

## CHE 516: Inorganic Materials Chemistry (3 credit hours)

**Class Times:** Tuesday and Thursday, 9:30 to 10:45 AM, CP-297  
**Instructor:** Dr. Beth S. Guiton  
**Office Address:** 105 Chemistry-Physics Building  
**Email:** [beth.guiton@uky.edu](mailto:beth.guiton@uky.edu)  
**Office Phone:** 257-4215  
**Office Hours:** Tuesday and Thursday, 10:45 to 11:45 AM, CP-105  
(or by appointment)

### Course Description:

Introduction to solid state inorganic materials chemistry, including atomic structure; optical, electronic, and magnetic properties; and characterization methods such as x-ray diffraction and electron microscopy.

### Prerequisites:

CHE 440G or CHE 547 or equivalent; and CHE 410G or 510 or equivalent; or permission from the instructor.

### Student Learning Outcomes:

After completing this course, the student will be able to:

1. Describe and identify basic crystal structures
2. Demonstrate comprehension of bonding in solids
3. Analyze experimental data to identify structural characteristics of solids
4. Describe and identify crystal defects, non-stoichiometry, and solid solutions, and predict the effects of these features on material properties
5. Interpret common phase diagrams to predict phase stability and phase transformations under different external conditions
6. Demonstrate comprehension of common electrical, magnetic, and optical characteristics of solids, and how these characteristics relate to structure and bonding
7. Critically evaluate published literature in the field of inorganic materials, interpret experimental data, and explain the pertinent details

### Required Materials:

1. *Solid State Chemistry and its Applications (Student Edition)*, Anthony R. West; 2<sup>nd</sup> Ed, Wiley (2014)

### Optional Visualization Aids:

1. Advanced Molecular Model Set for General and Organic Chemistry, LLC Mega Molecules (~\$20)
2. Polyhedral Model Kit, Institute for Chemical Education (~\$115)
3. CrystalMaker software suite: available in person in Dr. Parkin's x-ray diffraction facility, or remotely via VNC client

## Course Assignments

Distribution of the grade by assignment (graduate students)

Homework problem sets (best 8 of 10):	15%
1 Literature presentation:	5%
2 Midterm examinations:	25% each
1 Final examination:	30%
Bonus points (up to 10 pts):	up to an additional 2%

Distribution of the grade by assignment (undergraduate students)

Homework problem sets (best 8 of 10):	20%
2 Midterm examinations:	25% each
1 Final examination:	30%
Bonus points (up to 10 pts):	up to an additional 2%

## Summary Description of Course Assignments

### ***Examinations:***

Three examinations will be given: two midterms and a Final. Unless announced otherwise Midterm 1 will examine the material covered in classes 1-8, Midterm 2 will examine the material covered in classes 9-16, and the Final will be cumulative.

### ***Homework:***

Homework problems will be assigned every Tuesday and Thursday (by the end of the day), based on the material covered in class, and will be due **by 5 PM the following Tuesday**. Late homework will be graded, but will not count for credit. The lowest two homework scores will be dropped at the end of the semester. The beginning of each class will serve as a short recitation to cover questions regarding the homework problems. Homework problems will form the basis of the midterm and final examinations.

### ***Literature Presentations:***

A short (~15 min) presentation will be given by each **graduate student** during the final class before dead week (April 20). The subject of the presentation will be a paper from the literature chosen by the student which illustrates or uses material explored in the class. The literature choice should fulfill the following criteria:

- the paper must be from a peer-reviewed journal with impact factor >1
- the paper must have been recently published, or be well-cited (as judged subjectively by the student)
- the paper must describe original research (no review articles)

Students must email a pdf copy of their chosen paper to the instructor no later than April 13, including a brief justification for their choice. Students who are unfamiliar with performing a search of the scientific literature should meet with the instructor during office hours to discuss this process.

Further details for the presentation will be given in class, and will be based around the following guidelines:

- The presentations should be 10 minutes long *plus* 5 minutes for questions
- The presentations should introduce the general topic of the paper with examples provided by the literature, and explained using material learned in CHE 516
- The score for the presentation will depend upon the following criteria: Choice of paper, Content, Structure, and Delivery

***Bonus Points:***

Each student may earn up to ten bonus points during the semester. Each bonus point adds 0.2% to your final grade. Students will earn one bonus point for every question asked during the literature presentations on April 20. Bonus points may also be earned by participating in *Piazza* (see below). You can earn bonus points up to and including the last day of classes. No bonus points will be awarded after April 28.

***Grading scale (Graduate Students):***

80 – 100% = A; 70 – 79% = B; 60 – 69% = C; Less than 60% = E  
 Ranges may be lowered but will not be raised.

***Grading scale (Undergraduate Students):***

80 – 100% = A; 70 – 79% = B; 60 – 69% = C; 50 – 59% = D; Less than 50% = E  
 Ranges may be lowered but will not be raised.

**Course Tools**

***Canvas:***

*Canvas* is UK's learning management system. To access *Canvas*, go to <http://uk.instructure.com>. Use your Link Blue username and password to log in. Log into *Canvas* as soon as possible following your first class meeting to resolve any technical problems before the first assignment is due, and check it daily for announcements and assignments. Once in *Canvas*, click on *Courses* and choose this course. Use the links provided in *Canvas* to access online aspects of the course, including *Piazza*.

Students are strongly encouraged to explore the *Canvas* site for the course to see all of the resources available to them including lecture notes etc.

*Help with Canvas.* For technical assistance with *Canvas*, first try the *Help* link on the bottom left of the *Canvas* home page. *Chat with Canvas support* provides quick help 24/7/365. You can contact UKIT Customer Service by calling 218-4357 (218-HELP), by visiting 111 McVey Hall (M–F, 7:00 a.m.–6:00 p.m.), by visiting Tech Help @ the Hub in the basement of W.T. Young Library (M–F 10:00 a.m.–6:00 p.m.) or by emailing [218help@uky.edu](mailto:218help@uky.edu).

***Piazza and E-mail:***

*Piazza* is a question-and-answer platform for instructors and students. You can access *Piazza* via the link on *Canvas*. You can post questions and answers, and edit responses. *Piazza* simulates classroom discussion in a chat-room format. Students will be expected to post any course-related question (i.e. anything of a non-personal nature) on *Piazza*, rather than e-mailing the instructor directly, so that every student may benefit from the answer.

One bonus point will be earned for any answer on *Piazza* flagged by the instructor as “good answer”, if posted by a student in response to a student question.

### **Final Exam Information**

Wednesday, May 3, 10:30 AM to 12:30 PM, Room 297 Chemistry-Physics Building

### **Mid-term Grade**

Mid-term grades will be posted in myUK by the deadline established in the Academic Calendar (<http://www.uky.edu/Registrar/AcademicCalendar.htm>)

### **Tentative Course Schedule**

#### ***Important dates:***

Class and office hours canceled:	January 24
First Homework due:	Tuesday, January 24
Review class (tentative):	February 21
Midterm examination 1:	Thursday February 23, 9:30 to 10:45 AM
Spring break:	March 13-18
Class and office hours canceled:	April 4
Midterm examination 2:	Thursday April 6, 9:30 to 10:45 AM
Literature Presentations:	April 20
Final Homework due:	Thursday, April 20
Dead Week:	April 24-29
Review classes (tentative):	April 25; April 27
Final examination:	Wednesday, May 3, 10:30 AM to 12:30 PM

#### ***List of topics (tentative class schedule):***

1. Crystal Structures (classes 1-4)
2. Bonding in Solids (classes 5-8)
3. Crystallography and Diffraction Techniques (classes 9-10)
4. Other Techniques (class 11)
5. Crystal Defects, Non-Stoichiometry and Solid Solutions (classes 12-16)
6. Phase Diagram Interpretation (class 17)
7. Electrical Properties (classes 18-19)
8. Magnetic and Optical Properties (classes 20-21)

### **Course Policies:**

#### ***Excused Absences:***

Students need to notify the professor of absences prior to class when possible. *Senate Rules 5.2.4.2* defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit “reasonable cause for nonattendance” by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Two weeks prior to the absence is

reasonable, but should not be given any later. Information regarding major religious holidays may be obtained through the Ombud (859-257-3737, [http://www.uky.edu/Ombud/ForStudents\\_ExcusedAbsences.php](http://www.uky.edu/Ombud/ForStudents_ExcusedAbsences.php)).

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused) per University policy.

Per *Senate Rule 5.2.4.2*, students missing any graded work due to an excused absence are responsible: for informing the Instructor of Record about their excused absence within one week following the period of the excused absence (except where prior notification is required); and for making up the missed work. The professor must give the student an opportunity to make up the work and/or the exams missed due to an excused absence, and shall do so, if feasible, during the semester in which the absence occurred.

***Verification of Absences:***

Students may be asked to verify their absences in order for them to be considered excused. *Senate Rule 5.2.4.2* states that faculty have the right to request “appropriate verification” when students claim an excused absence because of illness, or death in the family. Appropriate notification of absences due to University-related trips is required prior to the absence when feasible and in no case more than one week after the absence.

***Academic Integrity:***

Per University policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the University may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: <http://www.uky.edu/Ombud>. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

*Senate Rules 6.3.1* (see <http://www.uky.edu/Faculty/Senate/> for the current set of *Senate Rules*) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording, or content from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Plagiarism includes reproducing someone else's work (including, but not limited to a published article, a book, a website, computer code, or a paper from a friend) without clear attribution. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work, which a student submits as his/her own, whoever that other person may be. Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone.

When a student's assignment involves research in outside sources or information, the student must carefully acknowledge exactly what, where and how he/she has employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content, and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas, which are so generally and freely circulated as to be a part of the public domain.

Please note: Any assignment you turn in may be submitted to an electronic database to check for plagiarism.

***Accommodations due to disability:***

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (DRC). The DRC coordinates campus disability services available to students with disabilities. It is located on the corner of Rose Street and Huguelet Drive in the Multidisciplinary Science Building, Suite 407. You can reach them via phone at (859) 257-2754 and via email at [drc@uky.edu](mailto:drc@uky.edu). Their web address is <http://www.uky.edu/StudentAffairs/DisabilityResourceCenter/>.

***Accommodations for victims of violence:***

By federal law, any student who is a victim of dating violence, domestic/intimate partner violence, sexual assault, or stalking (whether on or off campus) is entitled to appropriate accommodations for his or her coursework. To get help getting accommodations and other support, students who are assaulted can do any of the following:

1. Tell your instructor who can assist you in accessing resources appropriate to your situation;
2. Call the UK VIP Center (Violence Intervention and Prevention Center) at 257-3574 or [vipcenter@uky.edu](mailto:vipcenter@uky.edu) or [http://www.uky.edu/StudentAffairs/VIPCenter/about\\_contact.php](http://www.uky.edu/StudentAffairs/VIPCenter/about_contact.php); or walk in to the Center in Frazee Hall, lower level, between 8:30 and 5:00;
3. Call the University Counseling Center at 257-8701; 2nd floor, Frazee Hall;
4. Call Ms. Patty Bender from the UK Institutional Equity and Equal Opportunity at 257-8927 or [patty.bender@uky.edu](mailto:patty.bender@uky.edu); or
5. **In the case of an emergency, contact the UK Police Department at 911.**

6. Students may also contact community resources 24-hours a day, including:
  - a. Bluegrass Rape Crisis Center at 800.656.4673 or <http://bluegrassrapecrisis.org/>
  - b. Greenhouse17 (formerly Bluegrass Domestic Violence Program) at 800.544.2022 or <http://greenhouse17.org/>