2. Offer an alternative wording that would have helped you to avoid the problem.

In the space below, re-write the question so that it is a better one:

APPEAL– BASED ON CONTENT ISSUES (TEAMS ONLY) – TEAM # _____

QUESTION # _____

PROPOSED CORRECT ANSWER _____

Guidelines for preparing successful appeals:

Appeals are granted when they demonstrate that you understood the concept(s) but missed the question anyway or that your confusion was due to inadequacies in either the question or the reading material.

For appeals based on CONTENT, you should:

1. State the reason(s) for disagreeing with our answer and,
2. Provide specific references from the reading material to support your point of view.

In the space below, explain, with references from the readings if possible, why you feel your selected response was the BEST one.