

CH 223 "Quantitative Analysis"  
Fall 2003

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Office Hours: Monday 12:00 - 1:00 and Tuesday 1:00 - 2:00 and by appointment

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Required Text: D. Harris, Quantitative Chemical Analysis, 6<sup>th</sup> ed., W. H. Freeman, 2002

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### **COURSE OUTLINE AND SCHEDULE:**

Below are some notes which should help you to clearly understand the objectives of this course. In addition, suggestions are made in respect to preparation for lectures and tests as well as for some aspects of your laboratory work. Please note that this itinerary can be downloaded from the internet.

### **PREPARATION FOR LECTURES AND LABORATORIES:**

You should set aside some time to look at the lecture material to be covered before each class starts. If you want to stay ahead, you must adequately prepare! This will make it much easier to follow the lecture presentations. It is also a particularly effective device to cut down on the time required for test preparation since you actually already know the material to some extent. "Studying for tests" is not as effective as keeping up with the material as you go along. You have to put in more effort for the same result if you wait until the last day before the test.

It is assumed that you are familiar with basic concepts. The class has a prerequisite of CH101/CH102, after all. If it has been a while since you have taken the last chemistry course, you should spend extra time with problem solving. We have a rather challenging and modern book. As with nearly all books, there is too much information. The greatest weakness of the book is the problem section at the end of each chapter. The problems are just too long, and often, too complex. We will try to work around this difficulty.

Most of the figures in the book are available as Powerpoint presentations of variable quality. I will not make use of this technology but will present conventional overheads instead, to save some time. I will also still rely on the chalkboard as primary means of communication. The problems worked on the board will come from a variety of sources. I make it a habit of presenting at least 1 problem of each major topic (called "exercise" in your book) directly from your text. In this case, there is no need to write anything down. Use the time to do some thinking. Other examples from previous texts (Skoog & West, Harvey...) will complement problem solving. **It is really important to remember what materials from your text were covered in class. You will be responsible only for the material that was covered in class.** I strongly suggest that you either highlight the text or somehow mark the chapters, examples, figures, etc. we covered in class. This is an easy way to do it.

Please note that we will cover chapters out of sequence. The major reason is that the laboratory exercises must be coordinated with the lecture material as much as possible. The lecture schedule on the last page is only approximate.

## ATTENDANCE POLICY:

**You should come to each and every class even though a formal roll call will usually not be taken.** Participation in class is strongly encouraged. There is a proven correlation between performance (grade) and class room attendance, especially for students who normally earn grades in the C and D range. To encourage classroom participation, I will attempt to interact with you on an individual basis as much as possible. The following rules apply:

- You should select a seat of your choice and use the same seat throughout the semester (except for exams). This helps me to establish a seating chart and remember your names.
- I will try to ask a few simple questions at random during class. If a student is absent, a negative (-) mark will be recorded. An incorrect answer will be receive a check (✓) mark. A reasonable or correct answer will be marked as plus (+).
- A total of 0-2 points can be earned for this "classroom participation." This will be added as bonus to the grade point average you have earned (see grading philosophy).

## USE OF COMPUTERS, CALCULATORS, DATA BANKS:

"Quantitative Analysis" obviously deals with figures and calculations. Data treatment is one of the most important concepts to be understood and applied in this class. The calculation of something called "standard deviation" is central. The standard deviation of a data set can easily be calculated by hand, just as the result of an addition or multiplication. Unfortunately, the process can be quite lengthy for large data sets. Simple "scientific calculators" are available (cost under \$20) that can abbreviate this routine step. **You are strongly encouraged to buy such a calculator.** It will not only save you time during examinations but you will also need to calculate the standard deviation of the data sets produced in the laboratory.

Several computers are available in the laboratory. Some of the computers are used to control instruments but all have software to produce plots and do statistics. They are available for your personal use. Your TA will introduce you to the use of spreadsheets. You will frequently need to look up physical data such as dissociation constants, molar masses, etc. To save some time during examinations, the appropriate tables will be copied from your text and stapled to each exam.

## QUIZZES:

A total of 6-9 unannounced quizzes, approximately 5-10 minutes each, will be given. Quiz dates are random and will not be announced. There is no makeup for a quiz. If you miss the class period when a quiz is given, you automatically get a zero. If you have a legitimate excuse, please let me know immediately before or after class. The lowest 2 quiz grades will be dropped. A missed quiz will thus qualify as a drop grade. **Quiz questions will be taken either from the material covered in class (problems worked on the board) or from the problems given to you as a separate handout.** (To compensate for the lack of suitable practice problems at the end of each chapter, I have copied, from another source, short and concise problems, suitable for quizzes). **Quizzes will be limited to material covered within the last 2 classes.** Try to work at least one problem of each type.

## HOME ASSIGNMENTS:

There will be no formal home assignments and nothing has to be handed in. On the other hand, **up to 25% of exam questions will come directly from the practice problems and exercises listed in the lecture schedule at the end of this syllabus.** (The only variation may be a change in numbers). It is clearly to your advantage if you work as many problems as possible. Please note that detailed answers for the exercises are provided in the book whereas a separate solutions manual is required for the problem section.

## HELP SESSIONS:

To help you along, help sessions will be offered, as needed. We will meet at a time to be determined by popular vote. This is your chance to take advantage of a free tutor. There is no such thing as a stupid question. The atmosphere in help sessions is quite relaxed, giving you a chance to work through problems which you may not want to bring up during regular class periods. Besides, there is little time to ask questions during class. Help sessions also help me to get to know you. Who knows, you may need a letter of recommendation at some time in the future. Since help sessions are entirely voluntary, extra points cannot be earned. This also means that you will not be penalized for not showing up.

## GRADING PHILOSOPHY:

The only important goal for you is that you understand the material and are able to demonstrate this. The laboratory is an integral part of the course. It may be possible to do very well in the lecture but poorly in the laboratory, or vice versa. **If you have to miss a test, it is necessary to come by my office immediately before or after the test and present an acceptable excuse (i.e., doctor's statement).**

You will take a total of 3 examinations of 1 hour each. This includes the final. In other words, the final will be a regular 1 h exam that happens to fall on the date of the published final (May 9, 11:30 - 2:00 p.m.). Each exam will cover approximately 1/3 of the course material. Each exam counts the same. **The final exam will not be comprehensive.** You are allowed to drop the lowest of the three exams, including the final. Examples of a 1 hour exams with keys will be posted in Room 318, which is your laboratory.

The grade average will be computed, as follows:

The two best hourly exams: 25% each  
Laboratory: 25%  
Quizzes: 25%

**Remember: a maximum of two points can be earned for classroom performance..**  
Good attendance may make the difference.

## DISABILITY ACCESS STATEMENT:

To request disability accommodations, please contact the Office of Disability Services at 348-4285. After initial arrangements are made with that office, contact your professor.

## LABORATORY PROCEDURES:

Before coming to the laboratory you should have a look at the experiment you are to perform. Try to understand the basics. You can then decide for yourself which steps are critical and where you can afford to be lax.

You are requested to bring a laboratory notebook of your choice (no loose sheets) with you. Try to get into the habit of keeping a complete record of your lab activities as you go along. Your lab instructor will initial your lab book after each lab session (and after you have cleaned up your bench). Remember: This is your lab notebook. You will not be judged on its neatness but on the completeness of your entries. You will receive, free of charge, a binder that describes the laboratory experiments.

You must come to all laboratory sessions. **Under no circumstances will you be allowed to work by yourself in the laboratory.** Your instructor (or a substitute) must be present when you work. If he steps out for a moment, you will be told so. Violation of any safety rules will either result in a warning (first time) or expulsion if the transgression is serious enough. You have to wear

safety glasses at all times. You must also be properly dressed. The departmental safety rules apply. Any mishap or accident must be reported to your laboratory instructor immediately.

Balances are delicate tools. You are responsible for damage. Report malfunctions immediately. Your lab instructor will announce the policy concerning balances. He will also announce when report cards and bottles for unknowns are due. An example of a report card is posted inside of the laboratory.

### APPROXIMATE LECTURE SCHEDULE

Projected Number of Class Periods	Chapter	Topic	Practice Exercises	Practice Problems
1/2	0	Introduction		
1	1	Measurements, review of general chemistry	1-B, 1-C	1-3, 1-4, 1-13, 1-14, 1-15, 1-22, 1-25
1 1/2	3	Experimental error		3-1, 3-2, 3-5, 3-6, 3-8, 3-9, 3-10, 3-12, 3-14
1 1/2	27	Gravimetric and combustion analysis	27-A	27-1 to 27-10, 27-14, 27-24, 27-25, 27-28, 27-29
1/2	6-1 and 6-2	Chemical equilibrium, fundamentals		
1	6-7 to 6-9	A) Acids/bases, fundamentals	6-K	6-33, 6-34, 6-35, 6-36, 6-38, 6-39, 6-40
1/2	7-1	Titrations	7-B	7-1 to 7-6
2	10	A1) Monoprotic acids/bases	6-H, 10 C, 10-H	6-41, 6-48, 6-52, 6-53, 10-2, 10-8, 10-17, 10-20, 10-26, 10-27, 10-29, 10-31
<b>Exam I</b>				
1	11	A2) Polyprotic acids/bases	6-I, 6-J	6-50, 6-51, 11-2, 11-3, 11-4, 11-15, 11-22, 11-23
1	12	A3) Acid/base titrations		12-1, 12-3, 12-13, 12-19, 12-26, 12-36, 12-50, 12-56
1/2	7-2	(Kjeldahl) titrations		7-12

Projected Number of Class Periods	Chapter	Topic	Practice Exercises	Practice Problems
1	16	B) Redox		16-8, 16-9, 16-10
2	13	C) EDTA		7-16, 13-26, 13-28, 13-29
2	6-3 to 6-5	A4) Solubility, precipitation	6-C, 6-D,	6-14, 6-15, 6-19, 6-E 6-24, 6-25
<b>Exam II</b>				
1 1/2	8	D) Activity	8-A, 8-B, 8-C	8-1, 8-2, 8-3, 8-12,
2	18	Spectrophotometry, Fundamentals	19-A, 18-B	18-1 to 18-19, 18-16, 18-17, 18-18, 18-22, 18-23, 18-25
1	19	A) Applications		19-3
1	20	B) Spectrophotometers		20-1, 20-3, 20-5, 20-6,
2	23	Separations, Fundamentals		23-15, 23-16, 23-18, 23-19, 13-27 to 23-31, 23-33, 23-37, 23-43
1	24	A) Gas chromatography and GC/MS		24-1, 24-2, 24-3, 24-5 to 24-7, 24-11, 24-13, 14-14, 14-18
1	25	B) High performance liquid chromatography		25-1 to 25-3, 25-18 to 25-20

**Exam III (Friday, May 9, 2003, 11:30 a.m.)**