

Chemistry 21B: Survey of Organic and Biochemistry - Fall, 2009

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Chemistry 21B is the second semester of a two-semester sequence designed to provide students with the skills and knowledge needed to satisfy the requirements for several allied health related majors. This course continues the study of Organic Chemistry begun in Chemistry 21A and presents an overview of biologically important classes of compounds and their metabolic pathways.

PREREQUISITE: Completion of Chemistry 21A or equivalent, with a minimum grade of C.

MATERIALS:

1. Seager & Slabaugh, *Chemistry for Today: General, Organic, and Biochemistry*, 6th edition;
2. Campbell and Wolf, *Chemistry 21B Supplement, Part 1 (Organic Chemistry and Biochemistry) and Part 2 (Biochemistry and Metabolism)*; Campbell, *Chemistry 21A Packet*
3. Peller, *Exploring Chemistry: Laboratory Experiments in General, Organic, and Biological Chemistry*, 2nd edition.
4. Safety goggles ("Visorgogs", or other Instructor approved)
5. **OPTIONAL:** *Study Guide and Solutions Manual for Seager and Slabaugh's Chemistry for Today: General, Organic, and Biochemistry*, 6th edition
6. **RECOMMENDED:** set of different colored pens or pencils for note-taking

GRADING: Final letter grades will generally be assigned according to the following percentage of total points earned:

Grade	Percent
A	90 - 100%
B	80 - 90%
C	65 - 80%
D	55 - 65%
F	below 55%

Approximate distribution of points:

Tests (3 @ 100 points each)		300
Quizzes (4 @ 25 points each)		100
Laboratory (total points)		180
Homework/Assignments/Other		20
Final Exam		<u>200</u>
Course Total		800

SPECIAL NOTES: 1) Because chemistry is a laboratory science, passing work (55% or more of possible points) in the laboratory portion of the course is required in order to earn an overall grade of "D" or higher, regardless of test and quiz scores. 2) A minimum of 65% in the Lecture portion of the course (quizzes, tests, final exam) is required in order to earn an overall grade of "C" or higher, regardless of lab scores. 3) An especially high or low grade on the Final Exam will influence your course grade more than indicated above!

POLICIES, PROCEDURES, AND GUIDELINES FOR SUCCESS

(READ THOROUGHLY - YOU ARE RESPONSIBLE FOR AWARENESS OF ALL THIS INFO!!)

1. Unless you are anticipating a REALLY important call, PLEASE TURN YOUR CELL PHONE OFF!! Points may be deducted for such interruptions - is that incoming call worth it?
2. ATTENDANCE - Be PROMPT and regular in attendance. Quiz and Test questions come from lecture material and WILL include topics covered only in Lecture (i.e. not discussed in the texts)! Excessive absences and/or tardies will likely result in a lower grade – more than four absences may result in you being dropped from the class. If you arrive late to LAB you may be excluded from the lab (0 pts) that night.

IMPORTANT NOTE: Any “excusable” absence for a lab, quiz, or test MUST be substantiated by a WRITTEN note; a grade for missed work will be assigned as determined appropriate by the Instructor, on a case by case basis. No written excuse = no points for that assignment!

3. TESTS, QUIZZES, AND THE FINAL EXAM - It is your responsibility to be present and on time for all tests, quizzes, and especially the Final Exam. CHECK THE SCHEDULE! No extra time will be allowed due to late arrival. There will be NO MAKE-UP tests or quizzes. Your best 4 quiz scores will be used in calculating your final point total; ALL test scores will be counted in the final point tally - except that a higher Final Exam score may be substituted for one Test score.

4. ASSIGNMENTS - Problems from the texts relating to topics covered will be recommended. Working the problems is an essential part of the learning process and give you practice, drill, and reinforcement of the course material. SOME problem sets may be collected and graded, at the whim of the Instructor. Be prepared to ask questions at appropriate times during class or Office Hours concerning any material or problems you don't understand. Other assignments, including in the form of Handouts and/or “pop quizzes”, may be given and graded.

5. LABORATORY - See the page below relating to Guidelines for Labs and Lab Reports.

6. CHEATING - In a word, DON'T! Penalties range from points off, to zero for the assignment, quiz, or test, to dismissal from the class, to expulsion from the college. More importantly, you are here to get prepared for your next class, or your career. And please don't help someone else to cheat – will you give them part of your paycheck, too, when you work a shift together? Make sure your workmates are as prepared for emergencies as you intend to be!

7. GRADES are EARNED, not appointed. It is up to YOU to learn the material thoroughly enough to do well on Quizzes, Tests, and Labs. PLAN to spend 15-20 HOURS PER WEEK on this course IN ADDITION to time in class! Study effectively: read the texts before lecture; take good lecture notes (taping of lectures is permitted); rewrite your lecture notes to look for holes or areas that are not yet clear; study the texts and your notes; DO ALL THE SUGGESTED PROBLEMS. Use FLASHCARDS to help memorize terms and formulas and REACTIONS

Success is a matter of preparation and repetition. You've passed Chem 21A, so you already know you have the ability to pass this course. But, the material presented IS more complex – IT TAKES TIME TO LEARN IT. Make use of all possible learning resources - your texts, the Instructor (in class and during Office Hours), tutors if necessary, and especially your fellow students. Always remember that everything builds on itself, so don't let any gaps develop! KEEP UP – everything “builds” on earlier material!! STUDY PARTNERS OR GROUPS are HIGHLY recommended!

HINTS ON HOW TO STUDY ORGANIC CHEMISTRY AND BIOCHEMISTRY

For the study of ORGANIC CHEMISTRY we are taking a “functional group” approach. The key to this is to recognize specific bonding arrangements or groups of atoms (the functional groups) in a compound - from either its name or structure - and then to KNOW specific PHYSICAL properties and CHEMICAL properties (REACTIONS) typical of compounds containing the functional group(s).

Typically, for each “FUNCTIONAL CLASS” of compounds studied we will focus on:

- A. STRUCTURE - the atoms and bondings involved; polarity of bonds and molecules; shape
- B. NOMENCLATURE - common names, and IUPAC naming rules
- C. PHYSICAL PROPERTIES - especially density, solubilities, mp & bp (POLARITY is key!)
- D. REACTIONS -

1. WHAT can happen at the functional group - products from its interactions with other substances (or functional groups) : LEARN these as a LIST for each functional group! including any special conditions or catalysts required;

A LOT of organic chemistry (and BIOCHEMISTRY/PHYSIOLOGY) involves transformation of one functional group into another!

2. HOW a specific reaction occurs - the MECHANISM of the reaction; we will be learning several reaction mechanisms this semester; you'll need to get comfortable with writing these to excel in the course!

“A” and “B” above are interrelated - from a name you should be able to draw a structure; for a structure you should be able to provide a name. The Rules MUST be learned and followed - for both common and IUPAC names; we will review and build on what you learned in Chem 21A.

“C” above requires recollection of bonding and molecular geometry from Chem 21A - now applied to interactions between molecules, and sometimes within molecules.

“D” is best learned by making a LIST for each functional group of the reactions that it can do, especially transformations into other functional groups. Remember, most reaction systems exist in equilibria so we should recognize both what a functional group “does”, and also how it can form! We will not learn mechanisms for all reactions - just some selected few. These will allow us to better understand HOW a functional transformation can occur - and often show why the same functional group can react in several different ways as conditions change.

BIOLOGICAL COMPOUNDS typically contain more than one functional group - and can get quite complex. Common names are most frequently used and must be learned. And there is more detail to learn about structure/geometry and its effects on properties. BUT, what you learn about each INDIVIDUAL functional group still applies! We'll especially watch for how the presence of one group can influence the behavior of another.

In the study of METABOLISM we will learn PATHWAYS of SEQUENTIAL reactions - but the reactions are (mostly) the same as learned previously. Only the structures get more complex! Look for underlying commonality of structures, and behaviors - but expect some surprises!

STUDENTS WITH DISABILITIES, INCLUDING LEARNING DISABILITIES

Students with disabilities, including learning disabilities, who believe they may need accommodations in this class are encouraged to contact the Special Resource Center on campus as soon as possible to better ensure such accommodations are implemented in a timely fashion. If you suspect, or are unsure if, you have a learning disability you are strongly encouraged to contact the Special Resource Center on campus as soon as possible for testing, to better ensure any needed accommodations are implemented in a timely fashion. If you have a documented or suspected disability and wish to discuss academic accommodations, please contact me privately to discuss your specific needs.

GUIDELINES FOR WORKING IN THE LABORATORY AND FOR SUBMITTAL OF LABORATORY REPORTS

IN THE LABORATORY

1. SAFETY GOGGLES must be worn at all times when laboratory work is in progress! Points may be deducted for any violation of this policy!
2. SAFETY procedures and laboratory TECHNIQUES specific to each experiment are discussed at the start of the lab period; IF YOU ARRIVE LATE YOU MAY BE EXCLUDED FROM PERFORMING THE EXPERIMENT!
3. Before each experiment or exercise the Instructor will review the Procedures for that day's experiment, note any CHANGES to these, DEMONSTRATE and discuss any new lab techniques, and point out specific SAFETY concerns (including disposal of chemicals used in the experiment). Read over the Background and Procedures sections for each laboratory experiment BEFORE coming to class. This will allow you to take full advantage of instructions provided by the Instructor, and prepare you to ask appropriate questions about the procedures - so that you will be able to complete the laboratory work in the allotted time.
4. All DATA and OBSERVATIONS obtained in the lab must be recorded on the laboratory Report IN INK, at the time obtained. Do NOT record data or observations on scrap paper for later entry on the Report sheet! Obviously, you will need a copy of the lab procedures and Report sheet BEFORE the lab, for use during the lab. A copy of the lab text is kept on Reserve at the ECC Library.
5. Although most laboratory exercises will be completed with partners, all REPORTS must be completed INDIVIDUALLY unless specifically told otherwise! That is, you can work together on set-ups and clean-ups - but EACH student must record ALL of their own DATA and OBSERVATIONS INDIVIDUALLY at the time obtained (NOT just do half of the experiment and later copy the other from a lab partner!).
6. At the completion of each experiment be sure to: dispose of all materials appropriately; return special "checked-out" equipment or materials to the Stockroom; clean up your work areas – including in the hoods and around the balances; put your own lab equipment into your own locker; lock your drawer (give a gentle tug to make sure it is locked!).
7. There is NO time for make-up labs. See "Policies and Procedures" for what to do if you miss a lab for a legitimate reason.

GUIDELINES FOR LABS AND LAB REPORTS, cont'd.

SUBMITTAL OF LAB REPORTS (and other written assignments)

1. The Report for each lab experiment or exercise is due one week after completion of the experiment, unless specifically told otherwise. Lab reports submitted late will earn only partial, or NO, credit. Generally, a penalty of 5% is assessed for each day late, up to 50% of possible points, if the Report is submitted; no Report = zero points for the experiment.
2. For multi-page Reports, STAPLE pages together in proper order, at top left corner, keeping all parts readable. Your name should be written on each page (top right corner) in case pages get separated.
3. Reports generally consist of both Data Sheets and Reflective Exercises. ALL Reflective Exercises are part of the graded Report unless specified otherwise for the experiment.
4. Specified "Pre-lab" assignments will be part of the overall lab points total. These may be assigned as due before the lab experiment is performed, after the experiment is performed, or as part of the Report for the experiment – as specified by the Instructor for the particular assignment.
5. Although most laboratory exercises will be completed with partners, all REPORTS must be completed INDIVIDUALLY unless specifically told otherwise! EACH student must record ALL of their own DATA and OBSERVATIONS INDIVIDUALLY (NOT just do half of the experiment and later copy the other from a lab partner!), and complete the rest of each Report (including any Pre-Lab assignment) INDIVIDUALLY. Discussions of results and explanations with other people are OK and expected, but – AS FOR A JOB - YOU must write your OWN final Report. After all, you are here to learn, not just to watch your classmates. And you want them to learn also – you could be working with them later in your career!
6. All DATA and OBSERVATIONS obtained in the lab must be recorded on the laboratory Report IN INK. Other portions of the Report, including Reflective Exercises, and also any Pre-Lab assignments, may be written using either pencil or ink.

SPECIAL NOTE: the use of GREEN ink on ANYTHING SUBMITTED FOR GRADING (Lab Reports, Assignments, Quizzes, Tests, Exam) is reserved for the Instructor!

CHEMISTRY 21B - COURSE OBJECTIVES

By the end of the course you should be able to:

1. Do each of the following for the functional classes alcohols, phenols, ethers, aldehydes, ketones amines, carboxylic acids, and carboxylic acid derivatives:
 - a. write a name given a structure and vice-versa.
 - b. state common sources.
 - c. write equations for common reactions and methods of preparation.
2. Identify the type of mechanism used in common organic chemistry reactions as either concerted, carbocation or carbanion and illustrate the mechanism for representative reactions studied.

CHEMISTRY 21B - COURSE OBJECTIVES, CONTINUED

3. Do each of the following for carbohydrates, lipids, amino acids, proteins, and nucleic acids:
 - a. draw chemical structures for important members of each of the classes.
 - b. write equations for common reactions of each class.
4. Explain in writing the Krebs cycle in terms of the structural changes involved in each step of the cycle, the energy produced by the cycle, and the places in the Krebs cycle where other cycles enter or leave the Krebs cycle.
5. Discuss the genetic processes of replication, transcription and translation in terms of the structural changes which are involved.
6. Analyze the effect of pH, temperature, concentration of substrate and concentration of enzyme on the ability of any enzyme to function normally.
7. Name an enzyme on the basis of its function.
8. Discuss how ATP is made in the mitochondrion, the function of **NADH and FADH** in this process and where the energy is stored in ATP.
9. Analyze carbohydrate, lipid and protein catabolism and anabolism in terms of the structural changes involved in each step of these processes, ATP input and production, and function of each process.
10. Use common organic laboratory techniques for the synthesis, characterization, and identification of several classes of organic and biochemical substances.

CHEM 21B COURSE LEVEL STUDENT LEARNING OUTCOME:

On a written exercise, given the structures or names of reactants for a reaction, students will be able to write the correct structures of products and identify the reaction type.

CHEMISTRY PROGRAM LEVEL STUDENT LEARNING OUTCOME:

Students will practice safe laboratory procedures by putting their goggles on at the beginning of a chemistry lab experiment involving burners or chemicals, and by keeping their goggles in place during the entire course of the experiment. Students will not remove their goggles until the students are leaving or until the instructor has said that it is safe to do so (whichever comes first).