

Physical Chemistry Laboratory
CHE 362L-011
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All items on this syllabus are subject to change by the instructor

Office SC 351
Office Hours MWF, 9 – 10 AM
Outside of these hours, I have an open-door policy: if my door is open, you may feel free to knock and enter. If my door is closed, I am unavailable. For a guaranteed meeting time outside of office hours, please set up an appointment at least one day in advance.

Class Schedule: T, 8:00 AM – 12:50 PM SC 427

Co/Prerequisite: CHE 361

Text: *Experiments in Physical Chemistry*, 7th Edition, by C. W. Garland, J. W. Nibler, and D. P. Shoemaker.

Notebook: Lab Record Book for NKU Department of Chemistry, Hayden-McNeil Publishing.

Software: Graphical Analysis, Mathematica, SigmaPlot, PC Spartan

The student is expected to read the pamphlet *Safety in Academic Chemistry Laboratories* and abide by the safety rules and guidelines contained therein. An abbreviated list of NKU Safety Rules will be provided. Students not adhering to safety policies for laboratories may be dismissed from lab. Experiments may involve texts and sources other than the required text for the course. Students will work in groups, with typically three students per group.

Tentative list of Experiments:

1. Heat of Combustion.
2. Heat of Neutralization.
3. Two-Component Liquid-Solid Phase Diagram.
4. Effect of Ionic Strength on Solubility.
5. Three-Component Solubility Diagram.
6. Reaction Kinetics. Inversion of Sucrose.
7. Solubility Products from EMF Measurements.
8. Electrical Conductance.
9. IR Spectrum of HCl / DCl
10. Molecular Calculations.
11. Reaction Kinetics: The Effect of Temperature on Reaction Rate.
12. Reaction Kinetics: Stop-Flow method

The student must do eight of the above experiments, including 1, 2, 6, 9, and 10. Experiments need not be performed in the order given. The instructor reserves the right to substitute new experiments for some of those above. Students may need to spend more time in the laboratory than is listed in the schedule.

The student will be graded primarily on laboratory reports, but also on laboratory technique, and the laboratory notebook. Technique will be judged on the basis of direct observation as well as precision and accuracy of the reported results. Each member of a laboratory group is expected to contribute substantially to the performance of the assigned experiments. Some of the criteria that will be considered in grading the laboratory report are data presentation, data manipulation, discussion of results (including analysis of errors), proper literature citation, adherence to proper format, grammar, and conciseness. Plagiarism will not be tolerated. The overall grade for the experiment will be displayed on the returned laboratory report. **Reports are due in hard copy or by email by 5 PM on the day they are due.** Points will be deducted for lab reports turned in late. The course grade will be based on the average of the lab reports and on a lab test. The lab test will be given on the last day of classes and will cover the theory in experiments 1, 2, 6, 9, and 11. The lab test counts 100 points and each lab report counts 100 points. Students may be assessed for broken or damaged equipment. All raw data must be recorded in the lab notebook and dated.

Lab Report: Each member of a laboratory group must turn in a separate formal laboratory report. The laboratory report must be typed or printed from a word processor. The laboratory report should have the following format:

- Cover Page: The cover page must include the following: the title of the experiment, the course title, your name, the names of your lab partners, the beginning and ending date for the experiment, and the date the report is submitted.
- Abstract: The abstract must be on a separate page following the cover page. It should be a brief summary of the experiment, including any numerical results and a comparison with literature values, if possible. One or two paragraphs, each with a few sentences, should suffice.
- Main Body: The main body must include the objective of the experiment, a brief description of the theory and the experimental procedure in your own words, experimental observations, the raw data collected (preferably in tabular form), and the values calculated from the raw data. Be sure to include units for all data and calculated values, and a precision index for the calculated values. Sample calculations must be included to show the data manipulation. A discussion of the results of the experiment is a crucial part of the report. This should include comparisons with literature values (properly referenced with footnotes, *etc.*) as well as a discussion of possible errors and their probable effects on the experimental results. Suggestions for improvements can be included. Conclusions drawn from the results of the experiment must be explicitly stated; these conclusions should refer to the stated objectives of the experiment.

Although it is allowed (even encouraged) for all the members of a group to work up the data together, the error analysis and text of the report should be your own.

References: A list of references must be included. These should include the source or sources for the experimental procedure followed as well as references for literature values used for comparison with the experimental results obtained.

Lab Report	Due Date	Points
First	Feb 3	100
Second	Feb 20	100
Third	March 6	100
Fourth	March 20	100
Fifth	April 3	100
Sixth	April 17	100
Seventh	April 24	100
Eighth	May 1	100
Lab Test	April 28	100

*Reports due 1 week after the previous report.

Grading scale:	A	90 – 100
	B	80 – 89
	C	70 – 79
	D	60 – 69
	F	<60

The last day to withdraw without a grade is 2/02/2009. The last day to drop with a 'W' is 03/30/2009.

Appropriate Department of Chemistry Student Learning Outcomes

1. Explain the major concepts and experimental findings in the chemical sciences.
2. Demonstrate the ability to carry out experimental protocols using modern instrumentation and methods.
3. Utilize critical thinking skills to apply concept knowledge ... to: ...b) solve scientific problems.
4. Compile, critically evaluate, and interpret scientific information and data.
5. Effectively communicate scientific information through written and oral means.
6. Apply effective group strategies to solve scientific problems.
8. Apply computer technology and other technologies in the comprehension, interpretation, and presentation of the chemical sciences.

Specific Learning Objectives

- A. Adhere to NKU Department of Chemistry Safety Rules and Regulations.
- B. Demonstrate proper laboratory techniques and use of laboratory instrumentation appropriate for physical chemistry(2, 3, 6).

- C. Communicate clearly and concisely the results of laboratory experiments in formal lab reports (4, 5, 8).
- D. Use appropriate software for data analysis, graphing, and molecular modeling (8).

Department of Chemistry Policies

Students are responsible for reading and understanding all items on this syllabus. Any items not understood must be brought to the attention of the instructor within the first two weeks of class.

The work you will do in any course is subject to the Student Honor Code. The Honor Code is a commitment to the highest degree of ethical integrity in academic conduct, a commitment that, individually and collectively, the students of Northern Kentucky University will not lie, cheat, or plagiarize to gain an academic advantage over fellow students or avoid academic requirements. The Honor Code can be accessed at: <http://www.nku.edu/~deanstudents/policies.htm> .

Cheating will not be tolerated. In accordance with the Code of Student Rights and Responsibilities, which also can be found at <http://www.nku.edu/~deanstudents/policies.htm>, faculty members have the right to determine actions to be taken when a student is caught cheating.

Faculty members reserve the right to dismiss or to have removed a disruptive student from their classrooms.

Students with disabilities who require accommodations (academic adjustments, auxiliary aids or services) for this course must register with the Disability Services Office. Please contact the Disability Service Office immediately in the University Center, Suite 320 or call 859-572-6373 for more information. Verification of your disability is required in the Disability Services Office for you to receive reasonable academic accommodations. Visit the Disability Services website at <http://www.nku.edu/~disability/> .

SAFETY RULES AND REGULATIONS

You are required to notify your instructor at the beginning of the semester if you have a health problem, such as a seizure disorder, diabetes, etc. in order for your instructor to see that you get the necessary medical attention should the need arise.

1. Wear safety glasses in the laboratory at all times. **Protect your eyes!**
2. Wear suitable footwear (no open sandals) in the laboratory at all times.
3. Never smoke, eat, or drink in the laboratory.
4. Perform only those exercises that are authorized.
5. Report all accidents and injuries immediately to your instructor. An **Incident Report** must be filed. Forms are available in room SC .
6. Familiarize yourself with the first aid chart and the location of the fire extinguishers, fire blanket, shower and eyewash.
7. Exercise caution in using glass tubing, especially in inserting it into stoppers. Do not use cracked or broken glass equipment.
8. Never heat liquids in graduated cylinders. When you are heating a test tube, never point its mouth towards anyone nor look down into it.
9. Carefully read all labels on reagent bottles before using; an error may have serious consequences. Use only the quantities and concentrations called for.
10. Never pour water into concentrated acid. Always pour the acid slowly into the water while stirring the mixture constantly.
11. Use the fume hood or fume suction device whenever toxic or irritating gases are likely to be evolved. Never directly inhale vapors. Never taste a chemical.
12. Avoid possible poisoning by contamination through the hands. Always wash hands thoroughly after exposure to hazardous chemicals and as a general rule, after each lab period.
13. Use only glassware that is initially clean.
14. A laboratory apron or lab coat to protect your clothing is a wise precaution.
15. If the fire alarm sounds, turn off the gas and leave the building by the nearest exit. If you are the last one out of the lab, close the door behind you. Wait for your instructor's approval before re-entering the building.

The following laboratory regulations must be observed for efficiency and further safety in the laboratory

1. Never throw solid or liquid materials into sinks; **use the correct waste jars**. Your instructor will point these out.
2. Do not insert spatulas or pipets into reagent bottles. Instead, transfer an approximate amount of the reagent desired to a glazed paper, a watch glass, or a test tube. Do not carry stock bottles to your desk.
3. Weigh solids on a glazed paper or on a watch glass; do not allow chemicals to come into contact with the balance pans.
4. Clean up spilled materials immediately, using liberal quantities of water. Neutralize strong acids with sodium bicarbonate, and strong bases with acetic acid, then wash with water.
5. Keep your working surfaces clean at all times. Use a damp sponge for wiping the surface.
6. Before leaving the laboratory, make sure the water and gas are completely shut off. Return all special equipment to the stockroom or designated place.