CHEMISTRY 114 **GENERAL CHEMISTRY** Dr. A. H. Martin

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LECTURE TEXT

T. L. Brown, H. E. LeMay, B. E. Bursten, C. J. Murphy and P. M. Woodward, *Chemistry: The Central Science, 12th Ed.,* Pearson Education, Inc., Upper Saddle River, NJ, 2012.

RECOMMENDED SUPPORT TEXT (Optional)

R. Wilson, *Solutions to Exercises in Chemistry the Central Science, 12th Ed.,* Pearson Education, Inc., Upper Saddle River, NJ, 2012. (This book contains the solutions to all of the end of the chapter problems in the lecture text.)

Blackboard Site:
Chem114.S13 General Chemistry Code: Martin

COURSE DESCRIPTION

The material covered in this course will be an extension of that covered in Chem 113 (Fall 2012), i.e. Chapters 1 – 12 of the lecture text. A general understanding of the material from the first semester will be assumed. This course is organized in such a fashion that the text and classes should supplement each other. Students are also encouraged to consult other General Chemistry texts in the library or the Chemistry Periodical Room (HOSCI - 221). **The instructor is usually available most of the time during the day, when he is not in class, for private or group help sessions.**

COURSE OBJECTIVES

Upon completion of this course a student should be able to do, but not limited to, the following:

- Be able to convert between different concentration units
- Understand and be able to explain the solution process and the energies of the steps involved
- Understand colligative properties of solutions and be able to use them to solve problems
- Determine the rate law of a chemical reaction from experimental data.
- Propose a mechanism for a reaction from a given rate law and determine the rate law for a reaction from a proposed reaction mechanism.
- Explain the nature of the equilibrium process
- Write the equilibrium constant expression for a given equation
- Determine the equilibrium constant or equilibrium concentrations from given information
- Understand and be able to apply LaChatelier's Principle
- Understand the Bronsted-Lowery and Lewis Acid-Base Theories
- Understand pH
- Be able to do calculations involving weak acids or weak bases

- Understand salt hydrolysis and be able to determine the pH of salt solutions
- Understand Bronsted-Lowery acid strength on the basis of molecular structure
- Explain how buffers work and be able to calculate the pH of buffer solutions
- Be able to calculate the pH along a titration curve
- Understand solubility equilibria including the things which effect these equilibria and basic calculations
- Understand and be able to explain basic thermodynamics
- Understand and be able to explain entropy and free energy
- Understand and be able to use the relationship between free energy and equilibria
- Balance oxidation-reduction reactions equations using the half-life method
- Understand the operation and calculations of voltaic cells
- Understand the operation and calculations of electrochemical cells
- Understand the basic modes of nuclear decay
- Be able write nuclear equations
- Understand the patterns of nuclear stability and nuclear decay
- Explain nuclear fission, nuclear fusion, and the operation of nuclear reactors

ATTENDANCE

A student is required to attend all regular class and laboratory meetings. If a class is missed, it is the responsibility of the student to obtain the given material on his own time. If an hourly exam is missed, for a **VALID REASON ACCOMPANIED BY A WRITTEN EXCUSE ONLY**, the student should arrange a make–up time with the instructor as soon as possible after the exam. If this is not done within a reasonable period of time a grade of zero will be assigned for the exam. If a laboratory is missed, arrangements should be made to make up the laboratory with in one week of the student's return to classes. Arrangements for laboratory make-up should be made with course instructor within one week of the students return to school.

COURSE GRADE

Hour Exams (4) 40%
Laboratory 20%
Problem Session .....….....15%
Homework 5%
Final Examination .....….....20%

Your minimum letter grade will be determined as follows, when the % represents your final average calculated as described above.

A	93% and up	C	73 to 76%
A–	90 to 92%	C–	70 to 72%
B+	87 to 89%	D+	67 to 69%
B	83 to 86%	D	63 to 66%
B–	80 to 82%	D–	60 to 62%
C+	77 to 79%	F	Below 60%

LECTURE–DISCUSSION CLASSES

The lecture–discussion periods, M W F 7:50 to 8:40 AM, are the time during which new material in the course will be introduced and discussed. Attendance at all these classes is required as absence generally results in a poorer than expected showing on the work in the course. Hence, **ATTENDANCE WILL BE TAKEN AT ALL CLASSES**. Students who consistently miss class are subject to possible lowering of their grade from the scale above.

GRADED HOMEWORK

At the end of many lectures, periods the instructor will give a brief assignment based on that day's lecture. These assignments will be due at the next lecture period. These assignments will be collected on occasion and the grade from these assignments will constitute the homework portion of the grade. **NOTE: TO GET CREDIT FOR A COLLECTED HOMEWORK ASSIGNMENT THE STUDENT MUST BE PRESENT AT THE LECTURE DURING WHICH THE ASSIGNMENT WAS COLLECTED. NO LATE ASSIGNMENTS WILL BE ACCEPTED. ALL ASSIGNMENTS NOT TURNED IN WILL BE ASSIGNED A GRADE OF ZERO, UNLESS A WRITTEN EXCUSE FOR ABSENCE FROM THE LECTURE IS PROVIDED**. The solutions to these problems will be posted on the course Blackboard site.

NON-GRADED HOMEWORK

There are two types of non-graded homework in this course. The first type is the end of the chapter problems listed for each class in the tentative lecture schedule section of this syllabus. You should work these problems in order to get a better understanding of the material covered in this course. The answers to these problems are found in the solutions manual listed above. The second type is supplementary problem sheets handed out by the instructor. The answers to these problems sheets will be posted on the course Blackboard site. These problems provide additional reinforcement of the material covered in this course. It is advisable to attempt to work the problems yourself before looking at the solution. Simply trying to memorize how the problem is solved generally does not lead to a good understanding of the material and thus lower test scores.

PROBLEM SESSIONS

The problem session portion of the grade will be based on a 15-20 minute quiz given at the end of each problem session period, except those on weeks directly preceding an hourly examination. The material to be covered by the quiz will be announced in lecture prior to the quiz. **NO MAKE UP QUIZZES WILL BE GIVEN** and any unexcused missed quizzes will be assigned the grade of zero. At the end of the semester, the score on the lowest quiz will be dropped before the problem session average is computed. The solutions to these quizzes will be posted on the course Blackboard site shortly after the quizzes are given.

The initial part of the problem session period will be used to answer any questions that have arisen regarding either the lecture material or the assigned problems. In addition, review exercises on the assigned material will be conducted.

ADDITIONAL COURSE HELP

The instructor will be available for either private or group which can be arranged at any time by consulting the instructor.

The Chemistry Club provides student tutors a couple of evenings a week. The exact time of this tutoring will be announced after the start of the semester.

Free On-Line Tutoring is available via the SMARTHINKING program. See the informational handout in the back of the room.

EXAMINATIONS

There will be four (4) one–hour examinations given during the lecture period of the course on the following **FRIDAYS**: **Feb. 8**, **Feb. 22**, **Mar. 22**, and **Apr. 19**. You should mark these dates on your calendar to aid in avoiding conflicts with examinations in other courses. The specific material to be covered on each exam will be announced by the instructor prior to the exam. The answer key to the previous two year's hourly examinations will be posted on the course Blackboard site for further study. While these examinations will give you some indication of the type and nature of the questions asked, you need to study all of the material covered on the examination to get the best possible grade on the examination.

FINAL EXAMINATION

A comprehensive final examination will be given on **Sunday, April 28 at 1:30 PM** in the **HOSCI 204 (DANA)**.

ACADEMIC HONESTY

Collaboration between students is viewed by the instructor as a valid means of reviewing the material. However, since collected assignments are to evaluate the student's mastery of the material, there should be **NO EVIDENCE OF COLLABORATION ON LABORATORY REPORTS, HOMEWORK ASSIGNMENTS, QUIZZES, AND EXAMINATIONS**. If collaboration on a graded assignment is observed it will be viewed as a breach of academic honesty and will be penalized accordingly. For the first offense the grade of zero will be assigned to ALL parties involved for the assignment and reported to the Dean of the College as required by the Academic Honesty Policy of the College.

Students who wish to request accommodations in this class for a disability should contact Elaine Mara, assistant director of learning services for academic and disability support at 1307 Main Street, or by calling 610-861-1510. Accommodations cannot be provided until authorization is received from the Academic Support Center.

TENTATIVE LECTURE SCHEDULE

Day	Date	Topic	Text Ref.	Assigned Problems
Mon.	Jan. 14	Introduction, Solution Process,	13.1	13.2, 13.3, 13.14, 13,15, 13.16
Wed.	Jan. 16	Solubility	13.2 - 13.3	13.5, 13.7, 13.27, 13.28, 13.29, 13.30, 13.31, 13.33, 13.34, 13.91
Thur.	Jan. 17	Solution Concentration Units (in PS)	13.4	13.41, 13.42, 13.43, 13.44, 13.45, 13.46, 13.47, 13.48, 13.51, 13.55, 13.56, 13.58, 13.98
Fri.	Jan. 18	Colligative Properties	13.5	13.10, 13.63, 13.65, 13.69, 13.70. 13.71, 13.72, 13.73, 13.74, 13.76, 13.77, 13.79, 13.80, 13.81, 13.82, 13.104, 13.112
Mon.	Jan. 21	**No Class – MLK Day**		----------
Wed.	Jan. 23	Reaction Rates	14.1- 14.2	14.1, 14.2, 14.23, 14.24
Fri.	Jan. 25	Concentration Effects, Integrated Rate Laws	14.3- 14.4	14.3, 14.5, 14.6, 14.27, 14.28, 14.29, 14.30, 14.33, 14.34, 14.35, 14.36, 14.39, 14.40, 14.41, 14.98, 14.100, 14.102, 14.104
Mon.	Jan. 28	Temperature Effects, Rxn. Mechanisms	14.5 - 14.6	14.9, 14.12, 14.15, 14.53, 14.57, 14.58, 14.61, 14.62, 14.70, 14.71, 14.72, 14.73, 14.74, 14.77, 14.78, 14.79, 14.80, 14.112
Wed.	Jan. 30	Catalysts, Chemical Equilibrium	14.7, 15.1	14.11, 14.81, 14.85, 14.86, 14.113
Fri.	Feb. 1	Equilibrium Constants, Equilibrium Calculations	15.2 - 15.6	15.2, 15.3, 15.4, 15.7, 15.8, 15.9, 15.14, 15.15, 15.16, 15.17, 15.18, 15.23, 15.32, 15.33, 15.34, 15.37, 15.38, 15.70, 15.75, 15.76, 15.81, 15.82, 15.83, 15.84
Mon.	Feb. 4	Equilibrium Calculations, LaChatelier's Principle	15.6 – 15.7	15.10, 15.11, 15.43, 15.45, 15.46, 15.49, 15.50, 15.51, 15.52, 15.57, 15.61, 15.62, 15.63, 15.64, 15.67, 15.86,
Wed.	Feb. 6	Acids- bases, Conj. Acid-Base Pairs, Acid Strength	16.1 - 16.2	16.2, 16.15, 16.16, 16.17, 16.18, 16.19, 16.20, 16.25, 16.26, 16.101
Fri.	Feb. 8	**Exam 1**	----------	
Mon.	Feb. 11	pH, Strong Acids, Strong Bases, Weak Acids	16.3 - 16.5	16.4, 16.28, 16.29, 16.30. 16.35, 16.36, 16.37, 16.38, 16.41, 16.42, 16.43, 16.44, 16.45, 16.47,16.48, 16.107
Wed.	Feb. 13	Weak Acids, Weak Bases	16.6 - 16.7	16.49, 16.50, 16.51, 16.52, 16.53, 16.54, 16.55, 16.56, 16.59, 16.60, 16.61, 16.62, 16.63, 16.69, 16.70, 16.71, 16.72, 16.73, 16.74, 16.75, 16.76, 16.110
Fri.	Feb. 15	Polyprotic Acids-Bases, pK_a & pK_b,	16.8	16.67, 16.78, 16.79, 16.80
Mon.	Feb. 18	Salt Hydrolysis	16.9	16.8, 16.81, 18.82, 16.83, 16.84, 16.111
Wed.	Feb. 20	Acid Base Strength vs Structure, Lewis A-B Theory	16.10-16.11	16.9, 16.10, 16.87, 16.88, 16.89, 16.90, 16.91, 16.92, 16.97, 16.98, 16.99, 16.100, 16.114
Fri.	Feb. 22	**Exam 2**	----------	
Mon.	Feb. 25	Common Ion Effect	17.1	17.1, 17.14, 17.15, 17.16
Wed.	Feb. 27	Buffers	17.2	17.3, 17.20, 17.21, 17.22, 17.23, 17.24, 17.25, 17.26, 17.82
Fri.	Mar. 1	Buffers	17.2	17.27, 17.28, 17.29, 17.31, 17.32, 17.83, 17.86
		Spring Break		

Day	Date	Topic	Text Ref.	
Mon.	Mar. 11	Titration Curves	17.3	17.7, 17.33, 17.34, 17.37, 17.38, 17.41, 17.42, 17.43, 17.44, 17.45, 17.46, 17.47, 17.48, 17.88, 17.89, 17.91
Wed.	Mar. 13	Ksp, Common Ion Effect	17.4	17.49, 17.50, 17.51, 17.55, 17.56, 17.57, 17.58, 17.96, 17.98, 17.100
Fri.	Mar. 15	Precipitation Criteria	17.5	17.59, 17.60
Mon.	Mar. 18	Dissolving Precipitates, Qual. Analysis	17.5 – 17.6	17.8, 17.11, 17.61, 17.62, 17.67, 17.68, 17.69, 17.70, 17.71, 17.73
Wed	Mar. 20	Reaction Spontaneity, Entropy	19.1 - 19.4	19.4, 19.6, 19.11, 19.12, 19.29, 19.35, 19.38, 19.37, 19.38, 19.41, 19.42, 19.43, 19.44, 19.47, 19.48, 19.50, 19.53, 19.54, 19.87, 19.88, 19.89
Fri.	Mar. 22	**Exam 3**	**----------**	
Mon.	Mar. 27	Free Energy	19.5	19.57, 19.58, 19.59, 19.60, 19.61, 19.62, 19.63, 19.64, 19.97, 19.98,
Wed.	Mar. 29	Temperature Effects, Equilibrium	19.6 - 19.7	19.7, 19.8, 19.65, 19.66,19.71, 19.72, 19.81, 19.82
Fri.	Mar. 30	**No Class – Easter Break**		
Mon.	Apr. 1	**No Class – Easter Break**		
Wed.	Apr. 3	Redox Rxns, Balancing Redox Rxns	20.1 – 20.2	20.13, 20.14, 20.19, 20.20, 20.21, 20.22
Fri.	Apr. 5	More Balancing Redox Equations,	20.1 – 20.2	20.23, 20.24, 20.97, 20.98, **20.99**
Mon.	Apr. 8	Voltaic Cells	20.3	20.3, 20.27, 20.28
Wed.	Apr. 10	Cell Potentials, Cell Spontaneity	20.4 - 20.5	20.4, 20.5, 20.6, 20.7, 20.8, 20.30, 20.35, 20.36, 20.37, 20.38, 20.39, 20.40, 20.41, 20.42, 20.43. 20.44, 20.45, 20.46, 20.49, 20.50, 20.51, 20.53, 20.54, 20.55, 20.56, 20.58, 20.100
Fri.	Apr. 12	Nernst Equation, Batteries	20.6 - 20.7	20.10, 20.61, 20.62, 20.63, 20.64, 20.65, 20.66, 20.67, 20.68, 20.71, 20.73, 20.74, 20.102,
Mon.	Apr. 15	Electrolysis	20.9	20.11, 20.91, 20.92
Wed.	Apr. 17	Nuclear Radioactivity	21.1	21.9, 21.10, 21.11, 21.12, 21.13, 21.14
Fri.	Apr. 19	**Exam 4**	**----------**	
Mon.	Apr. 22	Nuclear Stability, Rate of Decay	21.2 - 21.5	21.1, 21.2, 21.4, 21.17. 21.18, 21.19, 21.20, 21.24, 21.27, 21.28. 21.29, 21.30, 21.35, 21.73
Wed.	Apr. 24	Nuclear Energy	21.6 - 21.8	21.6, 21.55, 21.56, 21.57, 21.58, 21.59, 21.60
Fri.	Apr. 26	Biological Effects of Radiation	21.9	21.66

DATES OF IMPORTANCE

Jan. 22	Last Day for Course Changes
Feb. 22	Midsemester
Mar. 4 – 8	Spring Break
Mar. 28 - Apr. 1	Easter Break
Apr. 5	Last Day to Withdraw

LABORATORY SYLLABUS

OBJECTIVES

The objectives of the laboratory experience in the General Chemistry course are:

- To familiarize the student with basic laboratory apparatus and initiate the development of correct and safe laboratory techniques.
- To demonstrate the practical application of some of the chemical principles introduced in class.
- To encourage the student to develop skill in observation, interpretation, application and presentation of scientific results.

GENERAL

Students will work in groups of three or four, assigned at the laboratory instructor's discretion. There is no laboratory manual for this course. Materials outlining the exercise to be performed on a given day will be provided in the lab and typically will not involve prior preparation.

ATTENDANCE

Each student is expected to take an active role in performing each of the lab exercises offered. In order to meet this requirement it is necessary that the student arrive for laboratory on time and remain engaged in the work until the group's recorder turns in the laboratory report or the scheduled lab period ends, whichever is earlier. If the student arrives late, leaves early, or appears disengaged from the effort of the group it is customary to reduce the student's score on that exercise relative to that received by the other members of the group. The amount of this reduction is at the discretion of the instructor and will depend upon the degree to which the student's absence or lack of engagement impacts the work of the group.

Students who miss a laboratory for any reason will be expected to make up the work while another laboratory section is in session within one week of the student's return to class. Make arrangements to complete missed experiments with the instructor of the lab in which you expect to do the work. If the work is not made up within one week of the student's return to class, a grade of zero will be awarded for that exercise. In the case of foreseeable absences such as athletic events, music performances, business or class related trips, etc., it's ordinarily to the student's benefit to arrange to make up the lab with another lab section doing the same experiment, possibly before the laboratory period in question is missed. In any case, all makeup work must be completed and the student checked out on or before Thursday, April 19, 2012 as after that date the lab will be prepared for the final lab exercise and no other work will be permitted.

LABORATORY REPORTS

A laboratory report form will be provided for each exercise which is to be completed by the group's recorder. All experimental observations are to be recorded in *ink* on this laboratory report form, or on a fresh sheet of paper, as the recorder prefers, in such a way that the result is legible. If a separate data sheet is used, it is to be submitted along with the properly completed report form provided. Extra report forms will be available if another is needed for some reason. The recorder is responsible for submitting this report for grading on behalf of the group.

A basis of ten points will be awarded each report that is turned in, assuming satisfactory engagement of the individual and the group. Up to ten additional points may be awarded based on the quality of the work done with reference to the scoring rubric for a given exercise. Consequently scores received on lab reports will typically range between 10 and 20. No credit is awarded reports that are not submitted at all.

Laboratory reports are to be turned in on the day the exercise is completed.

LABORATORY SCHEDULE

There are three laboratory sections this term and each will perform a given exercise contiguously with the others. The following schedule will be followed:

Tues. Jan 15 – Thurs. Jan. 17	Concept Testing – Group Formation
Tues. Jan 22 – Thurs. Jan. 24	Introduction to Spectrophotometry
Tues. Jan. 29 – Thurs. Jan. 31	Kinetics
Tues. Feb. 5 – Thurs. Feb. 7	Chemical Equilibrium
Tues. Feb. 12 – Thurs. Feb. 14	Acid-base Equilibria and pH
Tues. Feb. 19 – Thurs. Feb. 21	Anions
Tues. Feb. 26– Thurs. Feb. 28	Cations, Group I
Spring Break	
Tues. March 12 – Thurs. March 14	Cations, Group II Observations
Tues. March 19 – Thurs. March 21	Cations, Group II Unknowns
Tues. March 26 – Thurs. March 28	Cations, Group III
Tues. April 2 – Thurs. April 4	General Cation
Tues. April 9 – Thurs. April 11	General Salt, checkout
Tues. April 16 – Thurs. April 18	Eight-bottle Problem
Tues. April 23 – Thurs . Apr. 25	No Lab – Building Construction

All laboratory work to be considered in the computation of the laboratory grade, with the single exception of the Eight-bottle Problem, is to be completed no later than Thursday, April 11, 2013.

LABORATORY SAFETY

Students are expected to conduct themselves in an intelligent and orderly manner at all times in the laboratory. Disregard for sensible safety measures will result in dismissal from the laboratory. In particular, the following points are to be observed:

- Students will perform only those experiments assigned or otherwise bearing the prior approval of the laboratory instructor.
- Each student must provide his or her own safety glasses which include side shields for protection from flying debris. Appropriate eyewear is available for sale in the College Bookstore, but you're welcome to obtain them elsewhere if you think you can find a better deal. **Eye protection is to be worn over the eyes *at all times* when working in the laboratory.**
- **Shoes or other footwear that attach securely to the feet and cover the toes are to be worn at all times in the laboratory. Bare feet, stocking feet, flip-flops, sandals and shoes that leave the toes exposed are inappropriate and an invitation to injury**.

- Eating, drinking, smoking and applying cosmetics are prohibited in the laboratory at all times. If necessary, these activities must be pursued outside the laboratory. No laboratory apparatus or glassware is ever to be used in connection therewith. At no time shall any food or drink be brought into the laboratory.
- Each student is responsible for the cleanliness of his or her own area, including the adjacent sink. No solids are to be discarded into the sink. Use one of the trash cans. Broken glassware and other sharps are to be disposed of in the container indicated for such. Any hazardous materials, as identified in the lab handout or by the lab instructor, are to be disposed of in the special receptacles provided.
- To reduce clutter, all bookbags and other student possessions not needed to carry out the lab should be left at the back of the room.
- At no time shall any tightly corked or other sealed container be heated or placed near a source of heat.
- All pipetting is to be done with a mechanical suction device provided for that purpose. There is to be *no pipetting by mouth*.
- If somebody near you is doing something dangerous or in a careless fashion, gently bring it to his or her attention. If the behavior persists, inform the instructor. This may make you unpopular but will reduce your chance of injury due to somebody else's negligence.