CHEM 720: *Fundamentals and Methods of Analytical Chemistry*

Fall 2017

Instructor	David Weis Please try to address me as “David”. My pronouns are “he”, “him”, and “his”.
Office	3062A Malott
Phone	785-864-1377
e-mail	dweis@ku.edu My usual response time to email is 12-24 hours.
Office hours	I am happy to meet with you to answer questions, discuss chemistry, or if you are having difficulties with the course. MWF, 1-1:30 PM, no appointment needed. Otherwise, the best way to schedule a meeting with me is by e-mail with an explanation of what you want to discuss and a suggestion of 2-3 times when you could meet.
Meetings	MWF, 11:00-11:50 AM 3059 Malott
Pre-requisites	An undergraduate course in analytical chemistry, a year of organic and a year of physical chemistry; or consent of the instructor.
Credit	3 credit hours
Required texts	All readings will be taken from literature available through the library.
Recommended texts	A comprehensive undergraduate analytical chemistry text such as Harris, *Quantitative Chemical Analysis*; Christian, *Analytical Chemistry;* or Skoog, *Fundamentals of Analytical Chemistry*, will be a nearly essential reference. If you do not already own one, a slightly out-of-date editions can be easily acquired at little expense from online vendors.

Course description

“An introductory graduate level course in analytical chemistry, in which the principles of electrochemistry, spectroscopy and separation science are utilized to solve analytical problems in inorganic, organic and biochemistry.” (From the KU Catalog)

I teach this course as a seminar based on recent primary literature in the field of analytical chemistry. By using literature drawn from a variety of different areas, the course achieves a broad survey of the field of analytical chemistry. As a seminar course, a significant portion of the course material is taught by the students.

Most of you are first-semester graduate students: welcome to KU! Transitioning a graduate student is not easy; this course is designed to help! Enrolling in a Ph.D. program means that you aspire to be a scientist holding the highest degree in your field. You must develop new skills and perhaps adopt a new mindset about your education. Your future success is not measured by tests and course grades but rather by how well you can take ownership of your own professional development. To achieve this requires both a broad and deep understanding of your field, but that alone is not enough. Scientific fields advance and change; you need to learn how to keep up with these changes. All of this requires that you develop the ability to follow the literature in the field and also the ability *to teach yourself, and others, new things*.

Course objectives

- Develop a broad understanding of the field of chemical analysis.
- Develop the ability to search and critically read primary scientific literature.
- Learn to use different reading styles with scientific literature.
- Enhance your ability to communicate scientific concepts verbally and in writing.
- Develop self-teaching and research skills.
- Become familiar with analytical chemistry research at the University of Kansas.

Instructional Approach

The course is divided into six modules, each focused on a different paper. Each module consists of the following series of steps:

1. You will read the assigned paper before class to obtain a general understanding of the paper and to identify concepts that you do not understand. Expect this to require 1-3 hours.
2. You will take a short quiz on the assigned paper to assess your basic understanding.
3. As a group we will generate a list of key topics from the paper that need to be understood. Some of this material will be taught by the students, some by me.
4. Outside of class you will meet with me to review your teaching topics.
5. You will teach your topics to the class using both informal (*chalk talks*) and formal styles (*PowerPoint*), as assigned.
6. I will lecture and lead discussion on difficult concepts.
7. You will complete a written homework assignment about the paper.

To supplement our course readings, members of the Chemistry faculty who work in the area of analytical chemistry will give presentations on their research areas.

Course readings

J. M. Green, A practical guide to analytical method validation. *Anal. Chem.* **1996,** *68,* 305A-309A, DOI: 10.1021/ac961912f.

1. M. Krachler, R. Alvarez-Sarandes, G. Rasmussen, High-Resolution Inductively Coupled Plasma Optical Emission Spectrometry for 234U/238Pu Age Dating of Plutonium Materials and Comparison to Sector Field Inductively Coupled Plasma Mass Spectrometry. *Anal. Chem.* **2016,** *88,* 8862-8869, DOI: 10.1021/acs.analchem.6b02472
2. T. Piper, U. Mareck, H. Geyer, U. Flenker, M. Thevis, P. Platen, W. Schänzer, Determination of $^{13}C/^{12}C$ ratios of endogenous urinary steroids: Method validation, reference population and application to doping control purposes. *Rapid Commun. Mass Spectrom.* **2008,** *22,* 2161-2175, DOI: 10.1002/rcm.3601
3. R. J. White, H. M. Kallewaard, W. Hsieh, A. S. Patterson, J. B. Kasehagen, K. J. Cash, T. Uzawa, H. T. Soh, K. W. Plaxco, Wash-free, Electrochemical Platform for the Quantitative, Multiplexed Detection of Specific Antibodies. *Anal. Chem.* **2012,** *84,* 1098-1103, DOI: 10.1021/ac202757c
4. J. H. Wade, A. T. Alsop, N. R. Vertin, H. Yang, M. D. Johnson, R. C. Bailey, Rapid, Multiplexed Phosphoprotein Profiling Using Silicon Photonic Sensor Arrays. *ACS Central Sci.* **2015,** *1,* 374-382, DOI: 10.1021/acscentsci.5b00250
5. NMR-based metabalomics paper. To be announced later.
6. Voloshenko Rossin, S. Sladkevich, G. Gasser, A. Melman, O. Lev, Sensitive Analysis of Nitroguanidine in Aqueous and Soil Matrices by LC-MS. *Anal. Chem.* **2017,** DOI: 10.1021/acs.analchem.7b02364

Evaluation

***Quizzes* (5%).** You are expected to read each paper carefully before coming to class. Expect the initial reading to require 1-3 hours. To encourage preparation, a short quiz will be given at the beginning of the class meeting of each module. The quizzes will cover the paper at a basic level. You will not be able to look at the paper or your notes during the quiz.

***Teaching* (15%)**. You will have 2-3 opportunities during the semester to teach your classmates concepts from the journal articles. Some of your teaching will be done using a chalkboard style and some using PowerPoint. Your grade will be based both on the accuracy and effectiveness of your presentation. You will be evaluated by your classmates and by me. You are strongly encouraged to meet with me at least one day before your teaching to review your content. Students who teach more than the minimum number of times will have their lowest teaching score(s) dropped.

***Homework* (20%).** A written assignment combining homework problems and essay questions will review concepts covered in class discussion and also ask you to go beyond what is covered in class. You are encouraged to collaborate with your classmates on these assignments, but you must submit your own answers, written in your own words.

***Midterm exam* (15%).** The midterm exams will focus on your understanding of the analytical chemistry concepts covered in the papers.

***Term paper* (15%).** You will write a paper describing an analytical method of your choosing. Additional instructions will be provided in mid-September.

***Term paper presentation* (10%).** You will share what you learned in your term paper with the class using a formal, slide-based talk.

***Final exam* (15%).** The final exam will require you to analyze a journal article on your own. The article will be assigned one week in advance of the final.

***Participation* (5%).** Your participation grade will be based on attendance and engagement in the class.

Grading

Letter grades (A-F) will be used to evaluate your work. Your final grade will calculated using a weighted grade point average (A = 4.0, B+ = 3.3, etc.). An "A" grade represent exemplary work of high quality.

Grades for assignments		**Final Grades**	
Grade	GPA points	Course Average	Grade
A+	4.3		
A	4.0	3.7-4.3	A
A–	3.7	3.5-3.7	A–
B+	3.3	3.3-3.5	B+
B	3.0	3.0-3.3	B
B–	2.7	2.5-3.0	B–
C+	2.3	2.3-2.5	C+
C	2.0	2.0-2.3	C
C–	1.7	1.5-2.0	C–
D+	1.3	1.3-1.5	D+
D	1.0	1.0-1.3	D
D–	0.7	0.5-1.0	D–
F	0.0	0-0.5	F

Policies

Attendance: Your attendance at scheduled class meetings and other scheduled events is expected. Responsible students typically notify their instructors when they will be absent. Absences may result in a decreased participation grade. Repeated absences will be considered problematic.

Religious observances: Please inform me in advance if you have any religious observances that conflict with the course schedule. We will make alternative arrangements.

Late work and missed assignments: Professionals frequently find themselves working under non-negotiable deadlines. Thus, late work will not be accepted in this class. However, quizzes and homework averages will be calculated after dropping the lowest score. Exceptions to this policy may be granted under compelling circumstances.

Group work: Unless an assignment is designated as *individual work*, you are encouraged to work together to understand assignments. If you do work as part of a group, you must your own individual assignments written in your own words.

Electronic device use: Silence your phone and put it away when you come to class. Please inform me if you intend to take notes using a tablet or laptop or if you are awaiting an urgent phone call or text message. Students who are unable to adhere to this policy will be asked to excuse themselves from the classroom.

***Benevolent dictator*:** I am a benevolent dictator in this course and reserve the right to change the structure, criteria for evaluation, and assignments for reasons that are in the best interest of student learning. I will not make such changes capriciously. Any changes in schedule or structure of the course will be announced in class and on Blackboard.

Archives of student work: I may retain copies of your work in an archive. This archive may be used for teaching and course development and in course administration. I will obtain written consent for other uses of your work such as inclusion in a teaching portfolio or for sharing with the class.

Access to Education: The KU office of Disability Resources coordinates accommodations and services for all students who are eligible. If you have a disability for which you wish to request accommodations and have not contacted DR, please do so as soon as possible. Their office is located in 22 Strong Hall; their phone number is 785-864-2620 (V/TTY). Information about their services can be found at http://disability.ku.edu. Please also contact me privately with regard to your needs in this course.

Privacy and Tracking Notice: Blackboard may automatically record student activities, including but not limited to: your first and last access to the course, number of times you have accessed the course, pages you have accessed, the number of discussion messages you have read and sent, posted discussion messages, and chat room text. This data can be accessed by the instructor.

Firearms. Individuals who choose to carry concealed handguns are solely responsible to do so in a safe and secure manner in strict conformity with state and federal laws and KU weapons policy. Safety measures outlined in the KU weapons policy specify that a concealed handgun must be under the constant control of the carrier; must be out of view, concealed either on the body of the carrier, or backpack, purse, or bag that remains under the constant control of the carrier; must be in a holster that covers the trigger area and secures any external hammer in an un-cocked position; must have the safety on, and have no round in the chamber.

Academic integrity

You are expected to maintain the highest standards of honesty and integrity in your work in this course. Behavior that deviates from these standards will be dealt with as laid out in the University Senate Rules and Regulations (Article II, Section 6, http://www2.ku.edu/~unigov/usrr.html). For the purposes of this course, academic misconduct includes, but is not limited to: providing or obtaining unauthorized information on an assignment or an exam; fabricating information; claiming the work of another as your own; sabotage; plagiarism; aiding or abetting the misconduct of others; and dishonesty. At the very minimum, you will receive a grade of zero on any work in which you violate these integrity standards. Repeated violations will result in failure in the course and be reported to the Dean of the College of Liberal Arts and Sciences. I reserve the right to retain copies of all submitted work.

Obviously, cheating is cheating, but some forms of unethical behavior are more subtle. The following examples would be treated as academic misconduct:

- A student who has postponed an exam due to illness discusses the exam with a student who has already taken it.
- In preparing for a research project, a student in this course uses the research notes, bibliography, or other materials prepared by someone else, for example a previous CHEM 720 student. [Part of the objective of a research assignment is to learn how to do research. Using someone else's work defeats the purpose.]

- A student chooses a research project in which he or she has already carried out a substantial portion of the research for another reason, for example, for a lab meeting. [Same as the previous example, but this might be permitted with consent of the instructor.]
- An instructor has asked each student to write suggested questions with answers for the final exam. Without consulting with the instructor, a group of students circulates a pool of all their questions along with their answers. [This actually happened to your instructor in graduate school. The students decided that since sharing questions was not specifically prohibited, that it was acceptable to do so. How do you think the instructor responded when he learned about it?]
- In preparing a summary of a published research paper, a student uses wording that is a close paraphrase of the original text. [Even with a citation, written work must be original to the author.]
- A student incorporates information from Wikipedia in a research paper and deliberately misattributes it to an article in Mass Spectrometry Reviews to hide the original source. [This is falsification.]

When it comes to matters of misconduct the adage that "it is easier to ask for forgiveness than permission" **DOES NOT APPLY**! Ethical missteps have destroyed careers. As much as is possible, all assignments in this course will have clearly stated rules.

Avoiding plagiarism in your written assignments

While deliberate cheating on a writing assignments is unusual, past experience has shown that many students find it difficult to re-express what they have read in words that are truly their own. This presents two distinct, but important issues. The first is "parroting": repeating what has been read without truly understanding it. The second is an issue of writing, of not making the effort to express an idea clearly in original terms in one's writing. In some parts of the world, using the words of an authoritative source, such as a textbook author or prominent scholar in writing is a sign of respect. This is not the case for academic work in the United States. Most authors would be angry to find their words used without their consent and I expect my students to write original material. The following are some examples of the use and misuse of a source.

Original text (from Li and Brownawell, *Anal. Chem*. **2009,** *81,* 7927):

> *"The ability to resolve nominally isobaric elemental formulas based on accurate mass measurements depends on the combined elemental mass defects of the atoms in the ion of interest as well as the mass-measurement accuracy achievable with a given instrument."*

The following version is considered plagiarism because it is a very close paraphrasing of the original text *without a citation*:

> *Resolving nominally isobaric formulas using accurate mass measurements relies on the elemental mass defects of the elements in the ion and on the mass measurement accuracy of the given instrument.*

The following version could also be considered plagiarism ***even when the citation is included***:

> *Resolving nominally isobaric formulas using accurate mass measurements relies on the elemental mass defects of the elements in the ion and on the mass measurement accuracy of the given instrument* (Li and Brownawell, *Anal. Chem.* **2009,** *81,* 7927).

Why is this second version unacceptable? There is nearly a 1:1 correspondence between the original passage and this example. Nearly, anyone could take the original sentence and produce this slightly modified version without understanding any of the terms. It is not enough to simply change a few words or rearrange the original text so that it is not an exact quotation. An author must write something that is an original expression and interpretation of what has been read.

The following is a good example of an original restatement of the idea in the sample text:

> *When the mass defects are large enough, high accuracy mass measurements can be used to resolve compounds with the same nominal mass [4].*

Authors should strive to follow this last example in summarizing the work of others. It is also important when taking notes on reading to either record exact quotes with quotation marks or to carefully restate

notes in one's own words. This procedure protects an author from inadvertently plagiarizing when converting notes into a text.

If you are concerned about the originality of your written work, please discuss the matter with me before your assignment is submitted. There will be no penalty for any issues identified in this initial review.

Course schedule

This is a projected schedule for the course. Deviations will be announced in advance if they affect significant deadlines. Required work is due by the start of the class meeting except where noted.

Day	Date	Activity	Required work
Mon	8/21/2017	Course introduction	
Wed	8/23/2017	Paper 1 introduction	quiz 1
Fri	8/25/2017	Paper 1 help day	
Mon	8/28/2017	Paper 1, student-led	
Wed	8/30/2017	Paper 1 discussion	
Fri	9/1/2017	Paper 2 introduction	quiz 2
Mon	9/4/2017	Labor Day, no classes	
Wed	9/6/2017	Paper 1 discussion	paper 1 homework
Fri	9/8/2017	Paper 2 help day	
Mon	9/11/2017	Paper 2, student-led	
Wed	9/13/2017	Paper 2 discussion	
Fri	9/15/2017	Yong Zeng	
Mon	9/18/2017	Literature searching	
Wed	9/20/2017	Paper 3 introduction	quiz 3
Fri	9/22/2017	Paper 2 discussion	paper 2 homework
Mon	9/25/2017	Steve Soper	
Wed	9/27/2017	Paper 3, student-led	
Fri	9/29/2017	Paper 3 discussion	term paper topic proposal
Mon	10/2/2017	David Weis	
Wed	10/4/2017	Paper 4 introduction	quiz 4
Fri	10/6/2017	Bob Dunn	
Mon	10/9/2017	Paper 3 discussion	paper 3 homework
Wed	10/11/2017	Mid-term exam	
Fri	10/13/2017	Paper 4, student-led	
Mon	10/16/2017	Fall break	
Wed	10/18/2017	Paper 4 discussion	annotated bibliography
Fri	10/20/2017	Heather Desaire	
Mon	10/23/2017	Paper 4 discussion	paper 4 homework
Wed	10/25/2017	Paper 5 intro	quiz 5
Fri	10/27/2017	Cindy Berrie	
Mon	10/30/2017	Managing literature	
Wed	11/1/2017	Paper 5, student-led	
Fri	11/3/2017	Paper 5 discussion	
Mon	11/6/2017	Michael Johnson	
Wed	11/8/2017	Mei He	
Fri	11/10/2017	Paper 6 introduction	quiz 6, paper 5 homework
Mon	11/13/2017	Paper 6, student-led	term paper first draft
Wed	11/15/2017	Paper 6 discussion	
Fri	11/17/2017	Term paper conferences	
Mon	11/20/2017	Paper 6 discussion	paper 6 homework
Wed	11/22/2017	Thanksgiving	
Fri	11/24/2017	Thanksgiving	
Mon	11/27/2017	Term paper talks	
Wed	11/29/2017	Term paper talks	
Fri	12/1/2017	Term paper talks	
Mon	12/4/2017	Term paper talks	
Wed	12/6/2017	Term paper talks	Term paper final draft
Mon	12/11/2017, 10:30 AM-1:00 PM	Final exam	