# *CH203 Lecture 1*

# *September 2, 2010*

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***Department of Chemistry***

***porco@bu.edu***

# *CH203 AA Logistics*

- ***Instructor:*** *Professor John A. Porco, Jr.*
- ***Discussion Leaders: Neil Lajkiewicz and John Nguyen***
- ***Office:*** *Life Sciences and Engineering Building (LSEB) 802*
- ***Office telephone****: 353-2493*
- ***E-mail****: porco@bu.edu*
- ***Class Location and Meeting Times:*** *Tuesday-Thursday 8:00-9:20 am, STO B50.*
- ***Office hours****: Mondays 1-2 PM and Wednesdays 4-5 pm in LSEB 802 or by appointment. Please come at the beginning of the office hour. I will also hang around the class for a few minutes afterwards to answer questions.*

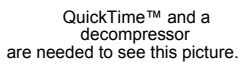
## *Lecture Textbooks and Other Course Material*

- *Organic Chemistry 7th Edition by John McMurry (Brooks/Cole)*
- *Study Guide and Solutions Manual (Sixth Edition) by Susan McMurry.*
- *"Pushing Electrons: A guide for students of organic chemistry (Weeks) is very helpful but not required*
- *Molecular Models are also extremely useful and a variety of types are available in the bookstore. Many sets are likely also available from former organic chemistry students.*

# *CH203 Objectives*

- *Develop an appreciation of organic structure and organic substances*
- *Use a functional group approach to organic chemistry, chemical reactions, and synthetic transformations*
- *Come to an understanding of how chemical reactions occur and how reaction mechanisms may be deduced*
- *Achieve Personal Goals*
- *Have Fun with it !*

# *CH203 Course Website*




http://people.bu.edu/porcogrp/CH203/CH203.htm

# *CH203 A1 Discussion Sections*

Discussions will begin the week of September 8th and will be led by Neil Lajkiewicz and John Nguyen:

| | | | | |
|---|---|---|---|---|
| **A0** | **SCI** | **111** | **Mon** | **12:00 - 1:00 pm** |
| **A2** | **PRB** | **146** | **Mon** | **2:00- 3:00 pm** |
| **A3** | **SCI** | **111** | **Mon** | **3:00- 4:00 pm** |
| **A4** | **CAS** | **312** | **Tue** | **9:30- 10:30 am** |
| **A5** | **SCI** | **111** | **Tue** | **5:00- 6:00 pm** |
| **A6** | **STH** | **625** | **Wed** | **2:00- 3:00 pm** |
| **A8** | **SCI** | **113** | **Wed** | **4:00- 5:00 pm** |

# *CH203 AA Course Grading*

| Total Points | % | Letter Grade |
|---|---|---|
| >368 | >92 | A |
| 352<368 | 88-92 | A- |
| 340<352 | 85-88 | B+ |
| 324<340 | 81-85 | B |
| 312<324 | 78-81 | B- |
| 288<312 | 72-78 | C+ |
| 256<288 | 64-72 | C |
| 232<256 | 58-64 | C- |
| 200<232 | 50-58 | D |
| <200 | <50 | F |

**The final grades will be based on 400 points (300 points for examinations and 100 points for the laboratory)**

# *CH203 AA Exams*

There will be three (3) 'in-class' examinations during the semester (1.5 h) and a final examination (2 h).
There are no "make-up" exams
If the median grade of an examination is less than **75%**, the median grade will be raised to a **75%** by adding a constant amount (**not more than 20%, however**) to the grade of each student. If the median grade is greater than 75%, the grades *will not be changed*.
You may drop one of the "in class" examinations for any reason, but *not the final examination*.
Each examination is worth 100 pts.

*Dates of Examinations*:
**October 7 (Thurs.), November 4 (Thurs.), and December 2 (Thurs.)**
**Locations: STO B50 and TBD).**
**Final Exam: December 16, 2010 12:30 - 2:30 p.m**
**(http://www.bu.edu/reg/dates/examdates-fall10.html)**

http://www.bu.edu/cas/undergraduate/conductcode.html

# *Other Helpful Hints:*

1) Attend the Lecture !

2) Keep up with the material

3) Review and rewrite your lecture notes after every lecture

4) Prepare notecards for key concepts and reactions/mechanisms

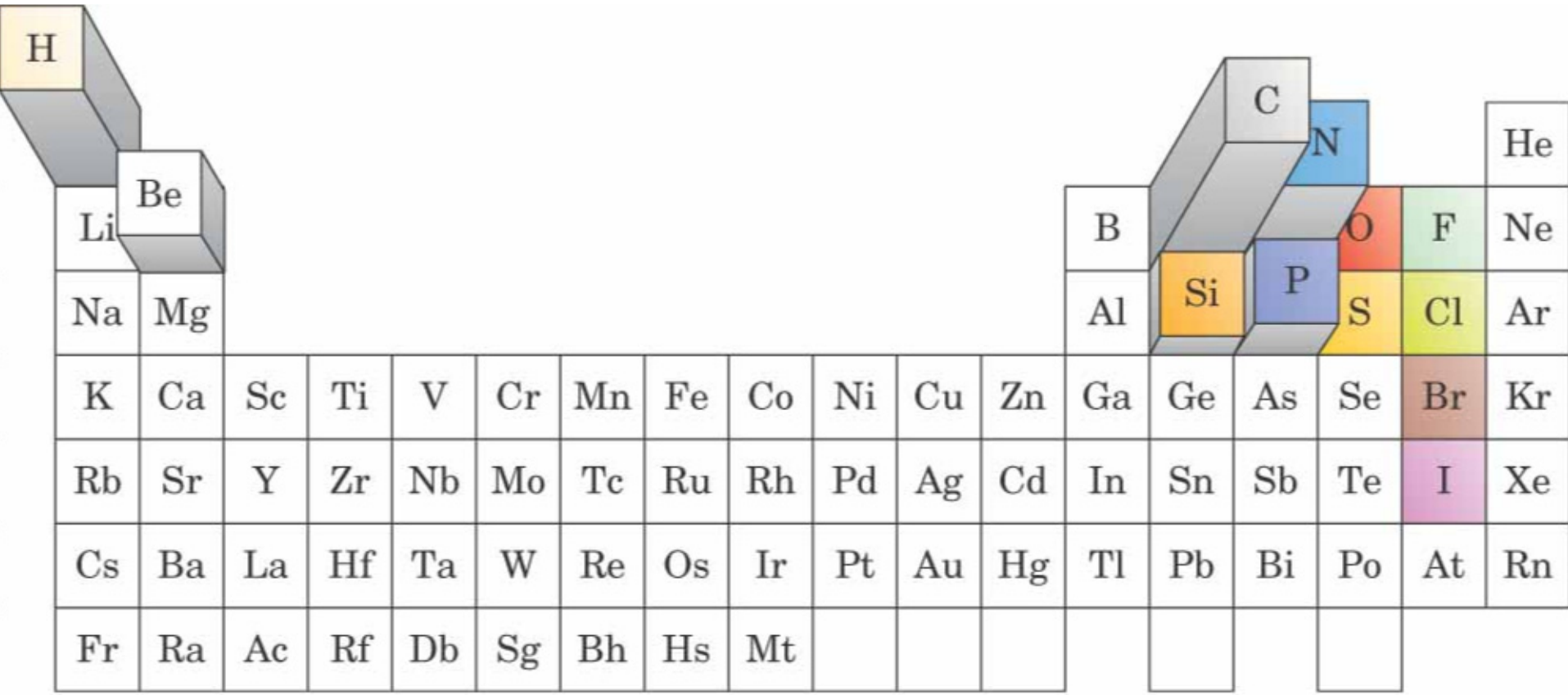
5) Form study groups (maximum of four students)

6) Find problems at the end of the chapter that correspond to the lecture material

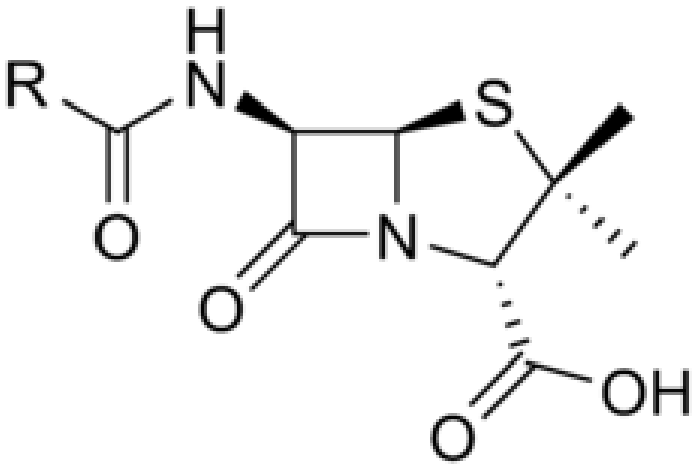
7) Don't cram for exams

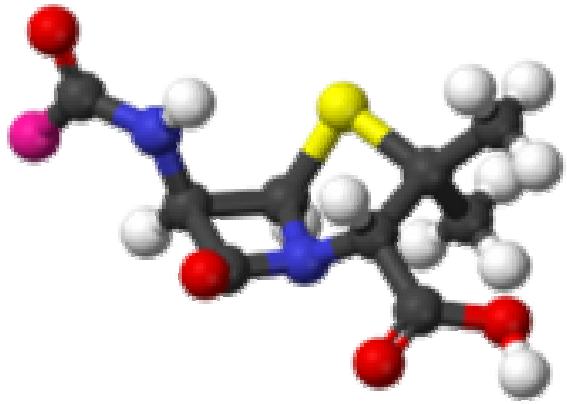
*Tentative Schedule of Topics from McMurry (7th Edition)*

**Chapter 1: Structure and Bonding**
**Chapter 2: Polar Covalent Bonds; Acids and Bases**
**Chapter 3: Organic Compounds: Alkanes and Their Stereochemistry**
**Chapter 4: Organic Compounds: Cycloalkanes and Their Steroechem**
**Chapter 5: An Overview of Organic Reactions**
**Chapter 6: Alkenes: Structure and Reactivity**
**Chapter 7: Alkenes: Reactions and Synthesis**
**Chapter 8: Alkynes : An Introduction to Organic Synthesis**
**Chapter 9: Stereochemistry**
**Chapter 10: Organohalides**
**Chapter 11: Reactions of Alkyl Halides: Nucleophilic Substitutions and Eliminations**
**Chapter 13: Structure Determination: Nuclear Magnetic Resonance Spectroscopy**
***Assigned problems for each chapter will be provided in lecture***

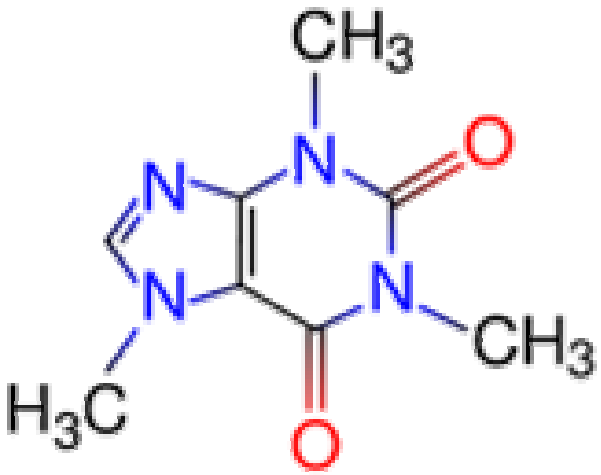


# *Examples of Organic Molecules as Drugs*



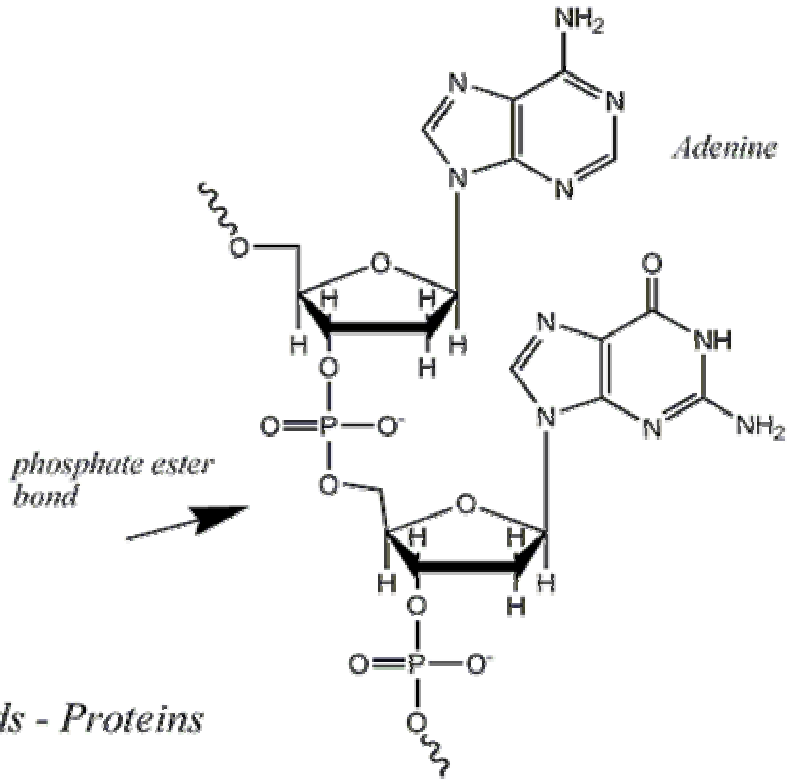
***Penicillin (antibiotic)***



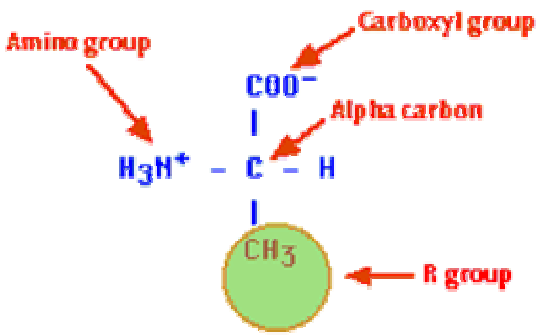

***caffeine (stimulant)***

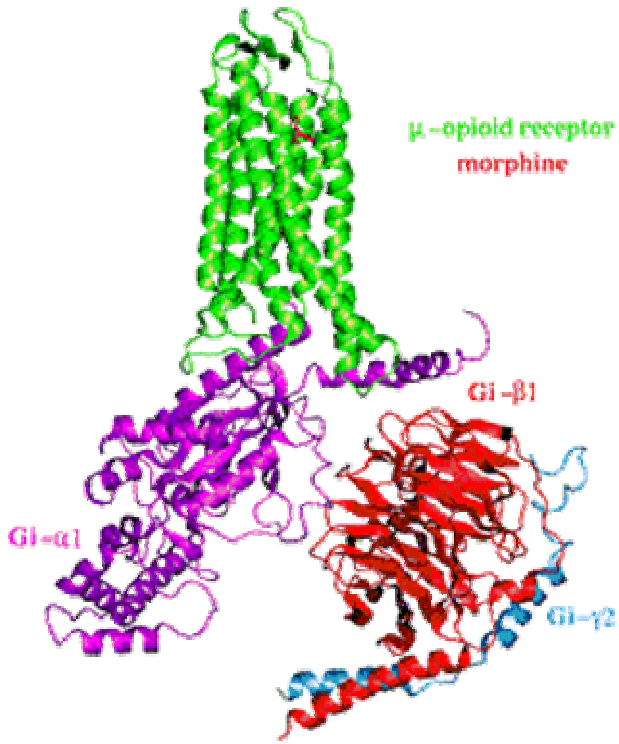
# *Carbon Compounds are Central to Life As We Know It*

*1) DNA*




*2) Amino Acids - Proteins*



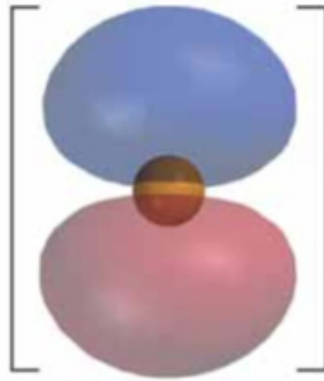



# *Representations of Orbitals*

An *s* orbital

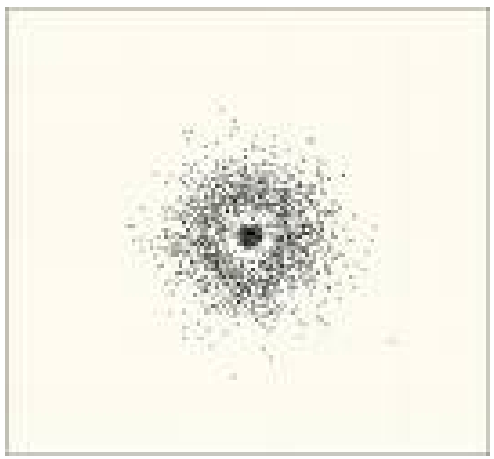
A *p* orbital

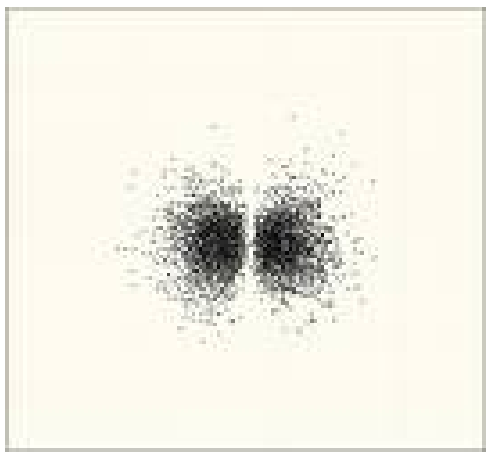
A *d* orbital



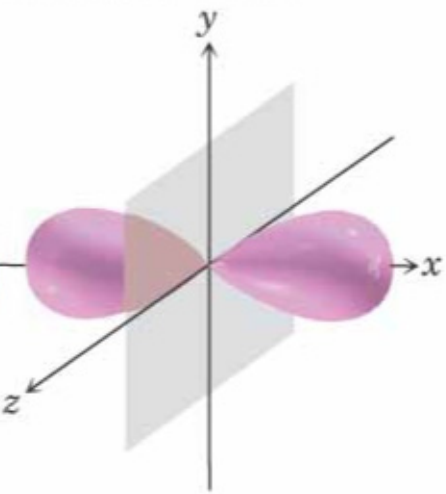
A 2*p* orbital



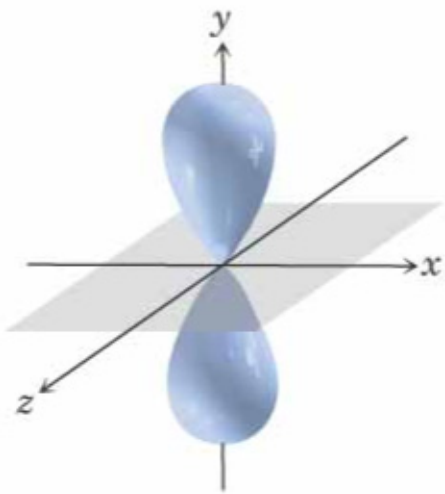




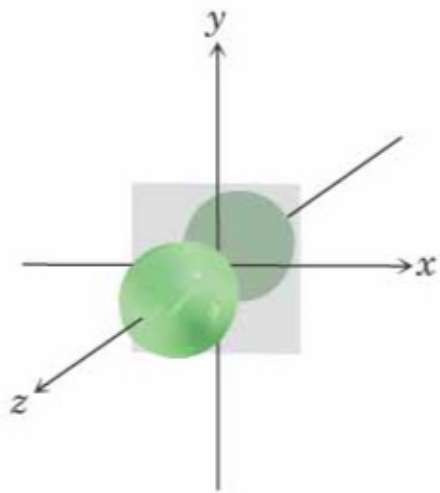
**Electron cloud plots**




A $2p_x$ orbital

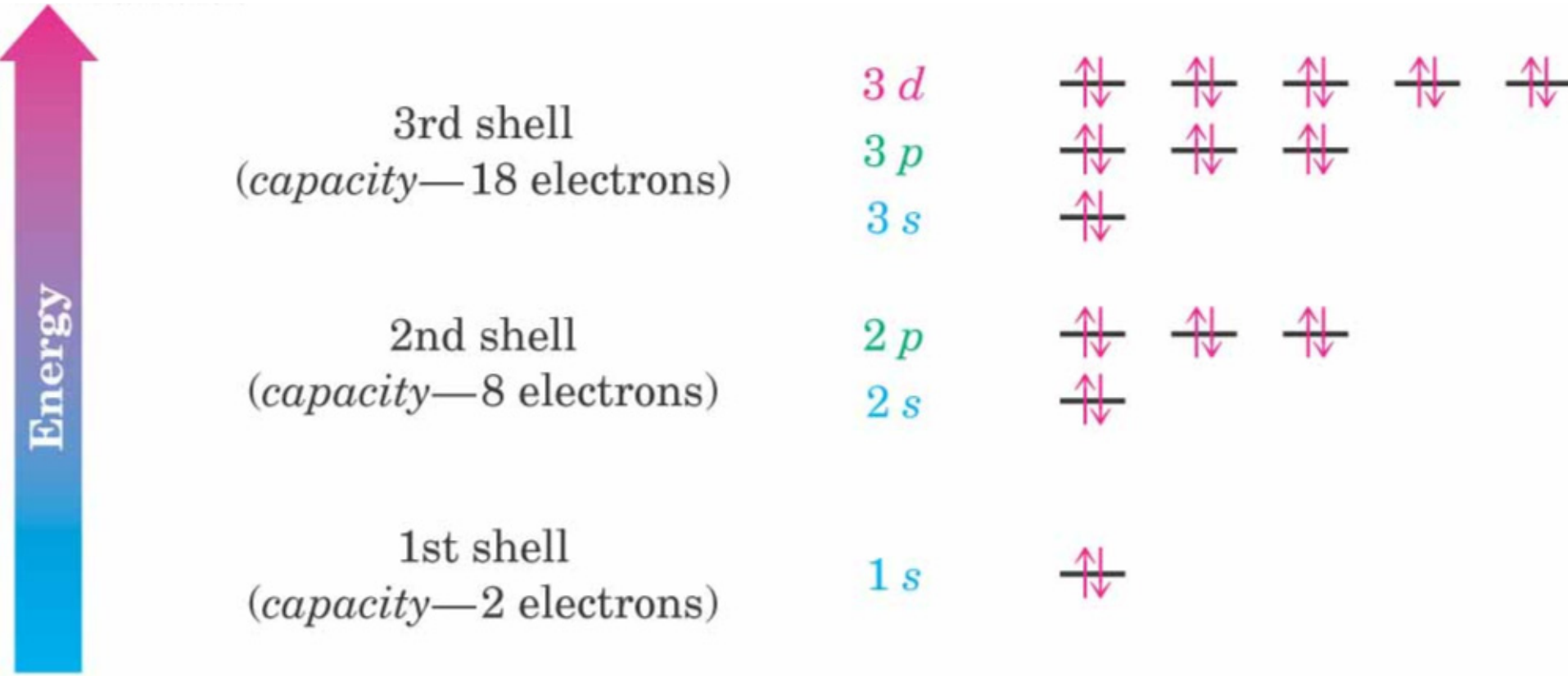



A $2p_y$ orbital




A $2p_z$ orbital

Three $2p$ orbitals



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Chapter 1
Structure and Bonding

Lecture 1 Notes

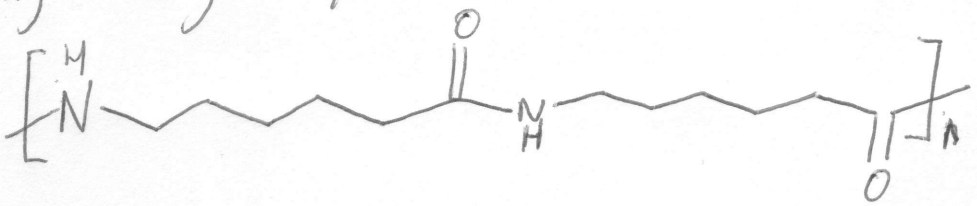
Organic Chemistry: Chemistry of compounds of Carbon (C)

1) C atomic # 6, second row
group 4A element

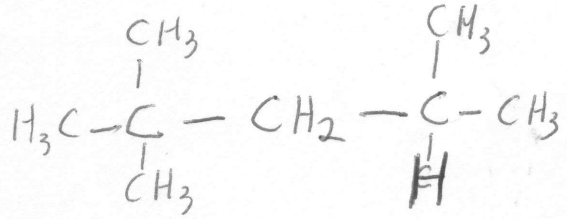
2) can share 4 valence e⁻s as we will see

We live in an age of Organic Chemistry

- Clothing e.g. nylon



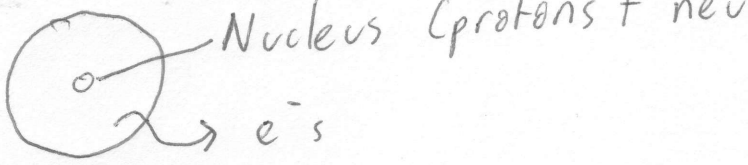
- gasoline 5 - 12 C atoms



2,2,4-trimethylpentane
(a.k.a. isooctane)

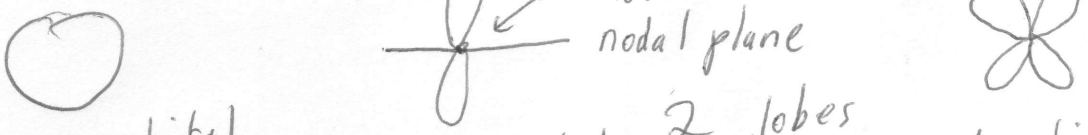
# Structure & Bonding

## 1. Atomic Orbitals




Orbital: a region of space where the probability of finding an $e^-$ is large ($e^-$ spends 90-95% its time)

- s and p orbitals most important in the formation of organic molecules



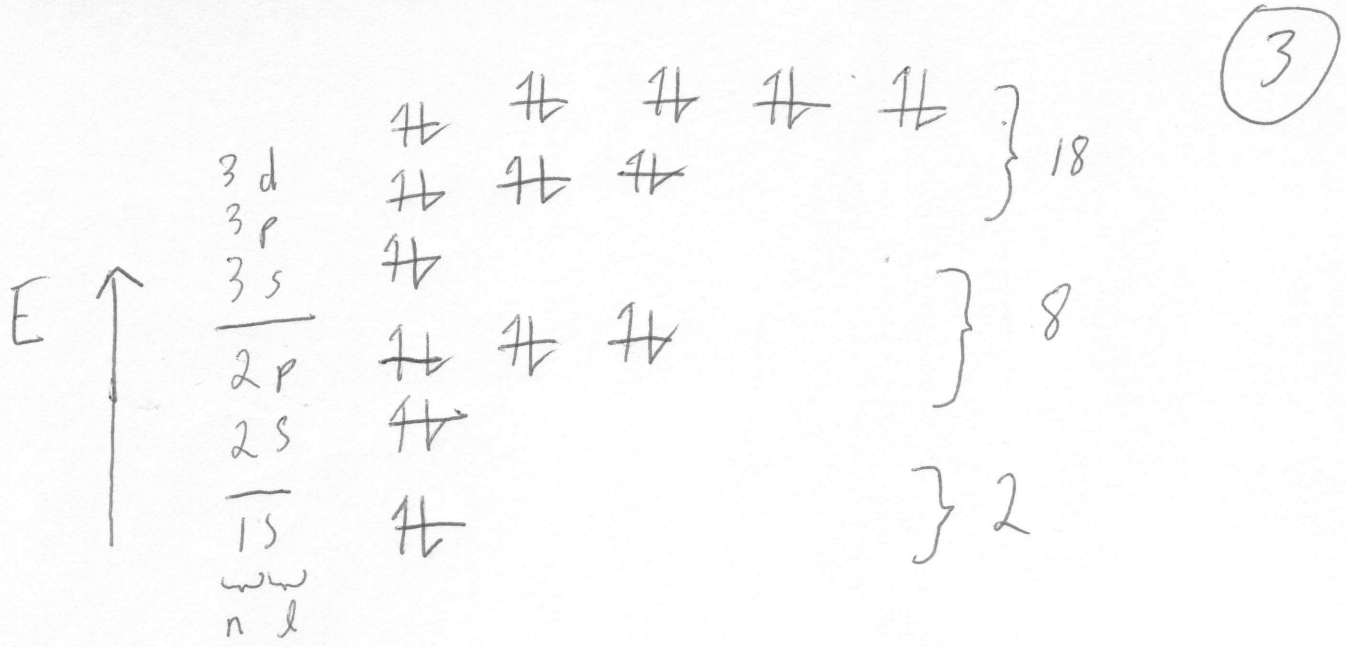

s orbital (spherical)

p orbital (lobe or dumbell) $p_x, p_y, p_z$

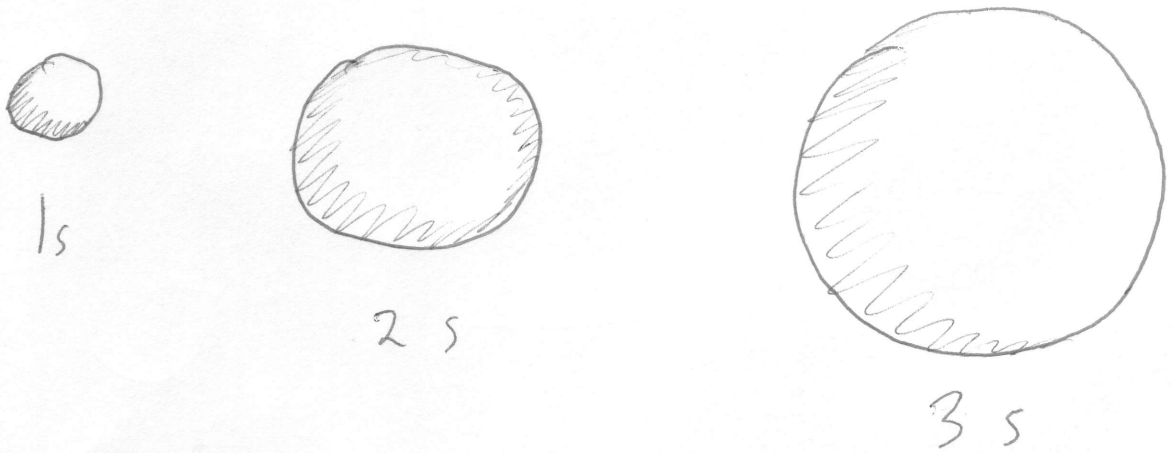
d orbital clover leaf

larger n, bigger size

- orbitals are organized into different layers or "shells"




electron shells:
- different energies
- successively larger size

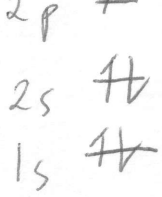


p orbitals

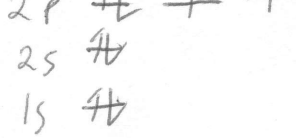
- oriented in space along mutually perpendicular directions
- $p_x, p_y, p_z$
- dumbell shaped
- two lobes separated by node (zero $e^-$ density)

Ex of $e^-$ configurations of some elements

1) Carbon (atomic # 6)




2) Oxygen (atomic # 8)



Follow these rules to arrive at the electronic configuration of any atom.

A. The Aufbau principle: orbitals are filled so that those of lower E are filled first:

$1s \rightarrow 2s \rightarrow 2p \rightarrow 3s \ldots$ etc.

(Aufbau ≡ german for "building up")

B. The Pauli Exclusion Principle: A max of $2e^-$s may be placed in each orbital and each must be of opposite spin ($\uparrow + \downarrow$)

C. Hund's Rule: When we come to orbitals of equal energy (≡ degenerate) e.g. p orbitals, add one $e^-$ with their spins unpaired until all orbitals are half full

Chapter 1 Problems

4, 10-13, 23, 25, 26, 28-31, 33, 35,
46-50, 56