CHM 325  ANALYTICAL CHEMISTRY  SYLLABUS
SPRING 2006, Section 20495

Lecture:  12:00-1:25 pm Mon,Tues,Wed and Thurs in  378 SEB
Laboratory:  1:30 - 5:00 pm Mon,Tues,Wed and Thurs in 284 SEB
Instructor:  C. Taylor   269 SEB   370-2333   taylor@oakland.edu
Office Hours:  By appointment
Teaching Assistant: Diana Walcott  272 SEB
Required:  A standard-size laboratory notebook.
A pair of safety goggles (the kind that completely protects the eyes in all directions).
Recommended:  A lab coat to protect you and your clothing.

Introduction:
Analytical Chemistry, CHM 325, is a laboratory course with a major supplement of class lectures. Its main purpose is to introduce you to the basic concepts, general problem-solving strategies, technology (chemical, instrumental, and statistical), and communication requirements associated with the ubiquitous problems of chemical analysis. Professionals in the disciplines of chemistry, biochemistry, chemical engineering, environmental health, forensic science, toxicology, industrial hygiene, medicine, pharmacology, pharmacy, geology, agriculture, and a wide range of manufacturing companies are frequently faced with the need to obtain the analysis of the chemical composition or chemical properties of substances. The business of chemical analysis is not only a matter of experts knowing what to do with samples brought to them for investigation, but, just as importantly, it involves communication — accurate statements of the problem requiring analysis, as well as accurate reports of the results of the chemist's work.

During the next 8 weeks you will analyze "unknown" samples using a variety of "wet chemical" and instrumental techniques including gravimetry, titrimetry, spectrophotometry, electrochemistry, and chromatography. One of the principle goals of this course is to give you the opportunity to become familiar with some of the methods used in analytical chemistry. Hopefully, the lectures will provide you with the fundamental chemical and physical principles underlying the analytical methods whereas the labs will provide you with the opportunity to make practical use of those same principles. Two additional goals of CHM 325 are the correct usage of analytical "equipment" and safe laboratory practices. With respect to the former, it is imperative that you understand how to use the technique/instrumentation correctly before actually using it. With respect to safety, it is expected that you will adhere to the practices outlined in the "Undergraduate Laboratory Safety Manual."

Learning Objectives: There are five major learning objectives for CHM 325:

• to provide you with a solid background in those chemical principles that are particularly important to analytical chemistry.
• to develop an appreciation for the task of judging the accuracy and precision of experimental data and to show how these judgments may be sharpened by the application of statistical methods.
• to introduce you to a wide range of techniques that are useful in modern analytical chemistry, some of which you will gain hands on experience in the laboratory portion of the course.
• to develop skills necessary to solve analytical problems in a quantitative manner, particularly with the aid of the spreadsheet tools that are commonly available.
• to acquire those laboratory skills that will enable you to gain confidence in your ability to obtain high-quality analytical data.

Course Grading:

Your grade in this course will be based on your performance on 3 examinations (including the final) at 100 pts each, 3 quizzes at 25 pts each and 10/11 experiments at 25 pts. each (the lowest experiment grade will be dropped). Therefore, the lecture portion (375 pts.) will constitute 60% of your final grade and the laboratory 40% (250 pts). Evaluation of the experiments will be based on the accuracy of the submitted result. A more detailed explanation of the laboratory grading follows.

The grading scale for this class is as follows:

<table>
<thead>
<tr>
<th>Points and percentage</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 560 points (≥ 90%)</td>
<td>4.0</td>
</tr>
<tr>
<td>470 points (75%)</td>
<td>3.0</td>
</tr>
<tr>
<td>375 points (60%)</td>
<td>2.0</td>
</tr>
<tr>
<td>280 points (45%)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Laboratory Grading:

At the beginning of each laboratory experiment you will obtain an "unknown" to analyze. Each of you will be assigned an “unknown” number, which you will use for all 11 unknowns. Be certain you always use this same number when picking up your unknown. After you have analyzed your unknown according to the particular procedure and with a measure of the precision of your determination, you will report your result with the prescribed units to the instructor using a standard form (forms are available in the laboratory). The instructor will then issue a grade based on the accuracy of your reported result assessed in the following manner. If your result is within the criterion indicated on the experiment handout, you will receive full credit for the experiment (25 pts.). If the result is outside the criterion then the following formula will be used to calculate your score:

\[
\text{score} = 25 - \frac{(\text{deviation} - \text{criterion})}{\text{criterion}} \times 5
\]

Scores less than 0 will be given a 0.

Example: In experiment #1, the criterion is ±5 g NaCl/L.
The following table lists some typical student results.

<table>
<thead>
<tr>
<th>Student</th>
<th>Reported</th>
<th>Actual Value</th>
<th>Deviation</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>76 g/L</td>
<td>74 g/L</td>
<td>2 g/L</td>
<td>25</td>
</tr>
<tr>
<td>B</td>
<td>122 g/L</td>
<td>111 g/L</td>
<td>11 g/L</td>
<td>19</td>
</tr>
<tr>
<td>C</td>
<td>88 g/L</td>
<td>56 g/L</td>
<td>32 g/L</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>1.6 M</td>
<td>95 g/L</td>
<td>93 g/L</td>
<td>0</td>
</tr>
</tbody>
</table>

Student D reported his/her results with the wrong units (M instead of g/L). D's result is graded as if it was reported in g/L. Converting to g/L, the result would have been within the criterion and thus student D would have received a score of 25.

If you made a **calculation error or reported your results with incorrect units** (student D above) you may resubmit your result **within one week of the due date**. Your new score will be multiplied by 0.75. You must also explain to the instructor why the initial result was in error and have evidence to support your contention that it was a calculation or a unit error.

If a report is handed in after the due date but within 1 week of the due date, your score will be multiplied by 0.5. **Reports filed later than this will be given a score of 0.** Due dates for each experiment are given in the Laboratory Schedule section of this handout.

If you should require more “unknown” your grade will be reduced by 25%. A second refill will cost you an additional 30%. The laboratory period on **May 30 (Tuesday)** has been set aside as "redo" lab. During this laboratory period you may repeat **any one of five experiments 1-3, 5 and 6**. If your score on this "redo" lab is higher than your initial score, the new score will replace the old one. **This is the only "redo" lab in the schedule.**

During the past four years, I have handed out awards to the student achieving the best result for each of the 11 laboratory experiments. This award consists of a valuable coupon, redeemable at no commercial venue, but worth an additional 5 points towards your final grade. This award practice has stimulated some friendly competition.

**Examinations and quizzes**

Exams and quizzes will cover theoretical material presented in lecture and studied through homework problems as well as practical material learned in the laboratory. Each of the tests will cover material presented in lecture prior to that test: **this means that the final exam is not cumulative.** The examination schedule is:

- Quiz #1: Tuesday May 9  (25)
- Exam #1: Thursday May 18  (100)
- Quiz #2: Thursday May 25  (25)
- Exam #2: Monday June 5  (100)
- Quiz #3: Tuesday June 13  (25)
- Final Exam: Tuesday June 20  12:00-3:00 pm  (100)
LABORATORY PRACTICES:

For the next 8 weeks, we will be sharing a relatively small area of laboratory space. In order to have an environment that fosters learning while minimizing risk, the following laboratory practices should be noted:

1. **Always wear your safety goggles in the lab!** Eyes are too precious to waste.

2. **Never eat or drink in the lab!**
   
   Remember, Johnny was a chemist,
   Johnny is no more,
   for what he thought was H₂O,
   was H₂SO₄.

3. **Always come prepared!**
   Students who come unprepared make more mistakes, waste time, and often get poor (and late!!) results.

4. **Know where the safety equipment is located and how it operates!**

5. **If you make the mess, you clean it up! This especially applies to the balances and the balance room!**

6. **Operations that require a fume hood must be done in the fume hood!**

7. **When you add acid to water you're doing what you oughter!**
   Don't do it the other way around.

8. **Report all safety incidents to the instructor!**

9. **Write directly into your lab notebook!**
   Sheets of scrap paper may be confiscated without warning.

10. **The lab closes at 5:20!**
    Start cleaning up by 5:00 if not sooner.