Chemistry 3719 - Organic Chemistry I

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Websites:

http://www.as.ysu.edu/~pnorris/public_html
www.chemfinder.com

Lecture needs:
• Carey
• Molecular models
• Adobe Acrobat Reader
• Web access

Molecular Models – www.darlingmodels.com

May be used on exams, will be used in lecture
Lab needs:

- Pavia, Lampman, Kriz and Engel
- Goggles
- Lab coat
- Bound notebook

Chemistry 3719 and 3720 (and labs)

Lectures

- Structure and nomenclature of compounds and groups
- Physical properties and analysis of materials
- Reactivity and transformations with reagents
- Importance of organic compounds in other subjects

Labs

- Glassware and equipment used to prepare organics
- Instrumentation used to analyze compounds
- Keeping a good notebook of lab preparations

Chemistry 3719R and 3720R (Recitation)

Objectives

- Practice the problems sets, old exams
- Practice the problems from the book
- Ask ?? of a professional chemist (other than lecture Prof)
- To encourage students to keep up with material (quizzes)

When: 12-12.50 or 1-1.50 on Mondays

(1 Semester hour, Separate grade to 3719/3719L)
Chemistry 3719 Personnel

Dr. Peter Norris  
3719 lecture

Dr. John Jackson  
3719 recitation

Calvin Austin  
3719 lab

Lucas Beagle  
3719 lab

Lemuel Carlisle  
3719 lab

Brian Dobosh  
3719 lab

Mike Evans  
3719 lab

Ashley Malich  
3719 lab

Kevin White  
3719 lab

Some does and don’ts for 3719 and 3720

Does

• Prepare for lecture and lab; read ahead
• Ask questions at any time; lecture, recitation, office hours
• Use all of your resources; email, website, tutors
• If you struggled in General Chemistry, seek help soon

Don’ts

• Don’t get behind, blow off class, ignore the available help
• Don’t wait until October to say “dude, I thought I knew the stuff.”
• Don’t complain when you get 20/100 if you ignore the above

Get help: pnorris@ysu.edu

Peter Norris  B.Sc., Ph.D.

Born: 1965, Liverpool, England
B.Sc. Chemistry: 1986, Salford University, England
Ph.D. Organic Chemistry: 1992, The Ohio State University
Post-doctoral: 1993-96, American University, Wash’n DC
Assistant Professor: 1996-2000 YSU Chemistry
Associate Professor: 2000-2004 YSU Chemistry
Full Professor: 2004 – present YSU Chemistry

40 publications, graduated 23 Masters degree students since 1998
$1,000,000 in grant money since 1999
Research and Publication


"Cu(i)-Catalyzed formation of D-mannofuranosyl 1,4-disubstituted 1,2,3-triazole carbohybrids," P.L. Miner, T.R. Wagner, and P. Norris, Heterocycles 2006, 69, 1035-1049.

>40 total, most with YSU undergrad or MS students as coauthors
What is Organic Chemistry?

The study of the compounds that contain carbon and the reactions of those materials (millions known)

Why a whole year of Organic?

Carbon can bond in multiple ways to form a huge number of different molecules, and these compounds form the basis of many different disciplines, e.g.:

- **Biology** (DNA, proteins, carbohydrates)
- **Medicine and Pharmacy** (Aspirin, Taxol, AZT)
- **Chemical Engineering** (oil, plastics, fine chemicals)
- **Forensics** (Biological materials, chemical tests)

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From Organic Chemistry to Biology, Medicine, Pharmacy, etc.

From Scientific American – www.sciam.com
**Staphylococcus aureus – Norris/Fagan**

Gram-positive, cluster-forming coccus, causes food poisoning, endocarditis, osteomyelitis, septicemia, infections on implants

**Organic Chemistry – Materials and Uses**

Organic Chemistry

- New Materials
- New Compounds
- New Medicines

- Nanotech, Engineering
- Proteomics, Genetics
- Pharmacy, Medicine

**Chemistry 3719-3720**

~1800 – Organic Chemistry: the chemistry of natural products based on carbon

2006 – Organic Chemistry: "molecular engineering"
Timeline

1807  Berzelius introduces the term “Organic Chemistry” to describe the study of compounds isolated from nature

1828  Wöhler makes urea, the first natural organic compound to be synthesized in the laboratory

1890  Fischer studies the chemistry of proteins, carbohydrates and the nucleic acids - Biochemistry

1950  Woodward and Eschenmoser complete the first total synthesis of Vitamin B12. NMR begins to be useful.

1990  Kishi, Nicolau, Smith, Schreiber, etc. complete total syntheses of compounds such as Brevetoxin B, Taxol, etc.

2000  Chemical Biology, Molecular Engineering

Teaching Philosophy: Organic Chemistry as a Language

Natural Products Chemistry

Ley, Velch, Beckmann, Burke, Boyer and Maslen. ACIEE, August 2007
Carey Chapter 1 - Chemical Bonding
“Structure determines properties”

- Atomic and electronic structure of atoms
- Ionic and covalent bonding
- Electronegativity and polar covalent bonds
- Structures of organic compounds - representations
- Resonance within molecules
- Shapes of molecules
- Molecular orbitals and orbital hybridization

Periodic Table of the Elements

1.1 Atoms, electrons, and orbitals

Probability distribution for an electron

Figure 1.1
Boundary surfaces of a 1s and 2s orbital
Figure 1.2

Boundary surfaces of the 2p orbitals
Figure 1.3

Electronic Configurations of Atoms
### Electronic Structure of Atoms

<table>
<thead>
<tr>
<th>Atom</th>
<th>Atomic No.</th>
<th>Electronic Structure</th>
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<tbody>
<tr>
<td>H</td>
<td>1</td>
<td>1s(^1)</td>
</tr>
<tr>
<td>He</td>
<td>2</td>
<td>1s(^2)</td>
</tr>
<tr>
<td>Li</td>
<td>3</td>
<td>1s(^2) 2s(^1)</td>
</tr>
<tr>
<td>Be</td>
<td>4</td>
<td>1s(^2) 2s(^2)</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>1s(^2) 2s(^2) 2px(^1)</td>
</tr>
<tr>
<td>C</td>
<td>6</td>
<td>1s(^2) 2s(^2) 2px(^1) 2py(^1)</td>
</tr>
<tr>
<td>N</td>
<td>7</td>
<td>1s(^2) 2s(^2) 2px(^1) 2py(^1) 2pz(^1)</td>
</tr>
<tr>
<td>O</td>
<td>8</td>
<td>1s(^2) 2s(^2) 2px(^2) 2py(^1) 2pz(^1)</td>
</tr>
</tbody>
</table>

### 1.1 General Concepts

- Orbitals higher in energy further they are from nucleus.
- Designated by principal quantum number (1, 2, 3, etc.).
- Degenerate orbitals (same energy) fill up singly before they double up (Aufbau).
- Maximum of two electrons per orbital, each having opposite spin (Pauli exclusion principle).
- Impossible to know both the speed and location of an electron at the same time (Heisenberg uncertainty).