CHEM 820 -- Inorganic Chemistry for High School Teachers I (Spring 2017)

3 credit hours
Online Format
(January 9 – May 5, 2017)

Instructor: Christopher L. Exstrom
Office: 405C Bruner Hall of Science
Phone: (308) 865-8565
E-mail: exstromc@unk.edu

Required textbook: *Inorganic Chemistry*, 2nd ed. (House) ISBN 978-0-12-385110-9
Any supplemental handouts and internet references will be provided by the instructor

Technical Requirements and Competencies. Course delivery will be made entirely through Blackboard. A broadband internet connection (DSL, cable, etc.) is recommended but the instructor will make every effort to keep the size of course documents down to accommodate those with dial-up internet connections. Course documents may be in Adobe PDF or Microsoft Office (Word, Excel, and PowerPoint) formats. Links to downloadable free viewers will be provided. It is expected that you be able to download documents and open them in their appropriate programs. Exams will be taken on Blackboard. Familiarity with standard online form functions – radio buttons, check boxes, fill-in blanks, etc. – is required.

Course Description. CHEM 820 emphasizes topic areas that are typically introduced in General Chemistry – atomic, molecular, and solid-state structure, periodic trends, and acid-base concepts. In CHEM 820, these topics are treated in more depth. The *UNK Graduate Course Catalog* indicates that this course may be offered for any number of credits between 1-4, with or without laboratory. This semester, CHEM 820 is offered for **3 credits** without laboratory.

Course Learning Structure. Welcome to the world of inorganic chemistry! Course content is divided between four modules:

Module 1 –Atomic and Molecular Structure
(Portions of textbook chapters 1, 2, and 4)
Module 2 – Intermolecular Interactions & Solid-State Structure
(Portions of textbook chapters 6 and 7)
Module 3 – Acid-Base Chemistry
(Portions of textbook chapters 9 and 10)
Module 4 – Chemistry of the Main Group Elements
(Portions of textbook chapters 11, 13, and 14)
NOTE: The instructor may add other required supplemental material readings to any of the modules.

Within each module, the following types of assignments must be completed:

Readings – from the textbook, instructor-generated supplemental handouts, and internet resources

Homework Problems – from end-of-chapter textbook problems and/or instructor-generated handouts

Your grade will be based on the number of accumulated points as a percentage of the total possible number of points according to the distribution given below:

GRADING DISTRIBUTION*

Exams (4)	50% (12.5% each)
Graded Homework (4)	25% (6.25% each)
Term Project	25%

Exams. Four examinations of 60- to 90-minute lengths will be given. These may consist of a variety of question formats (multiple choice, multiple answer, matching, short answer, essay, problem solving). Each exam will cover one module. There will be no cumulative "final" exam.

Homework. There will be one homework assignment per module. Assigned questions may come from the textbook end-of-chapter problems and/or be generated by the instructor.

Term Project. This focuses on the incorporation of higher-level science or math material into one of the courses you teach. The project features three discussion board assignments that explore the idea of adjusting language (jargon) and making judicious assumptions in making this higher-level material more accessible to students. A complete description of the project is given in the last three pages of this syllabus.

Grading Scale. The following weighted percentage point scale will be the initial starting point: A (92.50-100), A- (90.00-92.49), B+ (87.50-89.99), B (82.50-87.49), B- (80.00-82.49), C+ (77.50-77.99), C (72.50-77.49), C- (70.00-72.49), D+ (67.50-69.99), D (62.50-67.49), D- (60.00-62.49), F (below 60.00). This scale may be moved downward at the instructor's discretion. After the 2nd and 3rd exams, grading scale adjustments and individual course grade estimates will be posted on Blackboard.

DEADLINES. A table of deadlines for all assignments and exams is given on the last page of this syllabus. ***To keep the class flowing smoothly, these deadlines will be strictly adhered to.*** The following penalties will be applied to late work:

Up to 24 hours late	25% of possible points (or zero score for discussion board response)
Between 24-48 hours late	50% of possible points (or zero score for discussion board response)
Over 48 hours late	Zero score

(**NOTE:** These late times apply to business days only. Business days are defined as Monday-Friday except the following – January 16 (Martin Luther King Day).

CHEM 820 Course Material Outline and Objectives

Topic Area	Textbook Coverage	Broad Objectives
Module 1: Atomic Structure	Chapter 1 (sections 1.1 through 1.5) Chapter 2 (sections 2.2, 2.4, 2.5)	• Apply principles of the Bohr atomic model • Understand quantum numbers and their relationships to electronic orbitals • Understand electronic pairing energy, shielding, and their effects on how electronic fill atomic orbitals • Understand periodic trends in atomic size, ionization energy, electron affinity
Module 1: Molecular Structure	Chapter 4 (sections 4.1, 4.2, 4.4, 4.6)	• Apply Valence Shell Electron Pair Repulsion (VSEPR) theory to construct Lewis models of molecular structure and predict molecular geometries • Understand formal charges, resonance, sigma and pi bonding • Understand the relationship between bond energies and molecular structure stability
Module 2: Intermolecular Interactions	Chapter 6 (sections 6.1 through 6.4, 6.6)	• Derive bond and molecular polarity properties from Lewis structure and electronegativity • Understand London (dispersion), dipole-dipole, and hydrogen bonding intermolecular forces and their effects on physical properties • Understand structural and electronic effects on hydrogen bonding strength
Module 2: Solid-state Structure	Chapter 7 (sections 7.1 through 7.9)	• Understand the energetics of crystal formation and the ion-ion interactions within crystals • For certain example crystal structures, understand the relationships between unit cell type, particle packing and ion stoichiometry • Understand principles that determine the degree of solubility for ionic compounds • Understand the fundamental types of crystal defects
Module 3: Acid-Base Chemistry	Chapter 9 (sections 9.1 through 9.6, 9.8, 9.8.1, 9.8.3, 9.8.5) Chapter 10 (entire chapter)	• Understand and apply Arrhenius, Bronsted-Lowry, Lewis, and Solvent-System acid-base definitions • Understand and apply Hard-Soft Acid-Base (HSAB) theory • Understand superacid chemistry • Understand chemistry that occurs in certain non-aqueous solvents
Module 4: Chemistry of the Main Group Elements	Chapter 11 (sections 11.1, 11.2, 11.3, 11.5, 11.9) Chapter 13 (sections 13.1, 13.3) Chapter 14 (section 14.2)	• Understand the fundamental chemical reactions that occur for Group 1 & 2 metals, aluminum & beryllium, transition metals, hydrogen, oxygen, and nitrogen

CHEM 820 (Spring 2017) Deadline Summary

Date	Event
Friday, January 20	Term Project Part 1 Discussion Board post (level 1) due
Friday, January 27	Term Project Part 1 Discussion Board post (level 2) due
February 1-8	***Exam #1 access window***
Friday, February 3	Term Project Part 1 Discussion Board post (level 3) due
Friday, February 17	Term Project Part 2 Discussion Board post (level 1) due
Friday, February 24	Term Project Part 2 Discussion Board post (level 2) due
March 1-8	***Exam #2 access window***
Friday, March 3	Term Project Part 2 Discussion Board post (level 3) due
Friday, March 17	Term Project Part 3 Discussion Board post (level 1) due
March 29-April 5	***Exam #3 access window***
Friday, March 31	Term Project Part 3 Discussion Board post (level 2) due
Friday, April 7	Term Project Part 3 Discussion Board post (level 3) due
Monday, April 17	Term Project Part 4 (Final Product Phase 1) due
April 19-26	***Exam #4 access window***
Wednesday, May 3	**Term project Part 5 (Final Product Phase 2) due**

Exam time windows begin at 8:00 a.m. CT on the first day and end at 11:00 p.m. CT on the last day. Other deadlines are at 5:00 p.m. CT unless otherwise noted.

NOTE: For each module, homework problem deadlines are when you access that exam. Allow 48 hours (counting business days only) for feedback.

CHEM 820 Term Project – Spring 2017

Incorporating Higher-level Chemistry into Grade 6-12 Courses: Use of language adjustments and judicious assumption selections

In chemistry and related sciences, exciting developments seem to be appearing at an exponential rate – literally, see Moore's Law. For the educator, there are more ways than ever to motivate students about science, but how can we bring in some of these higher-level concepts to give students a better understanding of these developments and create a stronger link between cutting-edge science and the fundamentals that are critical as a foundation for future science studies or just being a scientifically literate citizen?

In this term project, you will explore and develop enhancements that could bring such higher-level material into your classes using language adjustment and judicious assumption selections. This idea is discussed in a TEDx talk by Tyler DeWitt, a PhD student in microbiology at MIT who has taught high school biology and chemistry. He has formal curriculum development experience with the state of Florida and he has an extensive set of YouTube chemistry topic lectures that are very popular.

Tyler DeWitt biography: tylerdewitt.org
Tyler DeWitt YouTube page: youtube/tdewitt451

The project will consist of a series of discussion board exercises followed by the development of a final product in which you will demonstrate the enhancement of a topic lesson through the principles described above and the use of or inspiration from CHEM 820 material. ***This term project will constitute 25% of your course grade and be broken down as follows:***

Part 1 – Discussion Board Exercise #1 (The Tyler DeWitt approach: General Impressions). View Tyler DeWitt's TEDx talk – click HERE to access it – and submit discussion board posts according to the following guidelines:

- ***Level 1 (5 pts) –*** In at least 200 words, describe your overall impression of the TEDx talk and incorporate your thoughts on the following questions: Do you see Mr. DeWitt's approach as something that would enhance or detract from (or both) from the learning in the classes you teach (they do not have to be chemistry)? Would rigor be sacrificed? If so, to what extent and is the cost worth it for enhanced learning and interest? If not, is this a way higher-level topics could be introduced?
- ***Level 2 (5 pts) –*** You will be assigned to respond to two other students' Level 1 posts from the following angle: With Mr. DeWitt's approach, what challenges would need to be overcome in order for there to be greater student learning? (These challenges could pertain to material coverage, local/state/federal standards, available class time, facilities, or other factors.)
- ***Level 3 (5 pts) –*** Respond to the Level 2 posts about your Level 1 post. Refine your answers to the Level 1 questions taking the Level 2 posts into account.

Part 2 – Discussion Board Exercise #2 (The Tyler DeWitt approach applied to a specific topic). Submit discussion board posts according to the following guidelines.

- ***Level 1 (5 pts) –*** Describe a topic in any math or science class that you teach (it doesn't have to be chemistry) that you feel you are unable to cover – or cover adequately – because the nature of that topic is too advanced or includes jargon that is too technical. Discuss why you feel it is important for students to learn about that topic in greater detail.
- ***Level 2 (5 pts) –*** You will be assigned to respond to two other students' Level 1 posts. Make at least one suggestion that the original poster could take to bring that topic (or greater detail) into his or her class.
- ***Level 3 (5 pts) –*** Respond to the Level 2 posts about your Level 1 post and discuss how you could bring this topic (or a deeper coverage of it) into your course.

Part 3 – Discussion Board Exercise #3 (Final product ideas). Now it's time to start working on the final product. First, choose your class to focus on. If you teach more than one subject, use the following priority: 1) Chemistry; 2) Physical or Earth Science (HS or MS); 3) Biology (HS or MS); 4) Physics; 5) Math (HS or MS). Submit discussion board posts according to the following guidelines.

- ***Level 1 (5 pts) –*** State the class subject and level. Describe two possible class topics on which to base the final product. One of these topics must be something you already teach but you would like to cover in greater detail. The other topic must be something new and considered more advanced. Discuss why you believe these enhancements would be beneficial for students and describe the specific CHEM 820 material that would apply. (NOTE: If you teach outside of chemistry and physical science, the CHEM 820 material may serve as either applications to your topics or as inspirations (in their educational approach) for how you address your topics – in either case, the instructor will notify you if your CHEM 820 connection is not sufficient.)
- ***Level 2 (5 pts) –*** You will be assigned to respond to two other students' Level 1 posts. For each proposed topic, offer at least one suggestion that the original poster could take to bring that topic (or greater detail) into his or her class. Also, point out at least one challenge that may need to be overcome in the process.
- ***Level 3 (5 pts) –*** Respond to the Level 2 posts about your Level 1 post. Choose the topic on which you will base your final product. Explain the reasoning behind that choice.

Part 4 – Final Product, Phase 1 (25 pts). This will be a paper assignment that is turned in using the assignment function in Blackboard. It will focus on the background for your proposed class enhancement.

- **If you chose to introduce a new, advanced topic:** Describe the role of this topic in the class curriculum and in any pertinent local/state/federal standards. Without worrying about scaling material down to your class level, thoroughly describe the content you would like to teach – there must be at least one lecture/guided discussion and at least one assessment (test, quiz, homework, presentation) or lab/field experience. Point out specific areas that make this topic difficult to teach to students at your class level, whether it's advanced concepts, difficult jargon, lack of demonstration equipment/supplies, etc. Outline – a few bullet points are fine – how you intend to make modifications in order to make the lesson plan more appropriate for your class level.
- **If you chose to enhance a topic you already teach:** Present your current method (including PowerPoint notes, assignments, tests/quizzes, demonstration notes, presentation rubrics, etc.) of teaching this topic -- there must be at least one lecture/guided discussion and at least one assessment (test, quiz, homework, presentation) or lab/field experience. Point out specific areas that make it difficult to teach this topic at a deeper level, whether it's advanced concepts, difficult jargon, lack of demonstration equipment/supplies, etc. Outline – a few bullet points are fine – how you intend to make modifications in order to make the lesson plan more appropriate for your class level.

Part 5 – Final Product, Phase 2 (30 pts) This will be a paper assignment that is turned in using the assignment function in Blackboard. It will focus on the new or enhanced topic lesson that you have prepared utilizing CHEM 820 material (directly, as application, or as inspiration).

Present your new method (including PowerPoint notes, assignments, tests/quizzes, demonstration notes, presentation rubrics, etc.) of teaching this topic -- there must be at least one lecture/guided discussion and at least one assessment (test, quiz, homework, presentation) or lab/field experience. Point out specific areas where you have utilized CHEM 820 material, made language simplifications, and made simplifying assumptions. For the latter two, include comment on their impact on the rigor of the lesson.