THE EXPERIMENTS

Session 1 (Jan 21-March 1)

(1) **FTIR-SPECTROSCOPY**: Infrared Spectroscopy of HCl, DCl, and CO₂.

(2) **GAS-SOLID ADSORPTION**: The Langmuir and BET Adsorption Isotherms

(3) **PHOSPHORESCENCE**: Examination of Molecular Excited States using Laser-Induced Phosphorescence

(4) **HEAT OF COMBUSTION**: Bomb Calorimetry

Session 2 (March 1-April 17)

(5) **SOUND VELOCITY**

(6) **X-RAY DIFFRACTION**

(7) **PULSE NMR SPECTROSCOPY**

(8) **ABSORPTION OF I₂**
IMPORTANT: Chemical Reagents Used In Chem 482L

Below is a list of all chemicals which are used in Chemistry 482L. Material Safety Data Sheets (MSDS) for all of these materials are on file in Morehead Labs Room 206, or may be found at http://siri.org/msds/. If you are currently pregnant or become pregnant during the semester of this laboratory course, you are encouraged to consult with your personal physician, or contact Dr. Mary Schlegel at Student Health Services (966-2281), to discuss the advisability of continuing this course.

Hydrogen chloride (gas)   IR
Deuterium chloride (gas)  IR
Carbon dioxide (gas)      IR ; Sound Velocity
Carbon monoxide (gas)     IR
Nitrogen (gas)            BET; Phosphorescence
Ethylene glycol           Phosphorescence
FeCl₂(aq)                 Phosphoresence
Ru(bpy)₃Cl₂(aq)           Phosphorescence
Oxygen gas                Phosphorescence; Bomb Calorimetry
Ar(gas)                   Sound Velocity
Propane (gas)             Sound Velocity
Naphthalene               Bomb Calorimetry
Benzoic acid              Bomb Calorimetry
Carbon                    Bomb Calorimetry

Honor Code:
It shall be the responsibility of every student at the University of North Carolina at Chapel Hill to obey and to support the enforcement of the Honor Code, which prohibits lying, cheating or stealing when these actions involve academic processes or University, student or academic personnel acting in an official capacity.

In particular all written material submitted for grading must be the original work of the report’s author.
Physical Chemistry Laboratory – CHEM 482L  
Spring 2013  
Room: Morehead 213  
Instructor: Prof. Jim Cahoon, Office: Caudill Lab 019  
Website: https://sakai.unc.edu/portal/site/482l

<table>
<thead>
<tr>
<th>TA’s</th>
<th>e-mail address</th>
<th>Expt. Session 1</th>
<th>Expt. Session 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joe Christesen</td>
<td><a href="mailto:jdcristesen@gmail.com">jdcristesen@gmail.com</a></td>
<td>High Resolution IR</td>
<td>Pulse NMR</td>
</tr>
<tr>
<td>Tom Celano</td>
<td><a href="mailto:celano@email.unc.edu">celano@email.unc.edu</a></td>
<td>Adsorption BET</td>
<td>X-ray Diffraction</td>
</tr>
<tr>
<td>Robert Zhang</td>
<td><a href="mailto:bobstar@email.unc.edu">bobstar@email.unc.edu</a></td>
<td>Bomb Calorimetry</td>
<td>Sound Velocity</td>
</tr>
<tr>
<td>Zachary Morseth</td>
<td><a href="mailto:morseth@live.unc.edu">morseth@live.unc.edu</a></td>
<td>Phosphorescense</td>
<td>Absorption I$_2$</td>
</tr>
</tbody>
</table>

*Check in at Morehead 213 at 1pm on Monday, Tuesday, and Wednesday January 14-16*  
For purposes of pairing up students into groups of 2 or 3, confirming enrollment, and signing up for lab time. TAs will then give a half hour training tutorial for the lab they are running.

*Experiments will begin January 21-23.* The last week to perform experiments will be April 15-17.

**Scheduling experiments:**
Session 1: Jan 21-March 1 (4 experiments available)  
Session 2: March 1-April 17 (4 experiments available)  
*Students must attend a training session with the TA prior to performing a laboratory experiment*

Experiments will be performed in groups of two students (three when necessary for scheduling). Sign-ups for each lab will be on a Google Docs spreadsheet. The link for it can be found on the course Sakai website under Resources\Sign Up Sheet. Students will have first-choice to sign-up for experiments on the day (Mon, Tues, or Wed) on which they are officially enrolled up to two weeks in advance. On the Friday afternoon, the sign-up sheets for the following week will be opened to students registered for any section.

Beginning on Jan 14, TAs for each lab will schedule ~30 minute tutorial and training sessions for the labs. Students must sign-in to the training sessions prior to performing the experiment.

Students must turn in a total of five lab write-ups and can choose their experiments. Write-ups are due every two weeks by 5pm on Friday on the following dates:  
- Feb 8, Feb 22, March 8, March 29, April 12, April 26  
Students should turn in printed lab reports to the lock box outside of Morehead 213. Students are allowed to skip one due-date of their choice or finish the course two weeks early.

*All labs start promptly at 1 PM, unless arrangements are made with the TA well ahead of time.*

**Course Materials**

**Notebook:** All student need to have a bound notebook in which to write up the pre-lab report, record all data taken in the laboratory, record data analysis calculations, write the mid lab progress report, etc.

**Lap Top:** It is essential that you bring your lap top computer in order to transfer the data to your hard drive for analysis with MathCAD or Excel.
Procedures and grading of each Experiment

Laboratory Reports (100 points):
Reports should be written as if they were research papers to be published in a scientific journal. The reports should be well written and show a logical train of thought. They should be typed and have the following format:

Title Page: (2 pts.) Title page should include experiment title, your name, your partner’s name, the date the experiment took place, and the date turned in with a signed copy of the honor pledge.

Abstract: (8 pts.) Abstract should be no more than 300 words and state the salient details of the experiment and summarize the results.

Introduction: (15 pts.) A description of the scientific questions you are attempting to answer and the approach that is being implemented. Develop the theory that will be used to analyze the data. Include references (Do not cite the lab manual).

Experimental Description: (20 pts.) Description of the experimental method and theory behind the operation of the apparatus. Describe the limitations of the instrument.

Results: (15 pts.) Numbers collected during the course of the experiment or spectra (or photocopies thereof) these results should be presented in neat tables or graphs.

Data Analysis: (25 pts.) In most of these experiments, the end result is a number (e.g. bond distance, sound speed, etc.) You should describe the data analysis procedure and report the final numbers to the appropriate number of significant figures and error limits. Where appropriate, you should compare your results with literature values. If they differ, provide an explanation. In addition, clearly identify the major sources of errors. Be quantitative! List them in order of importance.

Conclusions and Exercises: (15 pts.) An overview that summarizes what you have measured, what you have learned and where such results may be useful. Completion of exercises assigned by TA or of additional questions posed in your laboratory manual.

Participation: You must show up on time and participate in the lab. It is your responsibility to make arrangements with the TA if, for a valid reason, you cannot attend the scheduled lab period.

*Late reports; Minus 5 points per day late. Because students can choose to skip one of the due dates, there will be no extensions given.

COURSE GRADING
Five experiments: 500 points
Final Exam 100 points
Total 600 points
*The final exam will have questions from each experiment covering the background theory, data analysis, and experimental method.