

## CHEMISTRY 3005: Elementary Organic Chemistry

MWF 8:00-8:55AM    FH 408    Spring 2010

**TEXT:** *Intro to Organic & Biochemistry*, by Bettelheim, Brown, Cambell, Farrell.

**MOLECULAR MODEL KIT:** Available online and at the campus bookstore.

**LAB:** *A Laboratory Manual for Organic Chemistry 3005*, Dr. Dan Swartling, editor.

\*Safety goggles must be worn at all times in the organic laboratory.

**ILearn ONLINE:** View course content, recorded lectures, news, and grades:

<https://elearn.tntech.edu/>

**INSTRUCTOR:** Mrs. Janet Gray Coonce

E-Mail: [jcoonce@tntech.edu](mailto:jcoonce@tntech.edu)

Office: Room 127, Foster Hall

Phone: 931-372-6521

Emergency (cell): 931-267-6745

Office hours: 9-10AM MWF & by appointment

**PURPOSE:** Have you ever wondered what's in the food, medicine, fuel, cosmetics, and the "stuff" all around (and inside of) you? How do we obtain, identify, and communicate information about these substances? How do they react under different conditions? These are just a few of the questions that we will tackle in this one-semester organic chemistry course. I will try to incorporate applications in agriculture, nutrition, and medical technology whenever possible.

We will thoroughly cover **Chapters 1-12** of the textbook. (This corresponds to Ch. 9-20 in the larger version of the text; see course schedule below). Plan to work the problems presented in these sections. Pay attention during lecture for supplemental information and hands-on, problem-solving exercises. Please work with me to help make this semester meaningful and informative.

**Exam I:** Friday, Sept 24

**Exam II -** Friday, Oct 22

**Exam III -** Friday, Nov 19

**Literature Research Project:** due no later than Friday, Dec. 3

### **Cumulative Final Exam:**

8:00 - 10:00AM Thursday, Dec 16

Lecture attendance is expected, and several short in-class quizzes will be given throughout the term. The quiz questions content will come from the lecture notes or the homework problems in the textbook. Make-up quizzes and exams will not be given. Instead, I will drop your lowest quiz grade AND your lowest exam grade. I will be recording my lectures and posting them to iLearn under course "content." Please contact me if you have any questions.

### **GRADES:**

Grades will be posted to iLearn. **IT IS YOUR RESPONSIBILITY TO CHECK AND MAKE SURE YOUR GRADES ARE CORRECT.** If there is a problem, please contact me.

#### Grading Scale

90 and above A

90-80 B

80-70 C

70-60 D

60 and under F

#### Grading System

In-class quizzes 10%

Exams 40%

Literature Research Project 5%

Final Exam 20%

Lab Grade 25%

**Course Schedule:** Lecture topics will follow the general order found below. (The numbers in parentheses indicate the corresponding chapter numbers for the larger version of the textbook.) I expect you to read the *\*starred "Chemical Connection" boxes*, whether or not they are specifically covered in class.

**Ch. 1 (10). Introduction to Organic Chemistry and General Chemistry Review:**

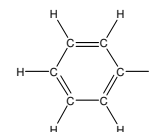
Atoms (protons, neutrons, electrons), isotopes, and ions. Atomic symbols. Valence electrons. Periodic Table. Electronegativity. Bonding. Naming. Chemical equations and formulas. Intermolecular Forces. Phase transitions. Lewis structures and the VSEPR Model. Common bonding patterns ("The Big Four" HONC 1234!) Line-angle formulas.

Families and Functional Groups: Alcohols ( $1^\circ$ ,  $2^\circ$ ,  $3^\circ$ ), amines ( $1^\circ$ ,  $2^\circ$ ,  $3^\circ$ ), aldehydes, ketones, carboxylic acids, esters. Hydroxyl group, amino group, and carbonyl group.

**Ch. 2. (11). Alkanes:** Saturated and unsaturated hydrocarbons, line angle formula practice, IUPAC & common nomenclature. Stereocenters. Isomers: constitutional, stereoisomers. Conformations of butane, cyclopentane, and cyclohexane. Properties. Common reactions: 1) Combustion 2) Halogenation.  
*\*Where do we obtain alkanes? \*Octane Rating.*

**Ch. 3. (12). Alkenes and Alkynes:** Structures, nomenclature, isomers. Reaction mechanisms: curved arrows,  $1^\circ$ ,  $2^\circ$ , and  $3^\circ$  carbocations. Common reactions: 1) Hydrohalogenation 2) Hydration 3) Bromination 4) Hydrogenation 5) Oxidation 6) Polymerization  
*\*Ethylene: A Plant Growth Regulator" \*Cis-Trans*

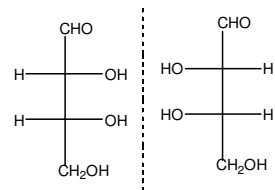
**Ch. 4. (13). Benzene and Its Derivatives:** Stability through resonance. Naming aromatic substitution reactions: 1) Halogenation, 2) Nitration, and 3) Sulfonation. *\*DDT \*Carcinogenic Polynuclear Aromatics and Smoking \*Iodide Ion and Goiter \*FD &C No. 6 (a.k.a. Sunset Yellow) \*Capsaicin \*Vitamin D.*



**Ch. 5. (14). Alcohols, Ethers, and Thiols.** Structures, names, and properties. Relative acidity. Lucas Test and Chromic Acid. Common reactions: 1) Dehydration 2) Oxidation of primary and secondary alcohols 3) Oxidation of thiols. *\*Nitroglycerin \*Breath-alcohol screening \* Ethers and anesthesia \*Commercially important alcohols.*

**Ch. 6. (15) Chirality: The Handedness of Molecules.**

Stereocenters, superimposable, nonsuperimposable, stereoisomers, chirality, constitutional isomers, cis-trans isomers, enantiomers, diastereomers, and meso compounds, dextrorotatory (+), levorotatory (-), racemic mixtures, Fisher projections - Ch. 12.1B (20.1B), Enzyme chirality, binding sites, and biochemical molecules. \*Chiral drugs.



**Ch. 7. (9) Organic Acids and Bases.** Equilibrium, conjugate acid/base pairs,  $K_a$ ,  $pK_a$ ,  $pK_b$ , buffers, pH, Henderson-Hasselbalch equation. Pushing electrons. \*Respiratory and metabolic acidosis and alkalosis. Practice Problems: 7.21, .23, .25, .26, .27, .28, .29, .33, .34, .35, .39, .53, .54, .55, .56, .57, .58, .65-.76

**Ch. 8. (16) Amines.** Naming. Basicity of aliphatic and aromatic amines. Separation and purification of amine and cyclohexanol. Reaction with acids to form a water-soluble salt. Peptide bond formation. Deamination. \*Amphetamines, \*Alkaloids, \*Tranquilizers, \*Solubility of drugs in body fluids, \*Epinephrine.

**Ch. 9. (17) Aldehydes and Ketones.** Naming. Properties. Keto-enol tautomerisation. Common reactions: 1) Oxidation 2) Reduction 3) Formation of hemiacetals and acetals. \*Benzaldehyde (oil of almonds) and other naturally occurring compounds.

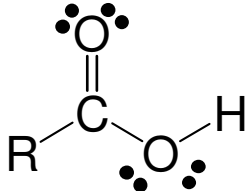
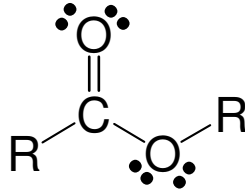
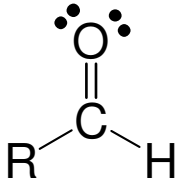
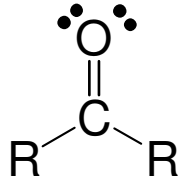
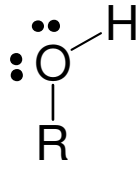
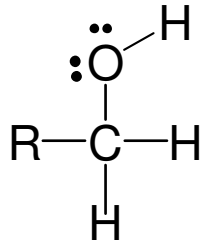
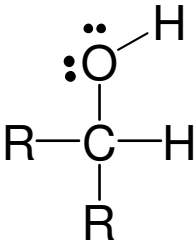
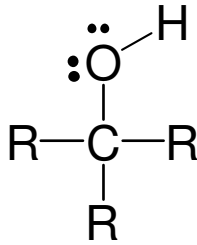
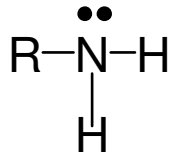
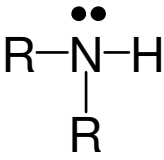
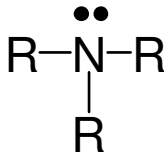
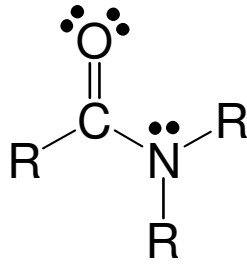
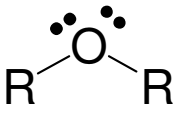
**Ch. 10. (18) Carboxylic acids.** Naming. Properties. Reactions: 1) Acid/Base reactions 2) Reduction to a 1° alcohol 3) Esterification 4) Decarboxylation \*Trans fatty acids \*Omega-3-acids \*Flavoring agents \*Ketone bodies.

**Ch. 11. (19) Anhydrides, Esters, and Amides.** Synthesis. Common reactions: 1) hydrolysis of anhydrides, esters, and amides. 2) Anhydride + alcohol → ester + carboxylic acid 3) Esters + amine (ammonia, 1°, or 2°) → amide + alcohol \*Insecticides of plant origin \*Penicillins \*Aspirin \*Sunscreen \*Barbiturates. \*Dissolving stitches. \*Nylon, mylar, polycarbonates.

*Students with a disability requiring accommodations should contact the Office of Disability Services (ODS). An Accommodation Request (AR) should be completed as soon as possible, preferably by the end of the first week of the course. ODS is located in the Roaden University Center, Room 112; phone 372-6119.*

*Should normal classroom activities be disrupted for any reason, the format for this course may be modified to enable completion. In that event, you will be given new instructions on iLearn for continuation of the course. If classes are unexpectedly cancelled the day of an exam, the exam will be given the first day we return to class.*

Homework. Make Flashcards!!! Organic Functional Groups and Families.

 <p><b>Carboxylic acid</b></p>	 <p><b>Ester</b></p>	 <p><b>Aldehyde</b></p>	 <p><b>Ketone</b></p>
 <p><b>Alcohol</b></p>	 <p>1° alcohol</p>	 <p>2° alcohol</p>	 <p>3° alcohol</p>
<p>Nitrogen NOT bonded to a carbonyl</p> <p><b>Amine</b></p>	 <p>1° amine</p>	 <p>2° amine</p>	 <p>3° amine</p>
 <p><b>Amide</b></p>	 <p><b>Ether</b></p>	<p>-C=O is a carbonyl group -OH is a hydroxyl group R represents any C group (alkyl group).</p>	