CHEMISTRY 5
Chemistry for Nurses
FALL, 2009

Instructor:
Dr. Linda Roberts
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Office hours: T/R/F 11-12 pm (Tuesday office hour will be held in the HELP office, Sequoia 502. Office hours will be cancelled on furlough days as announced in the lecture and lab schedules, below).

Course consultant:
Silvia Hilt, RN, Cardiac Intensive Care Nurse

Meeting times (lecture meets in Sequoia Hall, room 301; labs meet in Sequoia Hall, room 444):

Lecture section 1	MW 2:00-3:15 pm; F 2:00-2:50 pm	Linda Roberts
Lab section 2	M 9:00-11:30 am	Linda Roberts
Lab section 3	T 9:00-11:30 am	Mai Thao
Lab section 4	W 9:00-11:30 am	Linda Roberts
Lab section 5	R 9:00-11:30 am	Megan Cochran

Text: *General, Organic, and Biological Chemistry, an integrated approach*, 2/e. Kenneth Raymond. Wiley Publishing. ISBN 0-471-44707-2. You will also need to purchase WileyPlus, which is the on-line class component for homework and grading. You may purchase the on-line text along with WileyPlus instead of the hardcopy text, at a considerable cost reduction. You may also purchase a binder-ready hard copy version of the text, also at a considerable cost reduction (binder-ready can be purchased directly from Wiley). You will also need to purchase a models kit. This can be purchased from the bookstore or on-line (which is less expensive) at http://www.molecularvisions.com/cat--Molecular-Model-Kits--kits.html. Choose kit # 1, ISBN: 0964883716.

Catalog Description
A one-semester chemistry survey course for pre-nursing students, covering the areas of general chemistry, organic chemistry and biochemistry. Major lecture topics include atomic and molecular structure and bonding, nomenclature of relevant inorganic and organic compounds, states of matter and intermolecular forces, solutions and solubility, reactions of inorganic, organic, and biological molecules, stereochemistry, structure and function of biological macromolecules, nutrition and metabolism. The course will emphasize chemistry as it appears in a practical nursing context. Lecture, four hours. Lab, two and a half hours. Prerequisite: One year high school algebra. One year of high school chemistry is strongly recommended. 5 units.

General Education
Chemistry 5 fulfills the General Education Area B1 requirement.

Student Learning Objectives
Students who successfully complete this course will be able to:
- Perform calculations involving dimensional analysis, concentration and dilution, and other kinds of measurement, particularly as applied to nursing situations.

- Describe the shell model of the atom, find the valence electrons of atoms and ions and understand the trends of the periodic table.
- Name and identify binary compounds (salts, acids and bases) and polyatomic ions.
- Balance and complete basic chemical reactions involving binary compounds and polyatomic ions.
- Explain the properties and concepts of pH, acids, bases and buffers and apply these concepts to problems involving systems of the human body.
- Understand ionic, polar and non-polar covalent bonding.
- Draw molecular structures, indicating bond and molecular dipoles and use VSEPR theory to predict molecular shapes.
- Describe intermolecular forces and predict their effects on physical properties of solutions.
- Understand basic gas laws, especially in regard to the human respiratory system. Understand the relationships between respiration and blood pH.
- Name and draw the major organic functional groups (alcohols, thiols, aldehydes, ketones, acids and acid derivatives, amines).
- Apply the concepts of intermolecular forces to organic molecules.
- Draw and complete substitution and addition reactions involving aldehydes, acids, and acid derivatives.
- Describe, draw, and identify stereoisomers.
- Identify and draw basic structural elements of proteins (peptides), lipids, carbohydrates and nucleic acids.
- Understand the chemical reactivity, structural properties, and biological activities of the four major groups of biological macromolecules.
- Describe the occurrence of mutations in genes, particularly with regard to common disease states arising from errors in macromolecular structures.
- Understand the basic principles of bioenergetics and biological redox reactions.
- Describe the major anabolic pathways: glycolysis, Kreb's, β-oxidation, especially as they relate to basic nutrition. Explain the relationship between metabolic cofactors and vitamins.
- Understand alterations in metabolism, especially Type II diabetes.

Course Philosophy and Expectations

What profession could be more important than nursing? Nurses provide direct patient care and are the front-line health-care providers for almost all of us. Chemistry plays a central role in nursing, since the functions of the body are all explained and understood by fundamental chemical concepts. This course was developed partly to stream-line the pre-nursing requirements, but more importantly to provide pre-nursing students with a context-based chemistry experience. We have worked hard to focus on the aspects of chemistry that nurses need the most, and to present this material as much as possible in a nursing context. The labs and case studies in particular are geared towards nursing related situations. Because we are trying to cover so many areas of chemistry in one semester, this course covers a very large amount of material in a short period of time and consequently requires **a lot of work outside of class**. In addition to the approximately 7 hours/week you will spend in lecture and lab, you should plan on spending an additional 15 hours **minimum** outside of class studying and doing problems. That's right, *15 hours minimum*. The material in this course will move very, very fast and you will struggle mightily if you get behind. Because we believe nursing is a highly demanding, critically important profession, we are completely committed to the success of students in this class and we will do everything we can to help you. We expect you will bring a similar serious and hard-working attitude to the class. **If you feel you are not prepared to work long hours studying for this course, you should consider dropping the course now and taking it some other time.**

The main course components are as follows:

- 4 hours of lecture/week. This is where we will introduce fundamental chemistry concepts, linking these concepts as much as possible to nursing situations. We will do some problem-solving in lecture to help you understand the concepts we are introducing. We will evaluate your progress through three mid-terms and a comprehensive final exam.
- 2.5 hours of lab/week. The laboratory is where we will explore the concepts in hands-on real-life applications. We will also do some case studies during lab to further assist you in understanding the connection between chemistry and nursing practice. Your progress will be evaluated through your performance on pre-labs, post-labs and case studies.
- Homework. Homework is critical to success in any science class, especially chemistry. You will be assigned homework to do each week and we highly recommend you work on it every day. Homework will be assigned on a weekly basis and graded through the on-line program WileyPlus.

We have a big challenge in this course, which is to help you learn the chemistry you need to become excellent nurses in a very short amount of time. We don't have time to waste on tardiness and absences. Although we understand there are always unexpected situations that come up in life, if you feel your situation this semester is such that you are anticipating problems with attendance, **you should drop the course now and take it some other time**. Having said that, we also need to point out that this semester is only the second offering of this class, which is a novel and challenging approach to chemistry for nurses. We are still developing this course and there may be changes to the syllabus along the way. We will do everything we can to alert you to these changes as soon as we encounter them. We will also take any changes into account and adjust grades accordingly, if needed.

Furlough days. Due to the economic crisis occurring in the state of California, faculty are required this semester to take nine furlough days during which they are not allowed to work. Due to furloughs, three lectures (Sept. 18, Oct. 16, Nov. 25) will be replaced with worksheets (see below).

Assignments

Exams: There will be 2 exams and one comprehensive final exam. The 2 exams will be a mixture of multiple choice and short answer questions. The final exam will consist entirely of multiple choice questions.

Homework: Weekly online homework will be assigned using WileyPlus. This homework must be completed by the deadline, or it will count as a zero. Registering for WileyPlus will be explained the first day of class.

Quickwrites: Periodically during the semester, you will be asked to write 2-3 paragraphs about an important concept in chemistry. Quickwrites will be graded 0, 5, or 10 points depending on how well your writing reflects an understanding of the concept or problem.

Furlough day worksheets: The material scheduled for furlough days will be presented in a required worksheet. These will not be graded but must be completed (with reasonable answers). **Failure to fully complete all three worksheets will result in a grade of F for the entire course.** Late worksheets will not be accepted. The relevant dates are listed in the course schedule below.

Prelab assignments: Prelab assignments will consist of either questions in the lab manual that must be answered **before** you come to lab, or a short prelab quiz. Failure to complete the prelab questions **before** lab begins will result in your dismissal from lab that day. You will then be required to make up the experiment in another section (with instructor approval).

Lab reports: Lab reports are due at the beginning of lab (before the prelab lecture). Late lab reports will be subject to a 10% penalty per day late, and will not be accepted once the graded reports have been returned. Please note that a lab report is late starting at 9:01 am.

Make-up policy

Exams can only be made up if the student presents a legitimate verifiable excuse such as a police accident report or a doctor's note. Work situations are not included! If your work schedule is going to interfere with exams or assignments, **you should drop the course now and take it some other time**. This same advice applies to family situations. If you have a demanding family situation that will interfere with your attendance and ability to show up for exams, we suggest you take this course some other time.

Homework cannot be made up. It is due at the assigned time.

Quickwrites cannot be made up. They are due immediately following the writing activity. Your lowest quickwrite score will be dropped.

Labs can be made up either the week of absence or the week immediately following the absence, provided there is a legitimate excuse for the absence. **Labs cannot be made up at any other time**. Due to the limited time we have in lab, you will generally have to make up a lab in another section. **Failure to complete all of the labs will result in a grade of F for the entire course**.

Tardiness

Students who are late to lab without a verifiable excuse will not be allowed to complete the lab. Students who are repeatedly late for lecture will be asked to leave the room. Repeated infractions in either lecture or lab will result in disenrollment from the course.

Assessment

2 hour exams, 150 points each	300
14 laboratory experiments, 12 points each (may include case studies)	168
14 laboratory pre-lab assignments/quizzes, 3 points each	42
Laboratory final exam	100
Quickwrites	100
Homework, variable points per assignment	150
Furlough day worksheets	0
Final exam (cumulative)	140
Total points for the course:	**1000**

Grading

A: 92-100%
A-: 90.0-91.9%

B+: 87.6-89.9%	C-: 70.0-72.5%
B: 82.6-87.5%	D+: 67.6-69.9
B-: 80.0-82.5%	D: 62.6-67.5
C+: 77.6-79.9%	D-: 60.0-62.5
C: 72.6-77.5%	F: below 60.0

TENTATIVE LECTURE SCHEDULE
Note: subject to change. Appropriate notice will be given

Date	Week	Lecture Topic	Chapter	Lab Exercise
8/31	1	Course overview, scientific method, matter and energy, atoms and elements. *Note: sections 1.3-1.6 are covered in Experiments 1 and 3.*	1.1, 1.2, 2.1-2.2	Dimensional analysis
9/2		Periodic table, atomic and mass numbers, mole and mol/mass conversions	2.3-2.6	
9/4		Isotopes and radioisotopes, electronic structure, valence electrons, LDS, octet rule	2.7, 3.1-3.3	
9/7	2	**Labor Day; no class meeting**		Molecular models, part I *NOTE: Take-home lab*
9/9		Ions and ionic compounds, covalent bonds, molecules, polyatomic ions	3.4-3.6	
9/11		Formula and molecular weight, molar mass; structural formulas, formal charges	3.7, 4.1	
9/14	3	Electronegativity, polarity, molecular shape, noncovalent interactions	4.2, 4.3	Measurement
9/16		Alkanes, cycloalkanes, nomenclature	4.4	
9/18		Structural isomers *FURLOUGH DAY - required worksheet (handed out 9/16; return it on 9/21)*	4.5, 4.6	
9/21	4	Introduction to functional groups: alkenes, aromatic compounds, alcohols, carboxylic acids and esters	4.7-4.9	Molecular models, part II
9/23		States of matter and energy , gases and pressure, gas laws, partial pressures, vapor pressure	5.1-5.4	
9/25		Chemical equations	6.1	
9/28	5	Reaction types	6.2-6.4	Gases – exhaled CO_2. ABG case study.
9/30		Reaction stoichiometry	6.5, 6.6	
10/2		Free energy and reaction rate	6.7	
10/5	6	**EXAM # 1 Chapters 1-6**		Analysis of urine. Clinical case study.
10/7		Solutions, solubility of gases, ions, organic and biochemical compounds in water	7.1-7.5	
10/9		Concentration and dilution	7.6, 7.7	
10/12	7	Diffusion and osmosis	7.9	Solutions, diffusion, dialysis.
10/14		Acids, bases, salts, equilibrium	9.1-9.4	
10/16		Ionization of water, pH scale, acid and base strength, neutralization *FURLOUGH DAY - required worksheet (handed out on*	9.5-9.8	

		10/14; return it on 10/19)		
10/19	8	Buffers	9.9-9.11	Buffers. Respiratory acidosis case study
10/21		Carboxylic acids, phenols	10.1-10.5	
10/23		Amines, amides, stereochemistry (part I)	10.6-10.9	
10/26	9	Alcohols, ethers	11.1-11.3	Aspirin and acetaminophen
10/28		Aldehydes and ketones	11.4-11.7	
10/30		Monosaccharide structures, stereochemistry (part II)	12.1	
11/2	10	Reactions of monosaccharides	12.2, 12.3	Organic reactions
11/4		Polysaccharides	12.4, 12.5	
11/6		Simple and complex lipids	8.1-8.6	
11/9	11	Membranes	8.7	Carbohydrates and diabetes *NOTE: take-home lab*
11/11		**Veteran's Day - no class meeting**		
11/13		**EXAM # 2 Chapters 7-12**		
11/16	12	Amino acids and peptides	13.1, 13.2	Lipids: fat extratction from food. Cholesterol case study
11/18		Protein structure and function	13.3-13.5	
11/20		Enzymes	13.6, 13.7	
11/23	13	Nucleic acids *FURLOUGH DAY - required worksheet (handed out on 11/23; return it on 11/30)*	14.1-14.3	No labs due to Thanksgiving break
11/25		Thanksgiving break - no class meeting		
11/27		Replication, expression and mutation	14.4-14.7	
11/30	14	Overview of metabolism	15.1-15.3	Lactate dehydrogenase, heart attack case study
12/2		Glycolysis	15.4	
12/4		Gluconeogenesis, glycogen metabolism	15.5, 15.6	
12/7	15	Citric acid cycle, electron transport, and oxidative phosphorylation	15.7, 15.8	DNA and pre-natal metabolic tests
12/9		Fatty acid oxidation	15.9	
12/11		Metabolism and disease: Type II diabetes	Supplement	
12/16	16	**LECTURE FINAL EXAM, 12:45-2:45**		**LAB FINAL EXAM (12/14-12/17; held during regular lab meeting time)**

CHEM 5 LAB SCHEDULE
FALL 2009

WEEK	CONCEPT	ACTIVITY
1	**Dimensional analysis**	Check-in; learn DA technique; solve DA problems in nursing context.
2	**Molecular structure and shape, part I**	Work with molecular models to understand structure and shape of simple compounds. *NOTE: take-home lab.*
3	**Measurement**	Learn to make basic measurements; precision and accuracy.
4	**Molecular structure and shape, part II**	Examine structures and shapes of organic molecules using molecular models.
5	**Gases**	Learn basic gas laws, especially partial pressures of CO_2, using exhaled CO_2 gases. Use of EMT CO_2 indicators. Case study.
6	**Analysis of urine**	Learn components and analysis of urine; clinical case study.
7	**Solutions, diffusion and dialysis**	Examine solutions and colloids; observe diffusion; learn how dialysis works.
8	**Acids, bases, and buffers**	Use cabbage indicator buffers to demonstrate basic concepts of pH, acids, and buffers; respiratory acidosis case study.
9	**Esters and Acids - reactions and pain medications.**	Synthesis of aspirin and acetaminophen. Drug compatibility case study.
10	**Organic Reactions**	Exercise demonstrating fundamental organic reactions (addition, substitution, redox) of alkenes, alcohols, and carbonyls. Emphasis on biologically relevant reactions.
11	**Carbohydrates**	Glucose testing, diabetes case study. *NOTE: take-home lab.*
12	**Lipids**	Extraction of oils from chips. Lipid panels case study.
13	**THANKSGIVING - NO LABS**	
14	**Enzymes**	Properties of a clinically important enzyme (lactate dehydrogenase).
15	**DNA, genetics, and neonatal screening tests**	Simple DNA isolation, metabolic neonatal tests. Neonatal case study.
16	**FINAL EXAM**	**Covers all 14 labs, held during regular lab meeting time**