Chem 2423
Organic Chemistry

Instructor contact information

Instructor:	Pamela Auburn	**Office Phone:**	281-290-5014
Office:	Bldg 13-623	**Office Hours: M, Tu, Th 1-2pm and 6-7 pm or by appointment**	
E-mail:	Pamela.r.auburn@lonestar.edu	**Website:**	**NA**

Course Title:	Organic Chemistry	**Term and Year:**	Fall 2016
Course Subject:	Chem 2423		
Course Section:	Lec 6001 Lab 6002	**Class Days & Times:**	Lecture Online Lab Wednesday 6:10-10:10pm
Credit Hours:	4		
Lecture Hours:	3		
Lab Hours:	4		
Total Contact Hours: (All hrs. x 16)	112		

Course overview

For details go to http://research.lonestar.edu/cat/catsrch.asp

Catalog Description:

4 Credits (3 hrs. lec., 4 hrs. lab.) This science major's course covers the topics of alkanes, alkenes, alkynes, stereochemistry, alkyl halides, nucleophilic substitution, elimination, spectroscopy, conjugation, aromaticity, aromatic substitution and organic synthesis. The laboratory program includes appropriate experiments with product purification and methods of analysis including chromatography and infrared spectroscopy. (4005045203)

Student Learning Outcomes:

- Classify organic compounds by structure, molecular orbitals, hybridization, resonance, tautomerism, polarity, chirality, conformation, and functionality.
- Identify organic molecules using appropriate organic nomenclature.
- Describe the principle reactions for syntheses of molecules, ions, and radicals.
- Describe organic reactions in terms of radical and ionic mechanisms.
- Describe the use of spectroscopic data to determine the structure of organic molecules.
- Formulate appropriate reaction conditions for the synthesis of simple organic molecules.
- Perform chemical experiments, analysis procedures, and waste disposal in a safe and responsible manner.
- Utilize scientific tools such as glassware and analytical instruments to collect and analyze data.
- Identify and utilize appropriate separation techniques such as distillation, extraction, and chromatography to purify organic compounds.
- Record experimental work completely and accurately in laboratory notebooks, and communicate experimental results clearly in written reports.
- Demonstrate a basic understanding of stereochemistry.
- Perform organic syntheses of molecules.

- Classify organic compounds by structure, molecular orbitals, hybridization, resonance, tautomerism, polarity, chirality, conformation, and functionality in laboratory reports.
- Identify organic molecules using appropriate organic nomenclature in laboratory reports.
- Describe organic reactions in terms of radical and ionic mechanisms in laboratory reports.
- Use spectroscopic data to determine the structure of organic molecules.
- Formulate appropriate reaction conditions for the synthesis of simple organic molecules.

Getting ready

Prerequisites: CHEM 1412; ENGL 0305 or ENGL 0365 or ENGL 0115 AND ENGL 0307 or ENGL 0375 or ENGL 0117 OR higher level course (ENGL 1301) OR placement by testing. ENGL 0309 or ENGL 0310 also meets prerequisite
Note that to be successful in this class you must have achieved proficiency in the following learning objectives from General Chemistry (1411 and 1412)
Review of the following learning objectives from General Chemistry 1 and 2 might be necessary and appropriate. I will NOT review or repeat instruction of these learning objectives. If you need help you may see me during office hours or meet with one of the chemistry tutors.
1. Given a periodic table, write electron configurations or draw orbital diagrams for any of the following elements: C, H, N, O, S, P, the halogens, B, Al, Mg, Na, K, and Li. Determine the number of valence electrons for any main group element and draw a Lewis symbol for that element.
2. Define and/or distinguish ionic, covalent, and polar covalent bonds. Identify a compound as either ionic or covalent. Compare ionic and covalent compounds with respect to differences in boiling points, melting points, physical states (at room temperature), and water solubilities.
3. Predict the shape of a molecule, using VSEPR theory. From the shape of the molecule and the electronegativities of the bonded atom s, predict if the molecule is polar or nonpolar and identify the direction of the net molecular dipole moment for any polar molecules.
4. Identify the intermolecular force(s) that impact the physical properties of a given compound.
5. Predict which of two specified compounds is likely to have the higher boiling point based on the hydrogen bonding, dipole-dipole forces, and London dispersion forces acting on the molecules.
6. Predict the type of bond hybridization, if any, occurring in compounds in which C, N, and O are the central atoms and be able to predict the geometry of the bond.
7. Given the structure of an organic compound, calculate the molar mass of the compound.
8. Given an equation with the formulas of reactants and products, balance the equation. Given the names or formulas of the reactants used in a metathesis reaction, write a balanced equation. Given the amount of a reactant used or product formed, calculate the amount of any other reactant needed or product formed in the reaction. Given the mass of the reactants used in a reaction, calculate the theoretical yield and percent yield of the reaction.
9. Given appropriate data, be able to calculate the empirical or molecular formula for a compound

Required Material: Organic Chemistry, 2nd ed. by David Klein Publisher: Wiley, ISBN: 9781118452288
HSG Molecular Structure Model Set ISBN-13: 978-0-7167-4822-9
Scientific calculator
Hayden McNeil Organic Chemistry Laboratory Notebook: ISBN 978-1-930882-46-1

Recommended: Free version of ChemSketch installed on an personal computer
http://www.acdlabs.com/resources/freeware/chemsketch/
Organic Chemistry As a Second Language: First Semester Topics by Klein, 3rd Edition ISBN : 978-1-118-20377-4
Student Study Guide and Solutions Manual to accompany Organic Chemistry 2e 978-1-118-64795-0

Instructor guidelines and policies

Attendance: Attendance to all classes is expected. Your success in this class is based on a **cumulative** understanding of the material. Should you miss a class, you are compromising your ability to understand future material. You are thereby hindering your ability to succeed in this class. Since each of us learns by our own unique processes, borrowing notes from another student is not an adequate substitute for class attendance. If, however you should miss a class, it is

your responsibility to obtain lecture notes and assignments from another student. I will NOT provide handouts from prior classes.

Assignments: Chemistry is NOT a spectator sport. In order to learn this subject, you MUST work problems. You should work all the problems that are part of your chapter and enough end of chapter problems to ensure that you are comfortable with the material. They provide a good measure of your understanding of the material. The solution manual for this text is OUTSTANDING and includes complete solutions not just answers. Your homework grade is based on completion only. It would be possible to receive full credit for homework by merely copying answers from the manual. However, you would be cheating yourself as this would not provide you with a measure of your ability not would it prepare you for exams.

Make-up Exams: If a student misses a semester test for an acceptable, documented reason, they will be given the opportunity to take a make-up exam. Students should contact the instructor **prior** to missing a scheduled examination by phone, in-person, by e-mail, or by voice mail. All make-up exams will be administered in the College Assessment Center and must be complete BEFORE the first class following the scheduled exam. ***If you arrive to the class immediately following a missed exam and have not made prior arrangements, you may, at the instructor's discretion be allowed to take the exam immediately in the testing center.***

There will be NO makeup quizzes or labs. Lab reports and/or worksheets will NOT be accepted from students who did not attend the lab. Students may miss ONE lab periods without penalty. A grade of zero will be entered for each additional lab that is missed.

Computers: Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers or cell phones during class for reasons not related to class must leave the classroom for the remainder of the class period.

Cell phones: The use of cell phones, smart phones, or other mobile communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Please place your mobile communication device out of site and on silent while in class.

Make-Up Labs: There will be NO makeup quizzes or labs. Lab reports and/or worksheets will NOT be accepted from students who did not attend the lab. Students may miss one lab without penalty. A grade of zero will be entered for each additional lab that is missed.

Department/Division Contact: Department Chair: Chris Allen (281) 655-3783
Vice President of Instruction: Kathy Sanchez: 281-655-3715

GRADE DETERMINATION:

Your semester grade will be based on a combination of tests, quizzes, homework, laboratory reports and laboratory assignments. There will be four tests on the dates indicated in the class schedule. If your score on the final exam is higher than your lowest test score, the final score will replace your lowest test score; otherwise your final score will be averaged as an additional test score. There will also be **at least six pop quizzes**. Your best (n-1) scores will be used to calculate your quiz average. So if there are exactly 6 quizzes, the average of your best 5 scores would comprise your quiz average. If there are 8 quizzes then the best 7 scores will be used to calculate your quiz average. Should you miss one quiz, the missed quiz will be assigned a grade of zero and this will be one counted the dropped score. If you miss more than one quiz, the assigned zero will impact your quiz average and all completed quizzes will contribute to your quiz average.

Laboratory reports are due **one week** after completion of the laboratory. Late laboratory reports will be penalized 5% per day late. Laboratory notebooks will be inspected periodically unannounced five times.

You must read through laboratory information BEFORE coming to lab. Prelab questions have been uploaded to D2L. These lab questions must be completed and submitted to the appropriate D2L Dropbox prior to the lab to which they pertain. Prelab assignments will contribute 5% to your overall class grade.

There will be NO makeup quizzes or labs.

Your grade will be determined by the following	**Percent of Final Average**
Exams including a cumulative final	70%
Laboratory Reports/Notebook	10%
Prelab assignments	5%
Quizzes (unannounced)	10%
Homework (completion only)	5%
Total:	100%

LETTER GRADE ASSIGNMENT:

Letter Grade	**Final Average in Percent**
A	89.5 – 100
B	79.5 – 89.4
C	69.5 – 79.4
D	59.5 – 69.4
F	< 59.5

Withdrawal Policy
Withdrawal from the course after the official day of record and prior to "W" Day, (**Sept**) will result in a final grade of "W" on your transcript. No credit will be awarded for a course earning a "W." If you stop attending class, you must withdraw at the registration office prior to "W" day **(November 11)**. If you stop attending class and do not officially withdraw, you will receive an "F" for the course. Your instructor will NOT withdraw you from the class.

Six Drop Rule
Students who enrolled in Texas public institutions of higher education as first-time college students during the Fall 2007 term or later are subject to section 51.907 of the Texas Education Code, which states that an institution of higher education may not permit a student to drop (withdraw with a grade of "W") from more than six courses, including courses that a transfer student has previously dropped at other Texas public institutions of higher education that have already been counted against their six drop limit. Each student should fully understand this drop limit before you drop any course. Please see a Counselor or Advisor in our Student Services area for additional information and assistance. **This policy does not affect developmental or ESOL students**

Lone Star College-University Park Learning Center is committed to your success

Your success is our primary concern! If you are experiencing challenges achieving your academic goals, please contact your instructor or an advisor. We can provide assistance with academic needs, ADA accommodations, classroom difficulties, financial concerns, and other issues.

Tutoring: For all disciplines, please call 281.401.5388 for information on hours and location. The tutoring lab, reading/writing lab, and math lab can be found within the Learning Center in building 12, 8th floor. There also a "Science Hot Spot" located in Building 12 on the 6th floor.

Counseling Services: Counseling services are available to students who are experiencing difficulty with academic issues, selection of college major, career planning, disability accommodations, or personal issues. Students may contact Counseling, Career, and Disability Services at 281.401.5311, or in building 13 Suite 260.

The Assistive Technology Lab: The Assistive Technology Lab is available for students who benefit from its various technologies to convert text to speech, magnify items, convert text to Braille, etc. For further information, please contact the Learning Center in building 12, 8th floor.

Writing Lab: Having strong writing skills helps students become successful not only in their academic lives, but also in their professional and personal lives. With this goal in mind, the University Park Writing Center, located in the Student Learning Center, provides tutoring and additional services to help students strengthen their writing skills. Students enrolled in any course that requires any type of writing can get individualized help at the Writing Center.

Library: The Lone Star College-University Park Library is located in building 12, 8th floor and contains information resources for both college students and community members. Librarians are available to assist with research. To contact a reference librarian, uplibrary-ref@lonestar.edu.

For Library hours and contact information, please visit http://www.lonestar.edu/library .

Tentative Instructional Outline:

Lesson 1	General Review of General Chemistry: Electrons Bonding and Molecular Properties Klein Chapter 1 Lab 1 – Recrystallization (week 1) Lab 2 - Melting Point (week 2)	1. Draw Lewis structures for molecules (or ions) and position formal charges on atoms. 2. Identify any polar covalent bonds present in a given substance. Identify all partial charges that would exist on a molecule of that substance and depict the direction of the bond dipole moment. 3. Given a periodic table , write electron configurations or draw orbital diagrams for any of the following elements: C, H, N, O, S, P, the halogens, B, Al, Mg, Na, K, and Li. Determine the number of valence electrons for any main group element and draw a Lewis symbol for that element. 4. Define and/or distinguish ionic, covalent, and polar covalent bonds. Identify a compound as either ionic or covalent. Compare ionic and covalent compounds with respect to differences in boiling points, melting points, physical states (at room temperature), and water solubilities. 5. Predict the shape of a molecule, using VSEPR theory. From the shape of the molecule and the electronegativities of the bonded atom s, predict if the molecule is polar or nonpolar and identify the direction of the net molecular dipole moment for any polar molecules. 6. Identify the intermolecular force(s) that impact the physical properties of a given compound. 7. Predict which of two specified compounds is likely to have the higher boiling point based on the hydrogen bonding, dipole-dipole forces, and London dispersion forces acting on the molecules. 8. Predict the type of bond hybridization, if any, occurring in compounds in which C, N, and O are the central atoms and be able to predict the geometry of the bond. 9. Given the structure of an organic compound, calculate the molar mass of the compound. 10. Given an equation with the formulas of reactants and products, balance the equation. Given the names or formulas of the reactants used in a metathesis reaction, write a balanced equation. Given the amount of a reactant used or product formed, calculate the amount of any other reactant needed or product formed in the reaction. 11. Given the mass of the reactants used in a reaction, calculate the theoretical yield and percent yield of the reaction. 12. Given appropriate data, be able to calculate the empirical or molecular formula for a compound **HOMEWORK:** Homework: 1.1, 1.2, 1.3, 1.4, 1.10, 1.11, 1.12, 1.14, 1.15, 1.16, 1.18, 1.19, 1.20, 1.22, 1.26, 1.29, 1.30, 1.31, 1.32, 1.33, 1.71, 1.74 **DUE IN LAB Sept 7**
Lesson 2	Representing Organic Molecules Klein Chapter 2.1-2.6 Klein Organic Chemistry as a second Language First Semester Topics Chapter 1 and Chapter 3 Lab 3 –Simple and Fractional Distillation (Week 3) Lab 4 - Extraction (week 4)	1. Draw structural formulas of organic compounds belonging to the families listed: (alkanes, alkenes, carboxylic acids, alcohols, amides, amines, ethers, esters, anhydrides, alkyl halides, aldehydes, ketones nitriles) 2. Classify compounds according to their functional group and to identify all of the functional groups present in a compound. 3. Given the structure or formula for an amine or amide, classify it as primary, secondary, or tertiary. 4. Given a compound represented as a Lewis structure, structural formula, condensed Structural formula, line-angle drawing, or three-dimensional structure, represent the molecule using any of the other possible structures or formulas 5. Identify the location of lone pairs and hydrogens not shown in line drawings **HOMEWORK:** 2.1, 2.2, 2.3, 2.5, 2.6, 2.7, 2.8, 2.10, 2.11, 2.12, 2.14, 2.15, 2.16, 2.17, 2.21, 2.22, 2.23, 2.24, 2.25, 2.27, 2.28, 2.29, 2.32, 2.33, 2.34, 2.35, 2.36, 2.37, 2.64, 2.66, 2.76 **DUE IN LAB Sept 14**

Lesson 3	Resonance and Curved Arrow Notation Klein Chapter 2.7-2.12 Klein Organic Chemistry as a Second Language Chapter 2	1. Use curved arrows to show the movement of electrons in chemical reactions or the inter-conversion of two resonance structures 2. Correctly apply curved arrow notation to show the movement of electrons from source to sink. 3. Assess relative importance of resonance structures 4. Draw resonance structures for representative compounds, ions, or free radicals that follow all rules for resonance structures. Identify or draw major resonance structures of a given substance.
Lesson 4	Infrared and ^{13}C NMR Spectroscopy Klein 15.1-15.7, 15-16 and 16.11-16.12 Lab 5 Steam Distillation (week 5)	1. Given a table of the major IR stretching frequencies for organic molecules, interpret the IR spectrum for an organic compound by assigning the major peaks to specific types of bonds, determining the functional group(s) present in the molecule, and drawing or recognizing a reasonable structure for the molecule. 2. Identify the number of NMR distinct carbon atoms in a given structure 3. Integrate carbon 13 and IR data to distinguish between given structural and functional group options 4. You will know the major IR stretching frequencies for organic molecules. You will be able interpret the IR spectrum for an organic compound by assigning the major peaks to specific types of bonds, determining the functional group(s) present in the molecule, and drawing or recognizing a reasonable structure for the compound. 5. You will be able to use IR spectroscopy to determine whether or not a specified product was obtained from a given reaction. You will be able to support and explain your answer using the expected or observed frequencies for the major peaks in an IR spectrum **HOMEWORK:** 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, 15.7, 15.8, 15.9, 15.10, 15.12, 15.14, 15.15, 15-31, 15.32, 15.33, 15.34, 15.36, 15.38, 15.39, 15.41 **DUE IN LAB Sept 21**
Lesson 5	Acids and Bases Klein Chapter 3 Klein Organic Chemistry as a Second Language Chapter 3 Lab 6 Introduction to chromatography (week 6)	1. Recognize common acids used in organic synthesis including carboxylic acids, phenols, alcohols, inorganic acids, and water. Recognize common bases used in organic synthesis including amines, alcohols, water, and bases that contain hydroxide, alkoxide, hydride, or amide ions. 2. Given the reactants in an acid/base reaction , give the structures and/or formulas of the products of the reaction. Use curved arrows to correctly show how the products are formed. 3. Given a list of compounds, rank the compounds in order of their relative acidity. Identify the stronger acid and stronger base in a chemical equation and use that information to determine if the equilibrium favors reactants or products. 4. Use curved arrow notation to indicate the flow of electrons in acid base reactions. **HOMEWORK:** 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.143.15, 3.16, 3.17, 3.18, 3.19, 3.20, 3.21, 3.22, 3.23, 3.24, 3.25, 3.26, 3.27, 3.28, 3.29, 3.30, 3.31, 3.32, 3.34, 3.35, 3.60, 3.61, 3.62, 3.66, 3.69 **DUE IN LAB Sept 28**
Test 1		

Lesson 6	Alkanes and Cycloalkanes Klein Chapter 4.1-4.5 Klein Organic Chemistry as a Second Language First Semester Topics Chapter 5 Lab 7: Extraction and recrystallization of caffeine (week 7)	1. Define and/or recognize definitions of the terms given in the glossaries at the end of the reading assignment. Be able to recognize or cite examples of each. 2. State or recognize the general formulas and structures for alkanes and cycloalkanes (C_nH_{2n+2} and C_nH_{2n}) and apply them to predicting or recognizing molecular formulas for those compounds. 3. Recognize and /or write formulas for constitutional (structural) isomers of specified compounds in which the longest continuous chain contains up to ten carbons. 4. Apply IUPAC conventions for the nomenclature of alkanes and cycloalkanes to naming and drawing formulas of specified compounds with 10 or fewer carbons in the longest chain or largest ring. Use in proper context (i.e., naming and drawing formulas) alkyl group names including methyl, ethyl, propyl, isopropyl, butyl, sec-butyl, isobutyl, tert-butyl, and neopentyl. 5. Use in proper context (naming and drawing formulas) the IUPAC conventions for naming complex substituents. 6. Apply IUPAC conventions to name and draw unsubstituted bicylic systems with 10 or fewer total carbons. 7. Given the name or structure of an organic compound, be able to designate carbons And hydrogens as primary, secondary or tertiary. 8. Describe and/or recognize statements describing the general trends for the boiling points, melting points, densities, and solubilities of alkanes corresponding to (a) variations in chain length for a homologous series, (b) straight-chain versus cyclic molecules, and (c) branched-chain versus straight-chain molecules. Predict which member of a stated pair of compounds would have the greater boiling point, melting point, or solubility in a specified solvent. **HOMEWORK:** 4.1, 4.2, 4.5, 4.7, 4.8, 4.10, 4.11, 4.12, 4.13, 4.14, 4.16, 4.17, 4.18, 4.56 **DUE IN LAB Oct 5**
Lesson 7	Conformations Klein Chapter 4.6-4.15 Klein Organic Chemistry as a Second Language First Semester Topics Chapter 6 Dry lab Stereochemistry	1. Given a 3-dimensional structure for a specific conformation of a compound, draw the Newman projection for that conformation. Given a Newman projection for a specific Conformation of a substance, draw an appropriate 3-dimensional structure for that conformation. 2. Draw and/or recognize the Newman projections and/or three dimensional structures representing the staggered, skew, and eclipsed conformations of ethane, and the anti-, gauche, and eclipsed conformations of butane. Assign each conformation to a graph of potential energy versus dihedral angle or sketch such a graph. Know the basis for the energy barriers to rotation. 3. Given heat of combustion data for various isomeric compounds, predict which would be most stable. 4. Delineate the main factors involved in ring strain. 5. Draw and/or recognize drawings of the chair, boat, and twist-boat conformations of cyclohexane. Identify axial and equatorial hydrogens on the chair conformation. 6. Predict which of the two possible chair conformations of a monosubstituted cyclohexane is the more stable. 7. Draw and/or recognize drawings of all possible chair conformations of the cis and trans isomers of disubstituted cyclohexanes. Predict which of the alternate chair conformations is more stable for a specified disubstituted cyclohexane. **HOMEWORK:** 4.19, 4.20, 4.21, 4.23, 4.27, 4.28, 4.29, 4.30, 4.31, 4.32, 4.33, 4.34, 4.35, 4.36, 4.37, 4.38, 4.66, 4.74, 4.79

		DUE IN LAB Oct 12
Lesson 8	Stereochemistry Klein Chapter 5 Klein Organic Chemistry as a Second Language First Semester Topics Chapter 7 Lab 8 Resolution of Phenyl Ethyl Amine (Week 8)	1. Identify all chiral carbon atoms present in a molecule. Assign (R) and (S) designations to each chiral carbon. Designate the internal mirror plane of symmetry present in a molecule. Identify a given molecule as chiral, achiral, optically active, or not optically active. 3. Draw three dimensional structures for molecules which have chiral carbon centers. 4. Correctly name compounds with one or more chiral carbons using (R)-(S) designations. 5. Identify the relationship between two structures and classify them as representing structural (constitutional) isomers, enantiomers, diastereomers, conformations of the same compound, or different compounds that are not isomers. 6. Given the formula of a cyclic or acyclic compound with one or more stereocenter, draw three dimensional structures for all of the possible isomers or stereoisomers. Identify the relationships between the structures drawn (structural isomers, enantiomers, diastereomers). 7. Apply objectives 2 through 6 to Fischer projections as well as three dimensional structures. 8. Calculate the specific rotation for a chiral substance when given its concentration, observed rotation, and the length of the polarimeter cell. Calculate the percent optical purity of a chiral substance when given the optical rotation of the pure compound and the observed rotation of a sample of containing that compound. Calculate the enantiomeric excess when given the relative amounts of a pair of enantiomers. Calculate the relative proportions of a mixture of enantiomers required to produce a specified observed rotation. 9. Compare and contrast enantiomers and diastereomers in terms of the following properties: (a) melting and boiling points (b) density (c) refractive index (d) behavior toward plane - polarized light 10. Describe how the resolution of enantiomers can be accomplished. **HOMEWORK:** 5.1, 5.2, 5.3, 5.4, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, 5.15, 5.16, 5.17, 5.18, 5.19, 5.205.21, 5.22, 5.23, 5.24, 5.255.26, 5.27, 5.28, 5.29, 5.30, 5.53, 5.54, 5.56 **DUE IN LAB OCT 19**
		Test 2
Lesson 9	Chemical Reactivity and Mechanisms Klein Chapter 6	1. Given heat of combustion data for various isomeric compounds, predict which would be most stable 2. Use the rate equation to determine the impact that a change in concentration of one or more reactants will have on the rate of a reaction. 3. Be able to draw and/or use a reaction energy diagram (energy profile)to discuss or determine transition states, activation energies, intermediates, heat of reaction, and the rate determining step of a reaction. 4. Use the relative stability of methyl, primary, secondary, tertiary, allyl, substituted allylic, and vinyl free radicals and carbocations (carbonium ions) to rank a series of free radicals or carbocations in order of stability. 5. Distinguish between electrophiles and nucleophiles 6. Identify the four patterns of electron movement in reaction mechanisms 7. Combine the four patterns of electron movement to create complete reaction mechanisms **HOMEWORK:** 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.10, 6.11, 6.12, 6.13, 6.14, 6.15, 6.16, 6.17, 6.18, 6.19, 6.30, 6.33, 6.53, 6.54

		DUE IN LAB OCT 26
Lesson 10	Alkyl Halides: Klein Chapter 7 Lab 9 Nucleophilic Substitution	1. Given the structure of an alkyl halide, write the correct IUPAC name for the compound. Given the name of an alkyl halide, draw the correct structure of the compound. Given the name or structure of an alkyl halide, designate it as primary, secondary, tertiary, allylic, benzylic, vinyl, aryl, geminal, and/or vicinal. Correctly specify or draw the stereochemistry of an alkyl halide, as appropriate. 2. Predict and apply general trends in physical properties of alkyl halides. Given the name or formula of a molecule or ion, draw the Lewis structure for the substance and determine if it is a potential nucleophile. 3. Rank specified carbocations (carbonium ions) based on their relative stabilities. 4. Predict the major product formed by free radical halogenation and free radical allylic halogenation. 5. Identify the most appropriate hydrocarbon and reagents needed to prepare a specified alkyl halide.
Lesson 10	Substitution and Elimination Reactions of Alkyl halides Klein Chapter 7 Lab 10 Williamson's Ether Synthesis	1. Predict the major product formed by free radical halogenation and free radical allylic halogenation. Identify the most appropriate hydrocarbon and reagents needed to prepare a specified alkyl halide. 2. Draw the mechanisms for SN1, SN2, E1, and E2 reactions and account for the stereochemistry of the reactions and any rearrangements that occur. 3. Given reactants and reaction conditions for nucleophilic substitution or elimination reactions, predict the structure of the product(s). If more than one product can be formed, predict the major and minor products. Identify the mechanism by which the reaction would proceed (SN1, SN2, E1, or E2). 4. Use IR spectroscopy to predict the structure of the product formed during a reaction or sequence of reactions. Identify the reagents needed to convert a given substrate into a product consistent with the given IR. Use IR spectroscopy to determine whether a specified reaction was successful and justify your answer using specific peaks that are present or absent in the IR spectrum. You will not have access to the table of major IR stretching frequencies. 5. Outline the synthesis of specified compounds by free radical halogenation, nucleophilic Substitution , and /or elimination reactions, including selecting the appropriate reactants, specifying appropriate reaction conditions, and identifying major and minor products. Where necessary, specify reaction conditions that would result in the specified compounds being formed as the sole or major product. 6. Recognize and describe the effects of substrate, solvent, nucleophile, concentration of reactants, temperature, and leaving group on the various types of substitution and elimination reactions. 7. State or recognize the factors that determine the strength of nucleophiles and rank nucleophiles by strength. 8. Use reaction-energy diagrams of substitution and elimination reactions to identify the overall reaction order, the presence or absence of a reactive intermediate, the activation energy, the rate determining step, and the heat of reaction. 9. Describe the relationship between the rate equation and the transition state. 10. Given the equation for a nucleophilic substitution or elimination reaction, identify the reaction as 1^{st} or 2^{nd} order and predict the impact that changes in the concentration of reactants will have on the rate of the reaction. 11. Predict which member of a group of alkyl halides would react most rapidly by the SN2 mechanism and explain why. Predict which member of a group of alkyl halides would react most rapidly by the SN1 mechanism and explain why.

		12. Given groups of SN1 reactions or groups of SN2 reactions, predict which reaction would occur more rapidly and explain why. **HOMEWORK: 7.1** 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.11, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21, 7.23, 7.24, 7.26, 7.27, 7.28, 7.29, 7.30, 7.31, 7.32, 7.33, 7.34, 7.66, 7.69, 7.71, 7.82 **DUE IN LAB November 9**
Test 3		
Lesson 11	Alkenes and Alkynes Klein Chapter 8 Lab 11 Competitive Alkene Formation	1. Apply IUPAC conventions to naming and drawing structures of specified alkenes, cycloalkenes, and alkynes. Use in proper context the names ethylene, propylene, isobutylene, acetylene, and vinyl, methylene and allyl groups. Include the specifications cis, trans, (E), and (Z) in names and structures where appropriate in alkenes and cycloalkenes. Correctly specify or draw the stereochemistry of any asymmetric carbons present. 2. State or recognize the types of bonds, hybrid orbitals, and geometry of alkenes and alkynes. 3. Predict the physical properties of alkenes and alkynes. 4. Calculate the elements of unsaturation for specified compounds. Given a molecular formula, Calculate its elements of unsaturation and predict its structure (or possible structures) using all available spectroscopic and/or chemical data. 5. For specified pairs of alkenes and cycloalkenes, including cis and trans isomers, identify the compound that should be more stable based on such data as heats of hydrogenation, heats of combustion, degree of substitution, geometry, and ring size. State or recognize statements describing the general trends in the stability of alkenes and cycloalkenes. **HOMEWORK:** 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 8.11, 8.13, 8.14, 8.15, 8.16, 8.17, 8.18, 8.19, 8.20, 8.21, 8.22, 8.26, 8.27, 8.28, 8.29, 8.31, 8.33, 8.34, 8.36, 8.37, 8.38, 8.39, 8.41, 8.42, 8.43, 8.44, 8.45, 8.46, 8.79, 8.81, 8.82, 8.83, 8.84 **DUE IN LAB NOV 16**
Lesson 12	Reactions of Alkenes Klein Chapter 9 Lab 12 Electrophilic Addition to Trans Stilbene	1. Predict the major product in the following reactions by which alkenes can be prepared: dehydrohalogenation of alkyl halides dehydration of alcohols dehalogenation of vicinal dibromides. 2. Given reactants and reaction conditions, predict the product(s) of the following addition reactions of alkenes. Apply Markovnikov's Rule where it is applicable to predicting major products of reactions. If syn or anti addition occurs, apply those principles to predicting the outcome of the reaction. a. Catalytic hydrogenation b. Addition of HX c. Anti-Markovnikov addition of HBr d. Addition of bromine and chlorine e. Acid-catalyze dehydration f. Oxymercuration-demercuration g. Alkoxymercuration-demercuration h. Hydroboration oxidation i. Formation of halohydrins j. Epoxidation k. Anti hydroxylation (Preparation of anti vicinal diols via epoxidation and hydrolysis) l. Preparation of syn vicinal diols (syn hydroxylation) m. Formation of cyclopropanes n. Oxidative cleavage o. Ozonolysis 3. Write logical mechanisms for the following reactions and account for the stereochemistry of the reactions and any rearrangements that occur: dehydrohalogenation, dehalogenation, acid catalyzed dehydration of an alcohol Halogenation, addition of HX to an alkene, oxymercuration-demercuration acid catalyzed hydration (hydrolysis) of an alkene 4. Identify the best reagents and conditions needed to produce an alkene or convert an alkene to another functional group using 5. Describe the function of the catalyst in hydrogenation reactions and distinguish between syn and anti additions.

		6. Describe with equations simple chemical tests (solubility in cold concentrated sulfuric acid, reaction with bromine in carbon tetrachloride, oxidation by cold dilute potassium permanganate, and reaction with ethanolic silver nitrate) that would distinguish between specified alkanes, alkenes, and alkyl halides. **HOMEWORK:** 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 9.11, 9.12, 9.13, 9.14, 9.15, 9.16, 9.17, 9.18, 9.19, 9.20, 9.21, 9.22, 9.23, 9.24, 9.26, 9.27, 9.28, 9.29, 9.30, 9.31, 9.33, 9.34, 9.35, 9.36, 9.37, 9.40, 9.42, 9.43, 9.44, 9.45, 9.46, 9.47, 9.79, 9.81, 9.82 **DUE IN LAB NOV 30**
Lesson 13	Reactions of Alkynes Klein Chapter 10 Lab will be used for lecture catch up	1. Identify the relative acidities of alkanes, alkenes, and alkynes and explain their relative pKa's. Show how to prepare and use acetylide (alkynide) ions. 2. Predict the major product in the following reactions by which alkynes can be synthesized: a. alkylation of acetylide (alkynide) ions including formation of the acetylide ion, b. addition of acetylide ions to carbonyls and epoxides c. double dehydrohalogenation of alkyl halides. 3. Given reactants and reaction conditions, predict the product(s) of the following reactions of alkynes: a. Catalytic hydrogenation to alkanes or cis-alkenes b. alkali metal reduction of alkenes to trans-alkenes c. addition of halogens d. addition of hydrogen halides e. anti-Markovnikov addition of HBr f. acid hydration g. hydroboration-oxidation 4. Draw the mechanism for the following reactions: a. formation of an acetylide ion b. reaction of an acetyide ion with an alkyl halide, epoxide, aldehyde, or ketone c. addition of hydrohalic acid to an alkyne 5. Identify the best reagents and conditions needed to produce a specified alkyne or convert an alkyne to another functional group 6. Apply one or more of the units to the single-or multi-step synthesis of specified alkenes, alkynes and/or alkyl halides. 7. Use IR spectroscopy to predict the structure of the product formed during a reaction or sequence of reactions. Identify the reagents needed to convert a given substrate into a product consistent with the given IR. Determine whether a specified product was obtained during a reaction using IR spectroscopy and justify your answer using specific peaks that are present or absent from the spectrum. You will not have access to the table of major IR stretching frequencies **HOMEWORK:** 10.1, 10.2, 10.5, 10.6, 10.7, 10.8, 10.9, 10.10, 10.11, 10.13, 10.14, 10.16, 10.17, 10.18, 10.19, 10.20, 10.21, 10.22, 10.23, 10.24, 10.25, 10.28, 10.29, 10.30, 10.31, 10.32, 10.61, 10.63, 10.64 **DUE IN LAB DEC 7**
Test 4		
Lesson 14	Radical Reactions (As Time permits) Klein Chapter 11	1. Given heat of combustion data for various isomeric compounds, predict which would be most stable 2. State the reagents needed and the products formed by the combustion, cracking, hydrocracking, and free radical halogenation reactions of alkanes or cycloalkanes. 3. Draw the complete mechanism for free radical halogenation of any alkane or cycloalkane. 4. Use bond dissociation energy values to predict the likelihood of homolytic reactions. 5. Predict the major product formed by free radical halogenation of a hydrocarbon. 6. Explain the relative reactivity of the halogens towards halogenation of methane and the selectivity of bromine in free radical halogenation compared to chlorine.

		7. Use the rate equation to determine the impact that a change in concentration of one or more reactants will have on the rate of a reaction. **HOMEWORK:** 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 11.8, 11.9, 11.10, 11.12, 11.14, 11.16, 11.20, 11.21, 11.22, 11.24 **DUE IN LAB DEC 7**
Final Exam Cummulative		

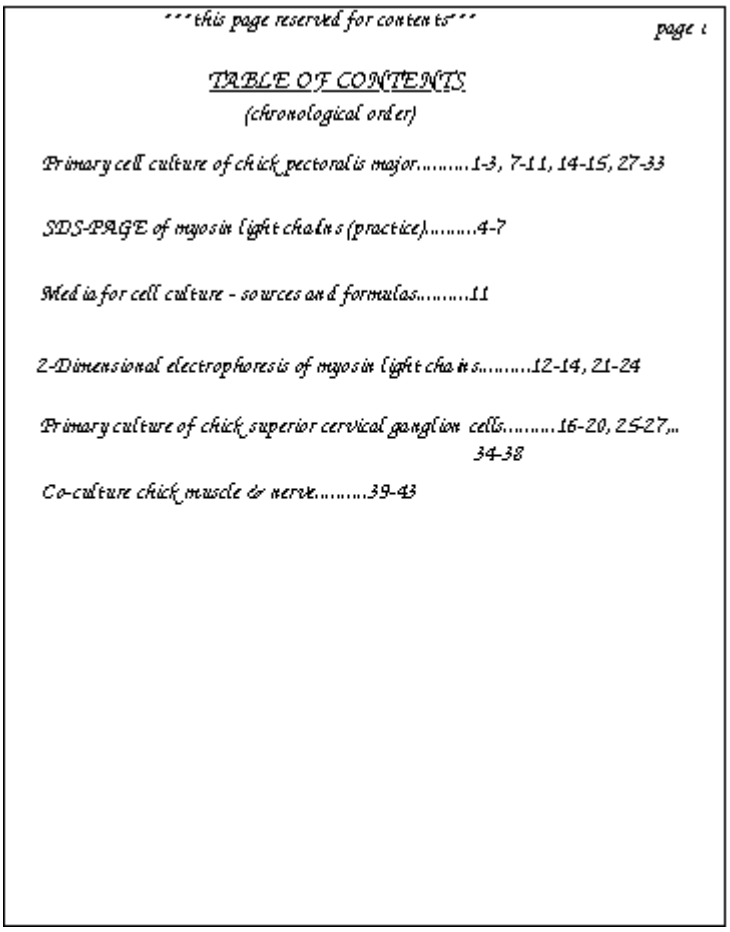
Notebook Checklist

As you record your activities in the laboratory, ask yourself, "Did I..."

Keep up with the table of contents?
Date each page?
Number each page consecutively?
Use continuation notes when necessary?
Properly void all blank pages or portions of pages (front and back)?
Enter all information directly into the notebook?
Properly introduce and summarize each experiment?
Include complete details of all first-time procedures?
Include calculations?

Table of Contents

Reserve several front pages for contents by indicating their purpose at the top of the page. Do not leave completely blank pages in the front of the notebook, for future tables, since blank pages could also be used to add entries out of order. If pages are not pre-numbered, it may be convenient to use small case Roman numerals to number the contents pages. Record contents in chronological order.



"'this page reserved for contents"' *page i*

TABLE OF CONTENTS

(chronological order)

BEFORE YOU COME TO LAB!

Always date and number every page in a consistent manner (e.g., at the top right, or bottom center, etc.). Start every experiment with a title and a brief introduction. Follow with "procedures," "materials and methods," or whatever you choose as the title for your laboratory work.

Title and Date: Give the title of the experiment and the date on which it is done.

Introduction: In a sentence or two, state the purpose of the experiment. If the experiment is a preparative experiment, the introduction also includes the balanced equation for the reaction. In organic chem I, there are different types of experiments: technique and preparative. A technique experiment is one in which you are performing a technique for the first time and studying its details, for example, distillation and extraction. A preparative experiment is one in which a compound is synthesized from other reagents.

Physical Data: List the MW, melting point, boiling point, density, solubility, and hazards of all pertinent chemicals used in the experiment. For your convenience, tables of physical data for all chemicals used in this course are included in the Handbook for Organic Chemistry Lab. Or, you can find the information on the Internet (see: Hazard and Physical Data for Compounds page). Calculate the amounts of reactants (or compounds to be purified) in moles, grams, or mL as appropriate. In a preparative experiment, calculate the limiting reagent and the theoretical yield of the product. Be sure to include your calculations for these values. Refer to the Handbook for information on how to calculate yields. The physical data are most conveniently presented in tabular form, although in a preparative experiment you may put the amounts of reactants and products under the balanced equations for the reaction.

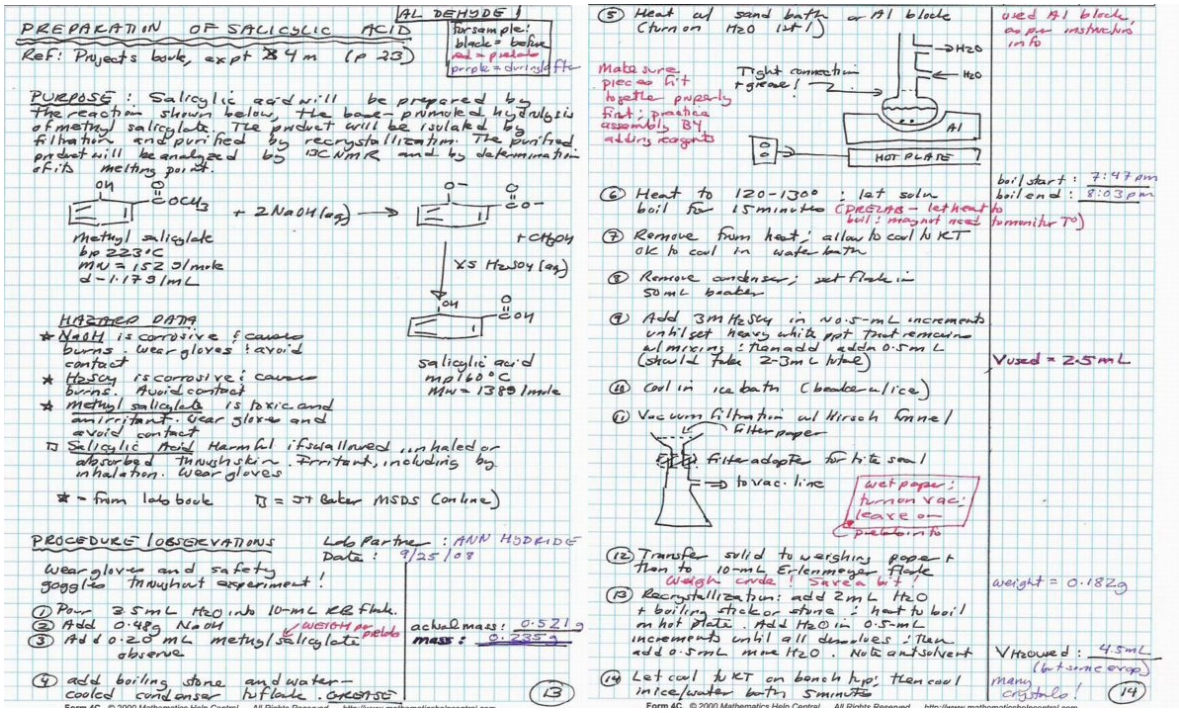
Procedure: Briefly summarize the procedure to be followed, preferably either as an outline or as a flow chart. You do not need to write out the procedure in complete sentences and you should not copy directly from the Lab Manual. All you need is a brief but complete listing of what you plan to do in the lab. The first time you do a technique, such as distillation, include in the procedure section a description of how to assemble the apparatus and how to conduct the distillation. In later experiments, it will be sufficient to state only that the liquid was distilled.

During Lab:
Observations: Document procedures within a reasonable time of doing them - during busy times your memory can fail you. Even if a procedure is outlined in a paper or published laboratory manual, record all of your procedures the first time you do them. Record HOW each procedure is done, even such mundane procedures as pipetting, calibrating a spectophotometer, or finding cells in a microscope. That is the only way you will be able to catch possible mistakes later, modify your procedures, or report exactly what you did. Do all of your calculations and take all notes right there in the notebook. Never do calculations or record observations on 'lab stationery' (paper towels). Loose papers can be lost easily.

When you make calculations, such as when you prepare a solution for the first time, write down all of your raw calculations. Even if you make mistakes, your progress is recorded permanently. Raw calculations may make your notebook appear a bit 'sloppy,' however if you don't include them you can't go back and correct mistakes.
When you have a 'recipe' that you anticipate using again, summarize the formula. You may want to include page numbers of all such recipes in a special place in your table of contents (reference materials need not be in chronological order).
Sometimes you just plain have a bad day. Consider that someone else may have a legitimate reason for examining your notebook. Don't put something in there that could embarrass you later. Remember, you can't blot anything out or rip out pages!

After Lab:
Discussion and Conclusions: This is the section in which you interpret the data obtained in the previous section. For instance, indicate the amount of purified compound that you obtained and how the purity and identity of the compound was assessed. In a preparative experiment, state the percent yield. Include and discuss instrument printouts, such as GC traces and IR spectra. In this section, you can state whether or not the procedure was a good method for making the desired compound; if not, try to make suggestions to improve the method for future experimenters.

Examples:



Lab Reports:
We will be using a format for the lab reports which is similar (but modified) to formats for scientific papers. That is, you must include an abstract, introduction, materials and methods section, results section, discussion, and literature citations. Your grade on the reports will depend on completeness, scientific accuracy and insight, organization, and writing skills. We will discuss this more in lab. We expect lab reports to be prepared using modern word-processing programs.

We will be using a format for the lab reports which is similar (but modified) to formats for scientific papers. That is, you must include an abstract, introduction, materials and methods section, results section, discussion, and literature citations. Your grade on the reports will depend on completeness, scientific accuracy and insight, organization, and writing skills. We will discuss this more in lab. We expect lab reports to be prepared using modern word-processing programs.

The format is as follows

Experiment Number
Title

AUTHOR NAMES
Lab day(s):
Due Date :

Abstract: (10%) The abstract is a brief summary of the experiment in 250 words or less. It should state what was done and why it was done. It should also summarize your findings.

Introduction (20%) You should provide a brief introduction to the experiment. What will you be doing and what do you hope to learn and accomplish? If you are learning a new technique explain the purpose and the fundamental underlying concepts. The text should not exceed half a page. Include a graphical representation of all important reaction(s) that you performed. All chemical structures and reactions should be drawn using ChemSketch. Structures should not be drawn by hand.
Experimental Results (20%) This is an account of the experiment, and all of your results. This section should contain the actual measured data obtained from the experiment in clear tabular form (make it easy to find all the information!).

Your data does not have to be numeric to be relevant – for example, if you were finding potential crystallization solvents, you should make a table showing your results. This section can be as long as necessary, but brevity (as long as everything is included) is appreciated.

It is best to use excel (or some other spreadsheet program) to make tables or graphs. Then paste the tables into your report as a picture. Please center all tables, figures, etc. with no text around it because it makes them easier to read. If you need help making, drawing, or pasting your tables or figures please just ask me for help.

Table 1. Example of a Table

Column 1	Column 2
Value A1	Value A2
Value B1	Value B2

Discussion (20%) As we have outlined in the lab syllabus, we are most interested in your understanding of an experiment and of laboratory techniques. Clearly discuss the success or failure of the experiment (if it was more failure than success why might that have occurred?). Are all of your results as you expected? Make sure to point out and discuss anything that appears unusual.

Questions (20%) Clearly answer all report questions (No working with anyone other than your partner).

Conclusions (10%) The conclusion can be brief, but should state the success or failure of the experiment, what you learned by doing the experiment, how it relates to class material, etc.

References:

If you obtained any information from outside sources you must reference the information appropriately. Chemists use the American Chemical Society format for references.[1]

1. *The ACS Style Guide,* Coghill, A. M.; Garson, L. R., Eds. 2nd ed. Oxford Press: New York, 2006.

Articles in Books:

Coakley, W.T., A.J. Bates and D. Lloyd. 1977. Disruption of bacterial cells. p279-341. In A.H. Rose and D.W. Tempest (ed.), *Advances in Microbial Physiology*, Vol. 16. Academic Press, London and New York.

Lone Star College-University Park Campus and System Policies

Academic Integrity The Lone Star College System upholds the core values of learning: honesty, respect, fairness, and accountability. The system promotes the importance of personal and academic honesty. The system embraces the belief that all learners – students, faculty, staff and administrators – will act with integrity and honesty and must produce their own work and give appropriate credit to the work of others. Fabrication of sources, cheating, or unauthorized collaboration is not permitted on any work submitted within the system.

The consequences for academic dishonesty are determined by the professor, or the professor and academic dean, or the professor and chief student services officer and can include but are not limited to:

1. Having additional class requirements imposed,
2. Receiving a grade of zero or "F" for an exam or assignment,
3. Receiving a grade of "F" for the course,
4. Being withdrawn from the course or program,
5. Being expelled from the college system.

Student Behavior Expectations Students are expected to conduct themselves appropriately while on College property or in an online environment. Students may receive disciplinary action up to and including suspension, if they violate System or College rules, disrupt classes, or interfere with the opportunity of others to obtain an education. Students who pose a threat to the safety of others will be subject to immediate withdrawal from the classroom, campus

environment, and/or online environment, as well as face subsequent criminal charges, as appropriate. Please refer to the Student Code of Conduct located online at http://www.lonestar.edu/student-responsibilities.htm for additional information.

Americans with Disabilities Act Statement Lone Star College-University Park is dedicated to providing the least restrictive environment for all students. We promote equity in academic access through the implementation of reasonable accommodations as required by the Vocational Rehabilitation Act of 1973, Title V, Section 504 and the Americans with Disabilities Act of 1990 (ADA) which will enable students with disabilities to participate in and benefit from all post-secondary educational activities.

Disability Services is located on the LSC University Park campus in building 13, Suite 200. You may contact Disability Services at the following number: 281.401.5370. Additional information may be accessed online at the following URL: http://www.lonestar.edu/disability-services.htm

Campus Safety and Security Lone Star College System is committed to maintaining the safety of the students, faculty, staff, and guests while visiting one of our campuses. See http://www.lonestar.edu/safety-nh.htm for details. Register at http://www.lonestar.edu/12803.htm to receive emergency notifications. In the event of an emergency, contact the police at 5911.

Computer Virus Protection Computer viruses are, unfortunately, a fact of life. Using flash drives on more than one computer creates the possibility of infecting additional computers and flash drives with computer viruses. This exposes college computers, personal computers, and any other computers to potentially damaging viruses. The college has aggressive anti-virus procedures in place to protect its computers, but cannot guarantee that a virus might not temporarily infect one of its machines. It is your responsibility to protect all computers under your control and use and ensure that each flash drive you use, wherever you use it, has been scanned with anti-virus software.

Equal Opportunity Statement It is the policy of the Lone Star College System to provide equal employment, admission and educational opportunities without regard to race, color, creed, national origin, gender, age, veteran's status, sexual orientation, or disability.

Lone Star Colleges strive to provide an excellent learning environment free from harassment or intimidation directed at any person's race, color, creed, national origin, gender, age, veteran's status, sexual orientation, or disability. Any form of harassment will not be tolerated.

FERPA In compliance with the Family Educational Rights and Privacy Act of 1974, the Lone Star College gives notice that the following types of information will be released upon request and may require approval of the appropriate administrator, unless the student desires to withhold all or any portion of it: student's name, address, LSC email address, telephone listing, date and place of birth, major field of study, participation in officially recognized activities and sports, semesters enrolled, degrees, certificates and awards received, photograph, enrollment status, student classification, and the most recent previous educational agency or institution attended by the student. Any student objecting to the release of all or any portion of such information must complete the FERPA release at http://www.lonestar.edu/consumer-safety in the online Student Center under Personal Information – Security/FERPA Restrictions. Release of any additional information pertaining to student records must be authorized by the student (i.e., grades, transcripts). The student's parents may authorize release of information if the student is younger than 18 years of age and a dependent as defined by the Internal Revenue Service. A student or parents of a student under the age of 18 may request to view the student's educational records with a written request to the student services office at the college(s) attended.

Online Learning: The instruction for online learning classes is delivered via the Internet. Students must have access to a computer and Internet services. Proctored exams at an approved location may be required. Students enrolling in online classes are expected to login to their classes before the end of the first day of the class. Student having any difficulties should contact LSC Online helpdesk as soon as possible by calling 832-813-6600 or VTAC chat in the D2L class.

Internet and E-mail LSCS provides computing and network resources. You are encouraged to use the computers, software packages, and electronic mail (e-mail) for educational or System-related activities and to facilitate the efficient exchange of useful information. The equipment, software, and network capacities provided through the district computer services are the property of the System. Use of the equipment and networks is to comport with the policies and procedures of the System and access may be denied to any student who fails to comply with the System's policies and procedures regarding its use.

Access to the System's e-mail and similar electronic communications systems are a privilege and certain responsibilities accompany that privilege. All users are expected to demonstrate the same level of ethical and professional manner, as is required in face-to-face or written communications. Threatening, anonymous, or forged messages will be treated as a violation of this policy.

Software Piracy Law strictly prohibits unauthorized copying of software purchased by Lone Star College-University Park for use in laboratories. Lone Star College-University Park administration will take appropriate disciplinary action against anyone violating copyright laws.

Evaluation of Instruction Lone Star College-University Park is committed to student success. As part of its' institutional effectiveness efforts, our instructors are assessed in several ways. For the continuous improvement of our instruction, all students are required to provide input for each course they take each semester using the Course Evaluations Questionnaire, which can be accessed online for each course. This occurs approximately half way through your course and your instructor will provide you more information on this process. Once you evaluate your course, print and turn in the receipt of completion to your instructor. The college deans review these evaluations each semester. The deans and/or department chairs may visit each instructor's class at some time during the semester to observe the instructional environment being provided and complete an assessment of the instructor.