

**CHEMISTRY LABORATORY IVA-CTW, section 023. (Chemistry 4160)**  
**Georgia State University**  
**Department of Chemistry**  
**Spring Semester 2019**

**Instructor:** Dr. W. Crawford Elliott, Associate Professor of Geosciences

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**Primary Texts:** *Elements of X-ray Diffraction 2<sup>nd</sup> edition Addison Wesley*, by B.D. Cullity. *X-ray diffraction and identification and analysis of clay minerals*, 2<sup>nd</sup> edition. Oxford University Press. Copies of these books are available in 409 Sparks. The student may sign out these texts for a short term (day or two). Otherwise, these texts stay in the lab. **Office Hours:** 4-5 pm M, anytime the door is open, or by appointment. Meeting times and laboratory hours are by arrangement, see below. Credit Hours earned: Three semester credit hours are earned on successful completion of this course. Prerequisite: CHEM 4000 and CHEM 4110 with grades of C or higher, or equivalent, and prior selection of special problems.

**Objectives:** The primary objective of this course is to be able to describe and to understand the uses of X-ray methods in the physical sciences (chemistry and geosciences, in particular). These methods include: X-ray diffraction and X-ray Fluorescence and related techniques. This course stresses understanding X-ray diffraction in uses related to mineral identification of common rock forming minerals although it is possible to include study of other mineral inorganic phases. This course is also intended to present the base information needed by students who wish to pursue advanced graduate courses in X-ray diffraction, X-ray crystallography or X-ray absorption methods. The laboratory work will stress the use of X-ray diffraction to identify minerals in bauxite ore collected by the instructor. This ore was collected from the Georgia Coastal Plain.

**Mechanism:** This course is a self-paced reading and lab-based course. The reading assignments are intended to introduce and provide the necessary background to understand the following topics: Generation of X-rays, Diffraction of X-rays; Absorption of X-rays; and use of diffracted X-rays to identify minerals.

The following reading activities are planned and should be accomplished before the W-WF deadline.

Cullity: Chapter 1 (all).

Moore and Reynolds (Chapters 1-3, 7).

After completion of the reading assignments, the student will be tested on the understanding of this material. This assessment can be completed in one of several ways. These possible ways include: traditional test; completion of problems at the end of Chapter 1 in Cullity; or write a short paper 5-10 p describing the generation of X-rays, diffraction of X-rays and the use of X-rays to identify minerals. Student's choice to be decided one month the W/WF date. The grade earned in the completion of this assignment will count 25% of the course grade. This assessment be it a paper, test or completion of Chapter 1 problems in Cullity should be completed February 27.

The following laboratory exercises will be done as a course requirement. These exercises include: Separation and cleaning the light mineral subfraction of BASF 3-1 bauxite sample; preparation of a random mount for X-ray diffraction analysis; the analysis of this subfraction using X-ray diffraction; Identification of the d-spacing values observed on the diffraction scan and identification of the minerals in this subfraction. This work is time consuming. The student can work on his own pace throughout the term. This component will count 25% of the course grade. The course grade will be based on the thoroughness, adherence to safe protocols; and application of technique. The instructor will describe the various techniques.

The third component of the work will be keeping accurate and complete notes of all laboratory work. The student will keep a lab note book and note all aspects of all laboratory work done for this course. The student will also complete early in the term the GSU X-radiation Safety Course and sign up for an X-ray dose badge. This grade earned in completing this component counts 25% toward the course grade. The student will maintain current laboratory certifications (e.g. Right to know, hazardous waste handling).

The final component of this course will be a written report. This report will follow all requirements set forth by the Department of Chemistry for this course as documented in the Undergraduate Research Form (already signed on by the student and on file with the Department). This paper will be graded based on: readability (grammar, sentence structure, paragraph structures), paper organization, references; technical content in equal amounts. This paper is due one week before the final exam period. This due date will permit the instructor to read this paper, offer commentary for the student in time to correct and submit the final product at the start of the final exam period.

**Accommodations for students with disabilities.** Any student with a documented disability that influences their participation in this course needs to visit the Georgia State University Disabilities Services office in the Student Center-East, Suite 205. The website for GSU Disabilities Services is here: <http://disability.gsu.edu/>. In most cases, you will first need to have your disability documented by GSU Disabilities Services. Once that is complete, you can schedule a meeting with the instructor to discuss how we can accommodate your full participation in the class. That meeting should conclude with signing of some forms that are outlined at the website above. Please always communicate with me about any issues you are having so we can address them promptly.

**Grading:** The grade will be a composite score based on the scores of assessment of reading materials; laboratory work, laboratory notebook review and final paper. The occurrence of plagiarism will result in a lowered grade on the assignment and the student will be reported to the University Administration if circumstances warrant it. If you have a valid reason for missing an exam or required laboratory exercise, please see me as soon as possible to reschedule the exam or due date for lab exercise. If I do not hear from the student in a reasonable period of time (3 days) from the time of the exam or due date of the exercise, then a zero will be awarded for that exam or exercise.

**X-ray Safety:** All students will be performing analyses using one of the two X-ray Diffractometer (XRD) housed in the Geosciences Department at GSU. The procedures for operating this XRD will be adhered rigorously. Serious deviations from these procedures at any time in the semester or failure to attend the required safety training sessions are grounds for immediate withdrawal from this course at any point in the semester. As mentioned earlier, students enrolled in this course must register and complete the GSU Radiation Safety Course and XRD Site Training before using the XRD. The GSU training request form can be read at: <http://www.gsu.edu/research/63461.html> Safety glasses are required for all laboratory work. Prescription glasses satisfy this requirement.

#### **Available Reference Books.**

The Books listed below can be found in the Clay Laboratory (SP 409). They remain in one of those three places for all to use. These books were purchased as reference texts for the study of clay minerals, separations techniques and soils and they are not to be removed from Sparls Hall.

*Minerals in the Soil Environment*, Second Edition. [eds. J.B. Dixon, and S.B. Weed], 1989, Soil Science Society of America Series 1., 1244 p.

Jackson, M.L., 1979, *Soil Chemical Analysis*. M.L. Jackson, Madison, WI., 897 p.

### **Important Dates**

February 27: Deadline for completion of reading assignments and assessment.  
March 5: Withdrawal date and possibly receive a "W"  
March 18-March 22: Spring Recess  
April 22: Paper/Project Due.