

## CHEM 300 Analytical Chemistry Spring Semester 2013

**Instructor:** Dr. Ryan J. White  
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**Office hours:** T,Th 9:00-10:00 or by appointment

**Lecture:** T, Th 11:30 – 12:45, Academic IV 003  
**Discussion:** Fr 11:00 – 11:50, UC 115D  
**Lab Section 3:** T 1:00 – 5:00 MEYR 340  
**Lab Section 4:** Th 1:00 – 5:00 MEYR 340

**Laboratory Instructor:** Dr. Stephen Mang; (410) 455-5747; smang@umbc.edu  
**Discussion Instructor:** Dr. Diana Hamilton; (410) 455-3461; hamilton@umbc.edu

**Important Dates:** February 8 – Last day to drop without a grade of “W”  
March 18 – 22 – Spring Break, No Class  
May 16 – Final Exam 10:30 AM – 12:30 PM

**Course Description:** This course is a combined lecture-discussion-laboratory class, in which students will be exposed to the theory and practice of quantitative chemical analysis as well as concepts associated with chemical equilibria. Active learning session each week will re-enforce the topics covered during lecture. Students will also get hands-on experience in gravimetric and volumetric techniques as well as basic principles associated with instrumental analysis techniques in the laboratory portion of class.

**Course Objective:** By the end of this course you will be able to: 1) *understand* the principles and theory behind chemical equilibria and quantitative analyses, 2) *identify* the most useful instrumentation involved in chemical analyses and understand the fundamental principles underlying them, and 3) *interpret* results and understand how to apply this knowledge to different samples.

### Tentative Lecture Schedule:

<u>Week</u>	<u>Topic</u>	<u>Chapter(s)</u>	<u>Exam</u>
01/28	Introduction/Measurements/Error	1-3,5	
02/04	Statistics/Sample Preparation	4,5,27	
02/11	Solubility/Equilibria Introduction, Activity	6,7	
02/18	Systematic Equilibria/Acid-Base Equilibria	7,8,9	
02/25	Volumetric Analysis/Titrations	10,11,15	Exam I
03/04	Volumetric Analysis/Titrations	10,11,15	
03/11	Volumetric Analysis/Titrations	10,11,15	
03/18	Spring Break		
03/25	Analytical Separations	22	
04/01	Gas and Liquid Chromatography	23,24	Exam 2
04/08	Gas and Liquid Chromatography	23,24	
04/15	Mass Spectrometry, GC/MS, LC/MS	21,23,24	
04/22	Chromatographic Methods/Capillary Electrophoresis	25	
04/29	Spectrophotometry/Spectroscopy	17-19	
05/06	Spectrophotometry/Spectroscopy	17-19	Exam 3
05/13	Last day of classes		

## Course Requirements:

**Textbook:** Daniel C. Harris "Quantitative Chemical Analysis", 8th ed., Freeman, New York.  
Online web companion to the book at: [www.whfreeman.com/qca](http://www.whfreeman.com/qca)

**Lab Text:** The lab manual for Chem 300 is available in the bookstore for purchase and handouts with additional information will be provided. In addition, you will also need to purchase a carbonless copy lab notebook entitled "The Official Laboratory Research Notebook" for the lab portion of the class.

**Grading:** The lecture, discussion and laboratory parts of the course will be graded separately. A grade of "D" or better is required in each part to pass the course. Final grades for the course will be 55% lecture, 35% laboratory and 10% Discussion.

Lecture grades will comprise three one-hour exams and one comprehensive final exam. Laboratory grades will be based upon ten laboratory reports, a laboratory final exam, and laboratory notebook condition. The weighting of these various components are described below.

Assignment	% of Grade
3 One-Hour Exams	45
Final Exam	10
Discussion/Active Learning	10
Laboratory Reports	25
Laboratory Final Exam	5
Laboratory Notebook	5
<b>Total</b>	<b>100</b>
<i>Extra Credit: Clickers</i>	<i>1</i>

Letter Grades for the class will be assigned based upon the following distribution.

Class Percentage	Letter Grade
90-100	A
80-89	B
69-79	C
56-68	D
0-55	F

**Academic Conduct:** Students are required to comply with the University rules of conduct, as described at <http://www.umbc.edu/NewsEvents/Student/oldstconduct.html> and related links. UMBC takes a strong stand against academic dishonesty in the classroom. To read the full Statement of Academic Integrity, go to <http://www.umbc.edu/provost/integrity/Honorcode.htm>. Cheating, fabrication of data, plagiarism, and other violations will not be tolerated in this course. Remember, UMBC is an Honors University.

Turning in work that is reproduced in whole or in part from a classmate's paper, any internet source, or any textbook or journal article without proper citation will be treated as an academic integrity violation and reported to the Office of the Provost. UMBC states that the penalty for such a

violation is to be at the discretion of the instructor; the penalty in this class will be at least a zero on the assignment for a first offense. Subsequent offenses will be rewarded with a failing grade in the class.

**Makeups:** Make up labs and exams will be given in accordance with University policy: a signed and readable note on letterhead paper from a physician, a police report, a certificate from a funeral home, etc. are required to be on file.

**Clickers:** Turning Technologies clickers will be used for short, interactive activities in lecture. It is your responsibility to purchase and register your clicker for this class if you choose to use it. You will often be permitted and even encouraged to discuss these questions with your classmates and then each of you transmits your response based on your own judgment.

Clickers will not be a mandatory part of your grade in the course. Rather, it will be used as bonus at the end of the semester. Therefore, if you do not want to participate with clickers this semester, you do not have to.

Participation in clicker activities can earn you a one percentage point curve in the class when final grades are assigned. For example, the cutoff for an A in the course is a 90%; upon qualification, you would only need to have an 89% to get an A. This will hold true for all letter grade cutoffs. To qualify, you must be in attendance on all days that clickers are used with the forgiveness of 3 days (see below) and you must have at least a 75% for your clicker grade. One point will be awarded for every response attempted and an additional point will be awarded for every correct response. If you do not attend all classes as outlined above, you do not qualify for the bonus. No exceptions.

It is academic misconduct to bring someone else's clicker to class and/or to have someone bring your clicker to class. If you are found in possession of someone else's clicker or if it is found that someone brought your clicker to class, you will be reported to the UMBC Academic Misconduct Committee and you will receive an F in the course.

Because unforeseen events happen, you will be given 3 free days for not clicking. These count towards all absences, forgotten clickers AND clicker malfunctions. If you think your clicker isn't working, contact Turning Technologies immediately!

You can purchase your clicker at the UMBC bookstore. If you are required to have a clicker in another class, you only need ONE clicker for all your classes. You must register your TT clicker through the course Blackboard site. You only need to register your clicker in Blackboard one time no matter how many courses you are using it in. The serial # is the 6 digit alpha-numeric code below the bar code. The code may include only 0-9 and A-F (not the letter "O" or the letter "I"). There is no additional registration fee. I strongly recommend writing your name on your clicker so that if you lose it, it can be returned to you. If you lose your clicker, you will have to purchase a new one or forfeit the opportunity for points in the class. If you get a new clicker during the course of the semester, register it as you did the first one and all points will be held and continued. You do not need to notify the instructor upon registering a new clicker.

### **Chemistry 300 Discussion/Active Learning:**

Dr. Hamilton and an experienced teaching assistant will oversee the Discussion sessions. These sessions will be used to guide you through the main concepts of the course by giving you practice in solving problems relevant to the lecture and exam material. These sessions are NOT a replacement for doing practice problems on your own. Discussion sessions will begin Friday September 7<sup>th</sup>. The

Discussion portion will be worth 10% of your grade in the course. Timely attendance is mandatory. Up to two absences will be excused for *University-recognized and documented reasons*. Unexcused absences will be penalized as follows:

# of Discussion Sessions Missed	Total % Deducted from Overall Course Average
1	2
2	6
3	14
4	30
5	62
>5	100

### Chemistry 300 Laboratory:

**Laboratory Reports:** 10 lab reports (for experiments 1 to 10) must be turned in for grading **one week** after the respective lab experiment has been completed. Lab reports will be graded out of 100 points. **A mandatory 10 point deduction will be assessed on the lab report grade for each late calendar day**, calculated starting from the due date and including weekends and days when UMBC is not in session. **A minimum 5 point deduction will be assessed for significant figures and rounding errors.**

**Missing lab reports, or reports that are turned in after the week of April 29<sup>th</sup>, 2013 will be graded with a score of 0 and be included in the calculation of the final grade for the laboratory portion of the course.**

**Lab notebook:** your lab notebook grade will be calculated from the carbon copy pages that you will turn in at the end of each lab day. Missing notebook pages will receive a score of zero. You can turn in the copy pages or the originals, as long as they are legible and neat. Illegible pages may receive lower scores if the information I am looking for cannot be located.

### Laboratory Schedule:

<u>Week</u>	<u>Experiment</u>
01/28	No Labs
02/04	Lab Introductory Lecture and Check-in
02/11	Experiment 1 - Introduction to the Analytical Laboratory
02/18	Experiment 2 - Calibration of Volumetric Glassware
02/25	Experiment 3 - Neutralization Titration
03/04	Experiment 4 - Precipitation Titration
03/11	Experiment 5 - Complexometric Titration
03/18	Spring Break (no labs)
03/25	Experiment 6 - Redox Titration
04/01	Experiment 7 - Redox Back-Titration
04/08	Experiment 8 - Potentiometric Acid-Base Titration
04/15	Experiment 9 - Absorption Spectrophotometry
04/22	Experiment 10 - High Performance Liquid Chromatography (HPLC)
04/29	Laboratory Exam; Clean-up and Check out

- All laboratory reports will be **due at the beginning of lab** the following week, any labs received after 1:05 pm on the day of the lab will be assessed a one day late penalty (i.e., 10 points), with additional days being incurred every 24 hours from 1:05 pm.
- Any excused absences **must** be accompanied by appropriate documentation (e.g., doctor's note, police report, tow truck receipt, etc.). In the case of a university-excused absence, any missed laboratory experiments **must be made up within one week** of the scheduled laboratory experiment, during one of the other lab sections. It is your responsibility to schedule a make-up lab with the instructor.

### **Materials:**

1. Lab Notebook: Students should **purchase a 100-page notebook (carbonless copy)**. Procedures for the experiment are to be summarized in the notebook **before** the scheduled lab period. Your TAs will check to see whether this has been done, and will initial your notebook page to indicate completion. Lab pages with no signature will receive lower lab notebook grades. All data are to be recorded directly in the notebook in ink! Try to maintain an organized and legible notebook (see below). Have the TA check your notebook for style and format within the first few lab meetings.

2. Safety: Goggles are to be worn in the laboratory at all times! In addition, the workbenches are to be kept clear of clutter (books, backpacks, etc.). Appropriate clothing is to be worn in the laboratory - no sandals or open-toed shoes, no shorts or sleeveless shirts. Long hair should be tied back. **NO FOOD OR DRINKS IN THE LAB!** Violation of any of these will result in your dismissal from the lab.

### **Laboratory Notebook Guidelines:**

Your lab notebook is intended to be a substantive record of work performed in the laboratory, in which you must record the data/results obtained from your experiments. It should contain sufficient information so that anyone reading your notebook would be able to reproduce your experiments, and evaluate your conclusions. In general, scientific notebooks follow a basic format similar to that provided below.

### **Notebook Format:**

1. Table of Contents - Leave a few pages at the beginning of your notebook so that you can list the individual experiments, the dates on which they were performed, and the pages on which the relevant procedures and data may be found.
2. Experiments - **Each lab exercise should be dated and initialed on every page.** In addition, the following items should be included:
  - a) Title - (see syllabus) Should be listed both in the Table of Contents and on the first page.
  - b) Objective - A brief (2 to 3 sentences) description of the purpose and goals of the analyses to be performed (in your own words).

- c) Procedures - An itemized list of the sequential steps performed, including information relevant to the preparation of samples, standards, and reagent solutions, and the equipment utilized.
- d) Data - **All data obtained during the analysis should be permanently recorded, in ink, directly in the notebook! Do not write data on pieces of scrap paper!** The data should be clearly labeled (including appropriate units) so that it is obvious what the data represents, i.e. tare weight, weight of tare + sample, etc. If you anticipate accumulating a lot of data, use data tables for convenient data entry. Preparation of these tables ahead of time can save time during the lab. If you make a mistake in entering data, do not erase, rather, draw a single line through the erroneous value(s) and enter the correct value(s) either above or next to the mistake(s). Include graphs when appropriate.
- e) Calculations - Provide any necessary calculations for the experiment (i.e., solvent volume calculations to provide a specific concentration solution from a certain amount of solute) in your laboratory notebook. Your calculations should be clear enough so that it is obvious how the final result was achieved.
- f) Observations - Report any useful, unexpected or necessary observations (e.g., the solution turned pink momentarily, followed by a return to clear). When possible provide potential explanations for unexpected phenomena.

**Originals pages of your lab notebook MUST BE TURNED IN IMMEDIATELY FOLLOWING THE LAB.** Required data tables and calculations will be listed on the whiteboard at the front of the lab room. Lateness penalties of 1 point per minute will be assessed starting at 5:00 PM. You can use the duplicate pages in the notebook to complete the laboratory report and any associated analyses.