CHE 345 **Physical Chemistry Laboratory** Fall 2018
Gabriel I. López-Morales **SYLLABUS** Tuesdays 9:00 – 12:50

Text: Garland, C. W., Nibler, J. W., Shoemaker, D. P., Experiments in Physical Chemistry, 8th edition, McGraw-Hill, New York, 2004. (GNS)
Handouts: When provided, handout information and directions take precedence over those given in the textbook or references.
References: Literature references (in some cases, online copies are provided)
Office Hours: By appointment
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Experiments

1. **Heat Capacity Ratio for Gases (GNS, pp 106 – 118)**
2. **Equilibrium of a Solute Between Two Immiscible Solvents (K_d) (Handout)**
3. **Constructing a two component Solid-Liquid phase diagram (Handout)**
4. **Adsorption from Solution (Handout)**
5. **Partial Molar Volume (GNS, pp 172 – 178)**
6. **TBA**

Course Schedule[1]

Week:	Description (Date):
1	General instructions, Syllabus (08/28)
2	Statistical analysis (09/04)
3, 4	No class (09/11, 09/18)
5 – 10	Experiments 1 – 3 (09/25 – 10/30)
11 – 16	Experiments 4 – 6 (11/06 – 12/11)
17	Due date: Final Report (12/18)

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 (handout found on blackboard):
      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 ± 1 g); the instrument(s) you will use to make the physical measurements of the experiment and the precision

[1]The semester will comprise of two six-week periods, and groups will rotate experiments within those periods.

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. Participation will be considered as part of the overall final grade (see **Grading**).
4. **Number of Experiments.** For the Fall 2018 semester, students must complete multiple experiments in each six-week period (at least 3; number according to class size).
5. **Experiment Worksheets.** At the end of each experiment, each student must hand in a filled in question sheet provided for that experiment. In a group, you may work together to solve the problems on the sheet, but each student MUST hand in an individual worksheet. The worksheets are due, hand written, at 12:50 PM on the day of class the week after the experiment has finished. **Late worksheets will not be accepted**.
6. **Laboratory Report.** At the end of the semester, each student must hand in ONE fully written out laboratory report based on an experiment done in the second 3-weeks period. The expectations of this laboratory report will be discussed in class, as well as an outline provided to you on blackboard. 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 Blackboard. **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. The handout titled "Recording Experimental Data and Laboratory Report Writing Guidelines" has extensive information on what should be in a laboratory report. Help and advice is available from the instructor on writing the report and it is recommended that the student take advantage of it.

Grading

Grading for this laboratory course will follow the outlined rubric:

a) Completed "Pre-Labs": 10%
b) Laboratory Worksheets: 10% each (50% total)
c) Final Laboratory Report: 25%
d) Laboratory Techniques and Participation: 15%

To ever receive a grade in this course, you must 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**.

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

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 references are to the handouts "Uncertainty in Measurement" and "Recording of Experimental Data and Laboratory Report Writing Guidelines."
- Introduction, Safety, Data Recording, pp 1-10
- Laboratory Report Writing, pp 10-27 and "Guidelines" handout (where the two differ, follow the handout) Calculations and Presentation of Data, pp 29-38 and "Guidelines" handout
- Uncertainty and Error - Graphical and Numerical methods, pp 37; 38-43 and "Uncertainty" handout
- Rejection of Discordant Data, pp 42-43
- Statistical Treatment of Random Error, [pp 43-52]; "Uncertainty" handout
- Error Propagation, [pp 52-59]; Uncertainty handout, Propagation of Uncertainty handout
- 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]; "Uncertainty" handout
- Rejection of Discordant Data in Linearly Dependent Data, pp 732-733.