**CHEM-375-A Advanced Inorganic Chemistry**

**01/17/2018-05/02/2018 LECTURE Monday, Wednesday 12:15PM - 01:30PM**

**Somerset, Room B15**

***I. Instructor Information***

**Name:** Denyce K. Wicht (pronounced Wik-t; the *ch* spells the sound /k/, just as in the word “*ch*emistry”and “s*ch*ool”)

**Email:** [dwicht@suffolk.edu](mailto:dwicht@suffolk.edu)

**Phone:** 617-573-8252 (but email is the best way to contact me)

**Office:** Somerset 833

**Office Hours:**

T 3:05 p.m. - 4:20 p.m.

W 10:30 a.m. - 12:00 p.m. by appointment (please schedule 24 hours in advance)

Th 10:50 a.m. - 12:05 p.m.

***II. Course Information***

**Catalog description:** Topics in inorganic chemistry including bonding theories, chemical structures, symmetry and group theory, kinetics and mechanisms of reactions, and spectroscopy. Advanced topics will be organometallics and homogeneous catalysis.

**Credits:** 3

**Co-requisites:** Concurrent enrollment in CHEM L375-A

**Prerequisites:** CHEM 314/L314

***III. Course Materials***

**Required Materials:**

Transition Metal Chemistry: (**custom version for Suffolk University**) Tro, Nivaldo J; Chemistry: structure and properties 2nd edition, Chapter 12 Crystalline Solids and Modern Materials and Chapter 22 Transition Metals and Coordination Compounds. Cotton, Albert F. Advanced Inorganic Chemistry 6th edition, Part I Survey of Principles and Part 4 The Role of Organometallic Chemistry in Catalysis.

Personal electronic devices such as cellular phones or laptop computers are not permitted for use while lecture is in session. Kindly store phones, laptop computers, and headphones in your personal Suffolk University locker

***IV: Learning Objectives***

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| **GOALS** | **OBJECTIVES** | **ASSESSMENTS** |
| **Upon successful completion of this course, students should be able to know/understand:** | **Upon successful completion of this course, students should be able to:** | **How the student will be assessed on these learning objectives:** |
| The fundamentals of chemistry and biochemistry | Demonstrate mastery of the fundamentals of inorganic chemistry (electronic structure, physical and chemical properties, bonding, inorganic chemical reactions and analyses, stoichiometric relations between reactants)  Demonstrate mastery of the fundamentals of organic chemistry (structure and bonding in organic molecules; acid/base properties of molecules and how they affect reactivity; organic mechanisms, predict outcomes/routes; spectral analysis (IR, NMR, MS); green chemistry)  Demonstrate mastery of the fundamentals of analytical chemistry (collect and analyze data from analytical instrumentation including spectrometric instruments (UV-vis, AA, luminescence); chromatographic instruments (GC, LC); and electroanalytical instrumentation (potentiometry)) | Reading Comprehension Tests  Quizzes  Take Home Exams |
| Know advanced chemistry concepts | Apply advanced theories of bonding to the structural geometry and reactivity of coordination complexes.  Apply transition metal chemistry to some relevant and active areas of chemical research and industry. The applied areas of chemical research and industry that will be focused on in the spring 2018 offering of CHEM 375 will be organometallics and homogeneous catalysis. | Proposal: Metal catalyzed Si-C bond cleavage of DMSD |

**Course Schedule:**

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| **January 2018** | | | | | |
| Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
| 15  University Closed | 16 | 17 lecture 1  Course syllabus, review | 18 | 19 | 20  RCT #1 due  11:59 p.m. |
| 22 lecture 2  Crystalline solids, unit cells | 23  last day to add/register | 24 lecture 3  Ionic solids, network covalent atomic solids | 25 | 26 | 27 |
| 29 lecture 4  Polymers and plastics | 30 | 31 lecture 5  Review: electronic structure of the transition metals |  |  |  |

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| **February 2018** | | | | | |
| Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|  |  |  | 1  . | 2 | 3 BRIC  RCT #2 due  11:59 p.m |
| 5 lecture 6  Coordination compounds | 6  Last day to drop without W | 7 lecture 7  Geometries and isomers | 8 | 9 | 10 |
| 12 lecture 8  Stereoisomers | 13 | 14 lecture 9  Bonding theories | 15 | 16  THE #1 due 6:00 p.m. | 17  RCT #3 due  11:59 p.m |
| 19  University Closed | 20 | 21 lecture 10  Coordinative unsaturation | 22 | 23 | 24 |
| 26 lecture 11  Oxidative addition | 27 | 28 lecture 12  Elimination |  |  |  |

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| **March 2018** | | | | | |
| Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|  |  |  | 1 | 2 | 3  RCT #4 due  11:59 p.m |
| 5 lecture 13  Migration | 6 | 7 lecture 14  Insertion | 8 | 9 | 10 |
| 12 | 13 | 14 | 15 | 16 | 17 |
| 19  **no lecture**  **ACS Meeting** | 20 | 21  **no lecture**  **ACS Meeting**  Last Day to Drop without F | 22 | 23  THE #2 due 6:00 p.m. | 24  RCT #5 due  11:59 p.m |
| 26 lecture 15  Homogeneous catalysis | 27 | 28 lecture 16  Homogeneous catalysis | 29 | 30 | 31 |

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| **April 2018** | | | | | |
| Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
| 2 lecture 17  Hydrogenation | 3 | 4 lecture 18  Hydroformylation | 5 | 6 | 7  RCT #6 due  11:59 p.m |
| 9 lecture 19  Acetic acid synthesis | 10 | 11 lecture 20  Pd catalyzed cross coupling | 12 | 13 | 14 |
| 16  University Closed | 17 lecture 21  Suffolk  University Monday  Metathesis | 18 lecture 22  Proposal Background: Metal catalyzed Si-C bond cleavage of DMSD | 19 | 20 | 21  RCT #7 due  11:59 p.m |
| 23 lecture 23  Symmetry | 24 | 25 lecture 24  Space Groups | 26 | 27  THE #3 due 6:00 p.m. | 28 |
| 30 lecture 25  Peer Feedback on Proposed Catalytic Cycle |  |  |  |  |  |

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| **May 2018** | | | | | |
| Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|  | 1 | 2 lecture 26  Peer Feedback on Proposed Catalytic Cycle | 3 | 4 | 5 |
| 7 | 8  Final Written Proposal Due  1:30 p.m. | 9 | 10 | 11 | 12 |

**Legend:**

Font in Blue: Submitted via Blackboard

RCT = **R**eading **C**omprehension **T**est

THE = **T**ake **H**ome **E**xam

Font in Red: Takes place in **Somerset, Room B15**

Font in Green: Important University deadlines

***V. Required Course Reading****:*

|  |  |
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| Specific Content Covered | Complete the Online Reading Comprehension Test no later than 11:59 p.m. on the date indicated |
| Crystalline Solids and Modern Materials   * pp. 1-34 | #1 due Jan 20th |
| Transition Metals and Coordination Compounds   * pp. 35-64 | #2 due Feb 3rd |
| Fundamental Reaction Steps of Transition Metal Catalyzed Reactions   * pp. 115-155 | #3 due Feb 17th |
| Fundamental Reaction Steps of Transition Metal Catalyzed Reactions   * pp. 155-176 | #4 due March 3rd |
| Homogeneous Catalysis by Transition Metal Complexes   * pp. 177-206 | #5 due March 24th |
| Homogeneous Catalysis by Transition Metal Complexes   * pp. 206-242 | #6 due April 7th |
| Basic Concepts of Molecular Symmetry; Character Tables   * pp. 253-273 | #7 due April 21st |

***VI: Assessment***

**Reading Comprehension Tests:**

There are 7 reading comprehension tests to be completed via Blackboard. You are required to complete the reading comprehension tests BEFORE the lecture on that content. **The reading comprehension tests are designed to assess your knowledge and understanding of the fundamental chemical concepts and vocabulary words presented in your course textbook.**

You may (and should) consult your textbook (and other textbooks from past or current Suffolk University courses) when completing the online reading comprehension tests. The online reading comprehension tests will always be available via Blackboard, but your opportunity to record your grade for that particular assignment will expire at midnight on the day that the reading comprehension test is due (see table in section V for specific due dates). For example, you must complete reading comprehension test #1 (Crystalline Solids and Modern Materials pp. 1-34) by 11:59 p.m. on Sat. Jan 20th in order to receive full credit. The amount of time required to complete this assignment will vary with each student, and that amount largely will depend on your reading comprehension skills and your chemistry background. You are in a better position to reflect upon and evaluate your reading comprehension skills and your chemistry backgrounds than I am, but it seems reasonable to plan for 3-4 hours to read and comprehend the material. Once you complete the required reading it seems reasonable to plan for 1 hour to complete the online reading comprehension test.

**Quizzes**

There will be four short written quizzes administered randomly throughout the duration of the course; only three will count toward students’ final grade. Quizzes are given at the beginning of the lecture. All quizzes are open notes and open book. Make-up quizzes will not be administered.

**Take Home Exams**

There will be three graded take home exams throughout the semester due on the following days:

Take Home Exam #1: February 16th

Take Home Exam #2: March 23rd

Take Home Exam #3: April 27th

I will post the Take Home Exams on Blackboard a week in advance, however the completed assignment must be submitted via Blackboard no later than 6:00 p.m. on the date on which it is due. Take home exams must reflect individual work. You must use ChemDraw to create structures of transition metal complexes within your take home exam (.docx documents only).

**Proposal: Metal catalyzed Si-C bond cleavage of DMSD**

Broadly speaking, my research interests involve understanding the mechanistic processes that cleave methyl group carbon bonds (–CH3) to high-valent main group elements, specifically silicon (Si) and sulfur (S).

I’m interested in silicon–carbon bonds (Si–CH3) of the molecule dimethylsilanediol (abbreviated DMSD) because this specific molecule has been detected in environmental matrices. One source of DMSD in the environment is from chemical additives in personal care and other down-the-drain household products. Because no naturally occurring organosilicon compounds have been reported, chemical species containing silicon–carbon bonds, such as DMSD, are anthropogenic. The impacts of organosilicon xenobiotics are not entirely clear, but there is evidence for Si–CH3 catabolism in mammals. The long-term goal of my research is the identification of a catalytic system that can efficiently break the Si–CH3 bonds of DMSD under mild conditions and physiological pH. Neither a chemical nor a biological catalytic system has yet been identified. The identification of a catalyst capable of breaking a Si–CH3 bond would be a significant advancement in the field and applicable to the design of systems engineered to treat environmental pollutants.

You will propose a metal-catalyzed cycle that ultimately cleaves at least one Si–CH3 bond in DMSD using fundamental reaction steps introduced in CHEM 375. There are no restrictions upon the other reagents used or products formed. However, your proposed catalytic cycle must produce a balanced chemical reaction (both mass and charge) and reagents must be known molecules with structures consistent with chemical theory. Proposed intermediates must be clearly depicted in your catalytic cycle. There are no restrictions to the number of steps you propose.

The completed proposal must be submitted via Blackboard no later than May 8th at 1:30 p.m. Proposals must reflect individual work, but you will have the opportunity to give and receive feedback from your peers (and your instructor) prior to the due date. You must use ChemDraw to create your proposed catalytic cycle (.docx documents only).

A detailed rubric will be provided and explained during lecture 22, April 18th.

***VII. Engagement Hours***

To complete this course, students will likely need to dedicate the following amount of time to the listed activities:

**Assignment/Activity Engagement Estimate Engagement Hours**

Course Readings: 492 pages x 8 minutes per page 36

Reading Comprehension Tests: 7 assignments at 1 hour each 7

Take home exams: 3 exams at 10 hours each 30

Final written proposal 40

Class Attendance: 26 lectures x 75 minutes 33

**Total: 146 engagement hours**

Per the Federal Government’s Credit Hour definition, this three credit course exceeds the required 135 hours per semester.

***VIII. Your Grade:***

Reading Comprehension Tests (average of 7): 35%

Quizzes (average of 3): 15%

Take home exams (average of 3): 30%

Final written proposal: 20%

100%

Final Overall Average

90-100% = A

80-89% = B

70-79% = C

60-69% = D

“plus” grades are 67-69, 77-79, and 87-89

“minus” grades are 60-62, 70-72, 80-82, and 90-92.

The highest letter grade one can earn in this course is “A” (93-100)

You must have a final overall average ≥ 60% to earn credit for this course

All graded work for this course should be completed independently. You should not provide your Blackboard username and password to anyone. You may not complete reading comprehension tests, quizzes, or take home exams in study groups (formal or informal), with a tutor, or with any other student. If you envision a situation in which you must interact with another person in order for you to fully complete an online assignment, please initiate a discussion about this situation with me first.

Please take the time to review the Academic Misconduct policy: Go to [www.suffolk.edu](http://www.suffolk.edu)

Home > Campus Life > Student Handbook > University Policies > Academic Misconduct

***IX: Electronic Resources provided by Suffolk University***

All Suffolk University students are assigned a University email account and a Blackboard account. These University assigned student email accounts and Blackboard accounts are the University's official means of communication with all students. You are responsible for all information sent to you at your University email account and/or posted to the course Blackboard. Please use **only** **your Suffolk University assigned email address** to correspond electronically with me, as I may not reply to your secondary/alternate email addresses. Why? Unrecognized email addresses may be inadvertently sent to my spam folder.

***X. Attendance Policy***

As you may have noticed, attendance does not factor into your final grade for this course. That being said, excessive absences from lecture are strongly discouraged.

In the event that the university cancels classes, such as for severe weather, all online assignments are due ***as scheduled*** unless otherwise notified. If necessary, new due dates will be posted to Blackboard and communicated via e-mail.

***XI. Additional Required Links to Suffolk University Policies/Statements/Services***

**UPDATE: Required Link (Spring 2018)**  
At the request of the UCC, the Provost's Office has built a single webpage to house all policy links and has matched it to a new syllabus template with a single link to just this one page.  Syllabi therefore may include JUST ONE LINK and a very brief statement: [http://www.suffolk.edu/syllabus](https://umail.suffolk.edu/owa/redir.aspx?C=KfahFNIJ_yBUieIHz0lU19Hy8vK6BTyt860mf2LDiniO1aHElljVCA..&URL=http%3a%2f%2fwww.suffolk.edu%2fsyllabus)

***XII***. UPDATE: Plans for Course Cancellations (Spring 2018)

Note that there are two required plans for course cancellations. In the event of an unexpected course cancellation (inclement weather, illness, etc.), syllabi are required to include an **Unexpected Course Cancellation Plan** about how these class hours will be made up.

If lecture is unexpectedly cancelled *once* in the Spring 2018 semester for any reason, the lecture will not be rescheduled and new assessment will be created that excludes the key learning outcomes from the cancelled lecture. If lecture is unexpectedly cancelled *more than once* for any reason, a new online activity will be created using Blackboard.

Syllabi should also explicitly describe an **Expected Course Cancellation Plan** for any expected course cancellations (university holidays, conference travel days, etc.).

Students should expect lecture to be canceled Spring 2018 March 19th and March 21st.