stylesheetNormal;CHEM.256:Physical Chemistry for the Biological Sciences.

Spring 1998-99

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Syllabus:

- Simple statistics for data: mean, standard deviation.Linear regression.
- Lowry-Brønsted acids & bases: equilibria, pH,K_A, K_B,pK_A, amphoterism.
- Titrations, amino-acids, polyprotic acids, isoelectric focusing.
- Behaviour of gases. Energy, heat and temperature - 0th Law.
- 1st Law: work, internal energy.
- Thermochemistry: heat capacities, enthalpy, Hess' law.
- Entropy, 2nd & 3rd Laws, Gibb's free energy.
- Dependences of ΔH, ΔG, K on T, P.
- Donnan equilibrium, osmotic pressure.
- Dispersions, diffusion, sedimentation.
- Electrochemical cells; E°'-values. Non-ideality & ion activitycoefficients.
- Phosphate transfer potentials.
- Rates of reactions: 0, 1st & nth order rate equations.
- Half-life, pseudo-order, flooding. The steady state.
- Models for dependence of *k* on *T*.
- Michaelis-Menten model.
- Lineweaver-Burke methods.

Objectives:

Be able to make estimates of the reliability and deviance of experimentaldata. Know about the acidic and/or basic properties of molecules and beable to compute equilibrium concentrations of various species in aqueousmedia under a variety ofconditions. Be able to predict the distributions of polyprotic species. Understandthe meaning of a state function, and the relationships amongstthermodynamic quantities such as *U*,*H*, *S*, *G*,*q*, *K*,*E* & *w* and be able to interrelate changes in their values. Be able to relatechanges in thermodynamic quantities to the progress and direction ofphyical and chemical changes. Be able to deduce the responses ofthermodynamic quantities to external influences such as *T* & *P*. Know which thermodynamic relationships are appropriate to the conditionsat hand, and when various approximations are or are not appropriate. Beable to apply thermodynamic principles to simple biochemical systems and processes. Understandthe concept of a rate law, and know how to analyze kinetic data in order toextract numerical and mechanistic information. Be able to design kineticexperiments in order to uncover fundamental properties of the reaction system in an efficiently way,utilizing appropriate experimental "tricks".

Text:

G. M. Barrow: Physical Chemistry for theLife Sciences, McGraw-Hill, 2nd Edn.

Another goodsource is:

Tinoco, Sauer & Wang: *Physical Chemistry:Principles and Applications in Biological Sciences*, 3rd. Edn.,Prentice-Hall 1995.

Relationship to other courses:

CHEM.256 starts off by reviewing and enlarging on material fromCHEM.102, which is the Chemistry pre-requisite. Some calculus is needed;it's useful, but not essential for you to be able to solve differentialequations.

Other stuff: Be sure that I have your correct Email address formy exploder. Attempt to solve the homework problems as soon as we havecovered the material in class. There is no grade given for attendance or for homework. If you donot do the homework, you will find it hard to pass the exams, and virtuallyimpossible to get a good grade. For help with problem sets, I may be foundin my office or lab most weekdays. Answers are provided for some homework problems, while others requirea descriptive/essay answer. You are encouraged to discuss these with me atour mutual convenience.

Your grade is based on the lab (15%), plus (usually three) exams: twomidterms (10%, 20%) plus a final exam (55%; most likely on May 27th.) Ifyou are not officially registered in the course, no exams or labs will begraded or returned.

Graduating Seniors ?

Drexel applies certain constraints in Spring quarter, in regard to thescheduling of final exams and make-up exams for Seniors. The obviousconsequences of this are an accelerated rate of coverage and earlyscheduling of exams. You don't need an excuse to take the make-up exam if you miss a midterm or the final. But you mustthen attend the make-up (most likely June 2nd or May 28th) or take a zeroon it.

Drexel Rules: Final on Exam Week Monday, Makeup Finals on Tuesday.!!!!!!!!

The 10-Minute Rule: If I'm more than ten minutes late, consider the class cancelled. If youneed to leave early, or are going to be more than ten minutes late for aclass, please let me know beforehand (otherwise, please don'tenter).

LABORATORY SYLLABUS
PHYSICAL CHEMISTRY
FOR THE BIOLOGICAL SCIENCES

Quarter: Spring 1999.
Scheduled time: Friday 8:00-11:00 am.
Scheduled place: 12-404
Course coordinator: Dr. A.W. Addison (12-418)
Lab instructor: Mr. Michael J. Prushan (12-402)
Required software: (i)*Microsoft Word* or comparable word processing software (ii)*Excel* or comparable spreadsheetsoftware.

Objectives:

- To learn how to apply thermodynamic and kinetic principles and theories tochemical systems.
- Begin toappreciate some of the practicalities and limitations of laboratoryexperiments.
- Utilizecomputer software to calculate derived quantities from physicalmeasurables, i.e. pressure, temperature, mass, and volume.
- Learn how to perform error analysis by employing propagationof errors and linear least squares analysis.

You will be expected to writeformal laboratory reports with theory and apparatus descriptions, tables,graphs, apparatus diagrams and a discussion of results and possibleerrors.

Laboratory Procedures:

At the first meeting of thecourse you will be assigned a lab partner. All experiments will beperformed with your partner. You are expected to have read the labexperiments carefully before coming to class.

Attendance in labs at thespecified time is required. No additional lab time will be availableoutside the scheduled three-hour laboratory period, and there will be nomake-up labs.

While in the chemistry laboratory you must wear eye protection at alltimes, even if you are not doing experiments at the moment. Hard contactsmay be worn if you have additional eye protection such as safety glasses orgoggles. Soft contact lenses are**NOT** permitted even if additional eye protection is worn;studies have shown that some chemical vapors can be trapped within soft contacts and released graduallyto eye tissue, producing irritation. These rules are for your protection,and will be enforced.

Lab reports are due **one week** from the day the experiment is completed, and are to behanded in at the beginning of the following lab period. Late labs arepenalized **10% per day**. No labs will be accepted after **June 2nd., 1999.**

We emphasize that physicalchemistry lab reports are to be written separately by each lab partner.Your reports should consist of your own descriptions, illustrations, tables, graphs,and references. The function of the report is to help you LEARN thesubject matter by seeing it and writing about it, so any shortcuts areself-defeating on your part.

All reports are to be prepared on the Computer so that revisions canbe made readily. Reports are to be handed in as Laser or Inkjet printouts(on standard white paper). Every laboratory report will have a cover page with the experiment number,e.g., **Experiment # 1**, and experiment title centered. Also, one inch from the left and one inchfrom the bottom, print "Date Submitted: (current date)" and directlyunderneath "Submitted by: (author's name)". The laboratory report must bestapled at the top left-hand corner.

Your final grade in N456 willbe calculated on the basis of the total number of points accumulated on the lab reports for theterm. Each lab report is worth 100 points, which allows for a total of 600points for the term. The breakdown of the lab report point system is asfollows:

A) PURPOSE	5 POINTS
B) THEORY	5 POINTS
C) DATA	5 POINTS
D) CALCULATIONS & GRAPHS	30 POINTS
E) RESULTS	5 POINTS
F) ERROR ANALYSIS	20 POINTS
G) CONCLUSIONS AND DISCUSSION	20 POINTS
H) ANSWERS TO QUESTIONS	10 POINTS
TOTAL100 POINTS	

Schedule:

Date	**Week**	**Experiment**
April 2	1	Statistics & error analysis
April 9	2	Beer's Law
April 16	3	Acid-base chemistry
April 23	4	Thermochemistry
April 30	5	Mb binding equilibrium
May 7	6	Electrochemical cell $\Delta G°$
May 14	7	Chemical kinetics
May 21	8	Enzyme kinetics
May 28	9	Enzyme kinetics cont.
June 4	10	**NO LAB**