CHEM 3111 - ANALYTICAL CHEMISTRY LABORATORY  
Fall, 2015  
Dr. Tanya Shtoyko  
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Office Hours: T, W, F from 11:15 to 12:15  
R from 1:00 to 3:00 pm  
Open door policies  

PREREQUISITES: CHEM 1312/1112; Credit or concurrent enrollment in CHEM 3310  

STUDENT LEARNING OUTCOMES:  
By the end of the course you will be able to:  
1. describe how certain chemical systems are modeled;  
2. explain the principles upon which many chemical analyses are based;  
3. make observations and assess their importance;  
4. perform several techniques commonly used in chemical analysis;  
5. assess data obtained using common analytical methods;  
6. solve real life problems by designing and performing the chemical analysis.  
7. keep a scientific notebook and to communicate the results of a scientific investigation in a clear manner.  

LAB MANUAL: The experiments you will explore come from a variety of sources. You are provided with a lab manual that details the procedures for each experiment.  

EVALUATION: Your grade in this course is based on your completion of and performance on several laboratory assignments. For each experiment you will be evaluated on whether or not you made certain critical observations, your ability to perform certain measurements, and your analysis and presentation of your findings. Specifically, each experiment will be assessed as follows:  

1. Pre-lab quizzes: 10%  
2. Base (all lab work, safety, cleaning after the lab, and a completed report and copies of notebook turned in by the deadline): 40%  
3. Observations, explanations, analysis, accuracy, precision, calculations: 30%  
4. Attention to details (report format, spelling, grammar, etc.): 10%  
5. Clarity of expression in your written report: 10%  

Since we will not have discussed the theory behind each experiment prior to your doing it, you may have to consult other resources (such as your textbook and books found in the library) to explain the observations you made. All experiments will count either 100 or 200 points (this is noted on page 8). The total percent of points attained on the reports determines your final grade.  

<table>
<thead>
<tr>
<th>Grade</th>
<th>Total %</th>
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<tbody>
<tr>
<td>A</td>
<td>100-90</td>
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<tr>
<td>B</td>
<td>89-80</td>
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<td>C</td>
<td>79-70</td>
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<tr>
<td>D</td>
<td>69-55</td>
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<tr>
<td>F</td>
<td>below 55</td>
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POLICIES: My expectation is that you will attend all labs unless directed otherwise. If you are absent from a lab, you will not be given additional time to complete the work unless the absence is
excused. For each laboratory experiment, you are to keep a written record of your procedure, observations, data and calculations in your laboratory notebook. Unless otherwise specified, you are required to turn in the carbonless copy along with a typewritten report no later than the beginning of the lab period one week after the scheduled end of the experiment unless directed otherwise. Unless there are extenuating circumstances, reports turned in after this time will have 10% of the total available points deducted for each 24 hours it was late. Reports will not be accepted after they were 7 days late and zero points will be recorded for the assignment.

IMPORTANT DATES:
September 4– Census Date
September 7 – Labor Day Holiday, no classes
October 26 – Last day to withdraw from the course with a “W”
November 23-28 – Thanksgiving holidays, no classes
December 7 - Study Day

STUDENTS RIGHTS AND RESPONSIBILITIES:
To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link:
http://www.uttyler.edu/wellness/StudentRightsandResponsibilities.html

STUDENT ACADEMIC CONDUCT: While students are encouraged to study and prepare for examinations with other students, each student must work alone and neither give nor receive help from any sources when taking quizzes. Under NO circumstances will cheating be tolerated! University regulations are very explicit about academic dishonesty and these regulations will be strictly enforced. The minimum penalty for cheating is a zero for the lab report or the quiz; the maximum penalties, up to expulsion from the university, will be pursued in extreme or repeat cases. Students are expected to help enforce this policy and are encouraged to obtain a copy of A Student’s Guide to Conduct and Discipline at UT Tyler, available in the Office of Student Affairs.

DISABILITY SERVICES:
In accordance with federal law, a student requesting accommodation must provide documentation of his/her disability to the Disability Support Services counselor. If you have a disability, including a learning disability, for which you request an accommodation, please contact Ida MacDonald in the Disability Support Services office in UC 282, or call (903) 566-7079.

GRADE REPLACEMENT//FORGIVENESS POLICY:
If you are repeating this course for a grade replacement, you must file an intent to receive grade forgiveness with the registrar by the Census day. Failure to do so will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates will receive grade forgiveness (grade replacement) for only three course repeats; graduates, for two course repeats during his/her career at UT Tyler.

STATE-MANDATED COURSE DROP POLICY:
Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the Census (September 4).
Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Registrar's Office and must be accompanied by documentation of the extenuating circumstance. Please contact the Registrar's Office if you have any questions.

STUDENT ABSENCES DUE TO RELIGIOUS OBSERVANCES:
Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

STUDENT ABSENCES FOR UNIVERSITY-SPONSORED EVENTS AND ACTIVITIES
If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

SOCIAL SECURITY and FERPA STATEMENT:
It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

EMERGENCY EXITS AND EVACUATION:
Everyone is required to exit the building when a fire alarm goes off. Follow your instructor’s directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building.

LABORATORY NOTEBOOK FORMAT:
Title/Date/Your name/Instructor’s name
Procedure: The procedure includes all experimental details related to conducting the experiment.
Data/Observations: All measurements and observations made during the experiment should be recorded directly in your notebook immediately after they are made. Please label all data and observations clearly.
Calculations: Include all calculations in this section and identify what you are calculating.

TYPEWRITTEN REPORT FORMAT (for experiments 1-7):
First page: Title/Date/Your Name/Your Partners’ Names/Instructor’s Name
Second page: Introduction: State what you are studying or determining and why this is important. State the principle(s) behind the analysis, give equations for all pertinent chemical reactions related to the analysis, describe with details the method of analysis used. Cite all the literature used to write the introduction.
Procedure: You have to describe the procedure and cite the lab manual.
Results/Discussion: This section should contain an organized (i.e., tables, graphs) presentation of the results of your experiment, a comparison with expected values and a discussion of any significant difference. In addition, you should state and explain all important observations.

Conclusion: State again what you are studying and shortly report your findings.

References: (if appropriate)

Use this checklist to help you write your report.

In the report,

1. Do you have a cover page, introduction, procedure, results/discussion section, conclusions and references?

2. In the introduction have you,
   - stated what you are studying and why?
   - explained the principle behind the analysis and described any pertinent chemistry related to it?

3. In the results and discussion sections have you,
   - stated the results of your investigation and compared those results with accepted values?
   - stated and explained all important observations made during your investigation?

4. What are your conclusions?

5. Have you properly referenced all appropriate material?

6. Do you have page numbers, are graphs needed and included, and have you proofread the report?

REFERENCES:

During the course, you may want additional information to help you understand a concept or interpret your data. I encourage you to come to me and ask questions and/or consult written material (i.e., books and/or journals) to better understand those concepts or to learn more about the subject. **However, you may NOT consult laboratory reports written by former Chemistry 3111 students.**

Any time that you use either the *ideas* or *writings* of another person in your report, you must acknowledge that you are not the originator of that work. This is a professional courtesy, and failure to give proper credit is **plagiarism**. In this course, I recommend that you use the **superscripts** and the following format to properly cite another author's work.

Journal publication:

1. First author last name, FI, MI; next author *Journal name abbreviation year of publication, volume number*, inclusive page numbers.

For example,

**Book:**
1. First author last name, FI, MI; next author *Title of book*, edition; publisher: place of publication, year of publication; chapter (or pages).

For example,

**Laboratory Manual:**

**Website:**
1. “Title of website,” address, date accessed.

For example,

**Notes:**
1. The number of the reference *(superscripted)* should be listed after the cited material in your text. For example, if you consulted chapter 13 in Harris to help you explain some of your observations on the second lab experiment, and this happened to be the first reference you used, then you would place 1 immediately following that explanation in your discussion. If, at a later point in your discussion, you again refer to Harris, refer to that reference as 1 again.

2. You should cite the procedure for the laboratory experiments by citing the laboratory manual.

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**SAMPLE LABORATORY NOTEBOOK DOCUMENTATION**

The determination of the hardness of water by EDTA titration 1/28/14

I weighed some dry Na$_2$H$_2$EDTA · 2H$_2$O and dissolved it in 1.000 liter of deionized water.

weight of Na$_2$H$_2$EDTA · 2H$_2$O: 0.3107g

observation: The EDTA dissolved readily to form a clear, colorless solution.

A 10.00mL portion of Evian water was pipeted into a 250mL Erlenmeyer flask and 3mL of the pH 10 buffer solution along with 3-4 drops of Eriochrome Black T indicator and 15 mL of deionized water was added. The sample was titrated until the color changed from wine-red to blue.

observation: The bottled water remained clear and colorless after addition of pH 10 buffer and had a characteristic ammonia smell. After addition of the Eriochrome Black T indicator, the solution turned a clear wine-red.

initial buret reading: 0.05mL wine-red
final buret reading: 20.15mL blue
volume of EDTA added: 20.10mL
initial buret reading: 0.10mL  wine-red
final buret reading: 20.15mL  blue
volume of EDTA added: 20.05mL

initial buret reading: 0.00mL  wine-red
final buret reading: 20.24mL  blue, overshot endpoint
volume of EDTA added: 20.24mL

initial buret reading: 0.20mL  wine-red
final buret reading: 20.24mL  blue
volume of EDTA added: 20.04mL

A blank was performed using 25.00mL of deionized water.

observation:  The blank remained clear and colorless after addition of the pH 10 buffer solution and had an ammonia smell. After addition of the indicator, the solution turned a clear wine-red.

initial buret reading: 31.10mL  wine-red
final buret reading: 31.16mL  blue
volume of EDTA added: 0.06mL

To determine the concentration of calcium in the water, a 10.00mL portion of bottled water was pipetted into a 250mL Erlenmeyer flask and 15 mL of deionized water was added along with 30 drops of 50% NaOH was added to the solution and swirled for two minutes to precipitate the Mg(OH)$_2$. About 0.2g of solid hydroxynaphthol blue indicator was added to the flask and the sample was titrated with the EDTA solution. The titrated solution was allowed to stand and was occasionally swirled to redissolve any Ca(OH)$_2$ that may have precipitated. It was then titrated to a blue endpoint if necessary.

observation:  Upon addition of the 50% NaOH solution to the water, the solution remained clear and colorless. After addition of the indicator, the solution turned a clear, pale wine-red.

initial buret reading: 0.10mL  wine-red, very pale
final buret reading: 10.14mL  pale blue, let stand 2 minutes, still blue
volume of EDTA added: 10.04mL

A blank was performed using 25.00mL of deionized water.

observation:  The blank remained clear and colorless after addition of the 50% NaOH solution. After addition of the indicator, the solution turned a clear pale wine-red.

initial buret reading: 41.10mL  wine-red, very pale
final buret reading: 41.14mL  pale blue
volume of EDTA added: 0.04mL
Calculations:

Molarity of the EDTA solution:

\[
0.3107 \text{ g EDTA} \times \frac{1 \text{ molEDTA}}{\text{FW of EDTA}} = \text{ mol EDTA}
\]

\[
\text{M (EDTA)} = \frac{\text{mol EDTA}}{1.000 \text{L}} = \text{answer}
\]

(moles of Ca\(^{2+}\) + moles of Mg\(^{2+}\)):

Titration 1:

\[
(0.02010 \text{L EDTA sol'n} - 0.00006 \text{L}) \times \text{M EDTA sol'n} \times \frac{1 \text{ molEDTA}}{1(\text{molCa}^{2+} + \text{Mg}^{2+})} = \text{mol Ca}^{2+} + \text{Mg}^{2+}
\]

Repeat for other titrations and other calculations.
<table>
<thead>
<tr>
<th>Dates*</th>
<th>Scheduled Experiments*</th>
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<tbody>
<tr>
<td>1. August 31,</td>
<td>Safety; orientation. Glassware calibration. (100 pts)</td>
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<tr>
<td>2. September 14-21</td>
<td>Gravimetric Analysis (100 pts)</td>
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<tr>
<td>3. September 28</td>
<td>Acid-base chemistry (100 pts)</td>
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<td>4. October 5</td>
<td>Determination of the pH optimum for β-galactosidase (100pts)</td>
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<td>5. October 12-19</td>
<td>Spectrophotometric determination of iron in an iron supplement tablet (100 pts)</td>
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<tr>
<td>6. October 26</td>
<td>Determination of Quinine in Tonic Water (100 pts)</td>
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<tr>
<td>7. November 2,</td>
<td>Analysis of caffeine in beverages by HPLC (100 pts).</td>
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<tr>
<td>8. November 9-30</td>
<td>Team challenges (Lab. Report and Project Presentation (200 pts)</td>
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*Note: If required by unforeseen circumstances, the right to change the schedule is retained.*