

**Text:** Garland, C. W., Nibler, J. W., Shoemaker, D. P., Experiments in Physical Chemistry, 8th edition, McGraw-Hill, New York, 2004. (GNS)

**Handouts:** Handout information and directions (when provided) take precedence over those given in the textbook or references.

**References:** Literature references (in some cases, online copies may be provided)

**Office Hours:** By appointment (Davis 302)

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## Experiments

- Absorption spectrum of a conjugated dye
- Freezing-point depression of strong and weak electrolytes
- Heats of combustion
- Intrinsic viscosity
- Partial molar volume
- Chemical equilibrium in solution

## Course Schedule

<u>Week:</u>	<u>Description (Date):</u>
1	Instructions, syllabus, statistics (01/29)
2	Experiment 1 (02/05)
3	No class (02/12)
4	Experiment 1 (02/19)
5 – 12	Experiments 2 – 5 (02/26 – 04/16)
13	Spring recess (04/19 – 04/28)
14 – 15	Experiment 6 (04/30 – 05/07)
16	Final brief report due (05/14)
17	Final report due (05/21)

## General Instructions

1. **Preparation for Laboratory.** This is a "problem-type" laboratory, and the student is expected to do a considerable amount of preparation before starting an experiment. This should include:
  - a) Studying the handout, references and text material relevant to the experiment
  - b) **Preparing a written outline of the experiment**, this will be extremely important in this course:
    - I. A brief statement of the general purpose of the experiment
    - II. A protocol (list or outline) of the steps you will follow to execute the experiment – the protocol should include the amounts (weights, volumes, concentrations) of the materials you will use; a notation of the glassware and instruments you will use to handle them and the desired precision for each measurement (e. g. mass  $\pm$  1 g); the instrument(s) you will use to

make the physical measurements of the experiment and the precision expected in these measurements

III. Calculations you need to make for above amounts

IV. What kind of results you hope to achieve according to your understanding of the experiment?

2. **Written outline.** Must be presented to the instructor for checking at the beginning of the laboratory period in which the experiment is to begin. The student will not begin experimental work until the outline has been submitted.
3. **Participation.** ALL group members are expected to participate during each experiment. It is recommended that before starting the experiment, group members split up the work to be done so that experiments run efficiently, while **avoiding individual-type work arrangements**. Participation will be considered as part of the overall final grade (see **Grading**). Be aware that overall attitude, common mistakes during procedures (along with the expertise or knowledge on how to correct or overcome these), abilities, and other concurrent elements will be considered inside this part of the final grade.
4. **Number of Experiments.** For the Spring 2019 semester, students must complete multiple experiments (at least 3; the final number will be according to class size and student performance). For this reason, as mentioned previously, all students are required to be fully-prepared for each experiment before starting. Each student group will choose an experiment to start from the list. Ideally, no two groups will be doing the same experiment at the same time. The order in which the groups will rotate between experiments will be assigned by the Instructor.
5. **Brief Reports.** At the end of each experiment, each student will have one week (until the week of the beginning of the next experiment) to hand in a brief, worksheet-type, laboratory report. The guidelines for writing this document, what to include and how to write it, will be provided (on Blackboard (BB)). Students will not start the next assigned experiment if this document is not turned in by the due date.
6. **Laboratory Report.** At the end of the final experiment, each student must hand in **one** official final laboratory report based on any of the experiments done. The expectations of this laboratory report will be discussed in class. There will also be an outline provided to you through BB. Both a hardcopy and an electronic copy must be submitted by 23:59 on the due date. Electronic copies must be submitted via SafeAssign on BB. **Laboratory reports will not be accepted late** and failure to turn in both the hardcopy and electronic copy, on or before its due date, will result in a zero for that laboratory report. Help/advice is available from the instructor on writing the report and it is recommended that the student take advantage of it.

## Grading

To ever receive a grade in this course, you must participate in all laboratory experiments, and turn in all your laboratory question sheets and laboratory reports to the instructor on the day they are due. **NO late assignments will be accepted.**

Grading for this laboratory course will follow the outlined rubric:

- a) Completed "Pre-Labs": 3% each (18% total)
- b) Brief Laboratory Reports: 7% each (42% total)
- c) Final Laboratory Report: 20%
- d) Laboratory Techniques, Participation: 15%
- e) Attendance: 5%

**Note:** Plagiarism will **NOT** be tolerated in this class. You must give the exact source and page of all references and quoted material. All laboratory reports must be accompanied with an electronic submission that will be scanned for plagiarism. Examples of plagiarism include:

- Buying a term paper or downloading one from online
- Copying from a book without acknowledgement
- Copying a friend's work
- Cutting and pasting from a website
- Failing to give credit for someone else's words or ideas
- Quoting a teacher's lecture without acknowledgement
- Paraphrasing without citation
- Quoting words or phrases without credit
- Copying a paragraph and rewriting each sentence so that each one conveys the same meaning
- Wikipedia is not a source to be cited, **but can be useful for finding good sources for citation**

The sanction for the first instance of plagiarism is failure for that laboratory. The sanction for a second instance of plagiarism is failure for the course. Disputes will be mediated via Lehman College's policies regarding plagiarism.

## Informative Reading

Page assignments are from GNS; brackets [] denote optional reading. Other included references may be provided (if so, they will all be posted on BB).

- Introduction, Safety, Data Recording, pp 1-10
- Laboratory Report Writing, pp 10-27; Calculations and Presentation of Data, pp 29-38
- Uncertainty and Error - Graphical and Numerical methods, pp 37; 38-43
- Rejection of Discordant Data, pp 42-43
- Statistical Treatment of Random Error, [pp 43-52]
- Error Propagation, [pp 52-59]
- A Case History of Error Evaluation, pp 60-62
- Fundamental Limitations on Instrumental Precision, pp 62-64
- Summary, pp 64-67
- Least Squares Fitting Procedures, pp 724-725; [pp 725-747]
- Rejection of Discordant Data in Linearly Dependent Data, pp 732-733