CHEM 343 – Organic Chemistry I

- Dr. Ive Hermans – CHEM 343/345 instructor and Professor of Chemistry
- Dr. Brian Esselman – CHEM 343/344/345 instructor and Associate Organic Laboratory Director
- Dr. Kimberly DeGlopper – CHEM 343/345 instructor
- Dr. Mary Beth Anzovino – CHEM 343/344/345 instructor and Associate Organic Laboratory Director
- Teaching Assistants
  - John Mannone
  - Lizzy Sielaff
  - Jacob Kailing
  - Liza Ryutov
  - Rashi Bhatnagar
  - Pete Verardi
  - Niall Ellias
  - Julia Fraser
  - Sara Simonson

Lecture 1 9:55 AM

Lecture 6 12:05 PM

Lecture 5 1:20 PM

Lecture 3 2:25 PM

*All in S413 Chem

Useful resources

- Undergraduate Chemistry Office (undergrad@chem.wisc.edu)
  - Handles all registration-related issues for organic chemistry
  - Be sure to include in your email
    - Your ID number
    - Which section you are currently enrolled in
    - Which section you want to switch into
- Canvas course page – Lots of information
  - Office hours
  - Link to piazza for Q&A
    - Please check to see if your question has already been asked

Chem 343

- Fast paced
  - New concepts build on what you've learned previously
  - Keep a **consistent** pace in learning
- You need to learn the material in depth
  - Discussions
  - Textbook
  - Problem sets
- Do NOT rely on memorization
- Work together
- Course is out of 575 pts
  - 3 quizzes (25 pts each), 3 exams (100 pts each), 1 final exam (200 pts)

Chapter 1 – chemical bonding and chemical structure

- Learning Goals
  - Lewis structures
    - How to draw
    - Help you understand and keep track of molecular changes
    - Resonance structures
  - Chemical bonds
    - Have a better understanding of electrons and chemical bonds
    - Know the different types of bonds in an organic molecule
- Extra reading material on Canvas
  - Modules → Supplemental Materials & Handouts → "Chem 343 – Structure and Bonding"

Chemical Bonding (Ch 1.3)

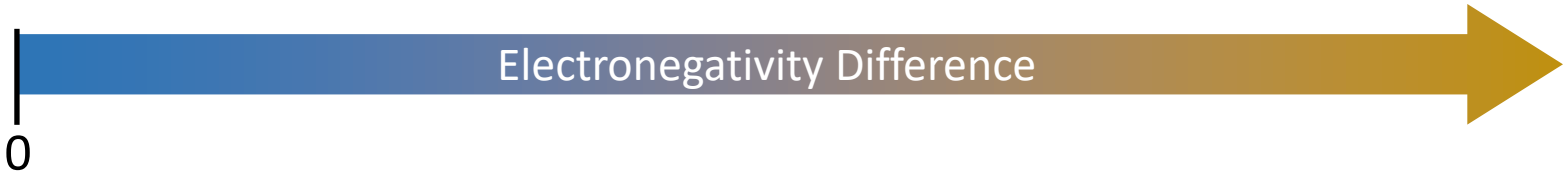


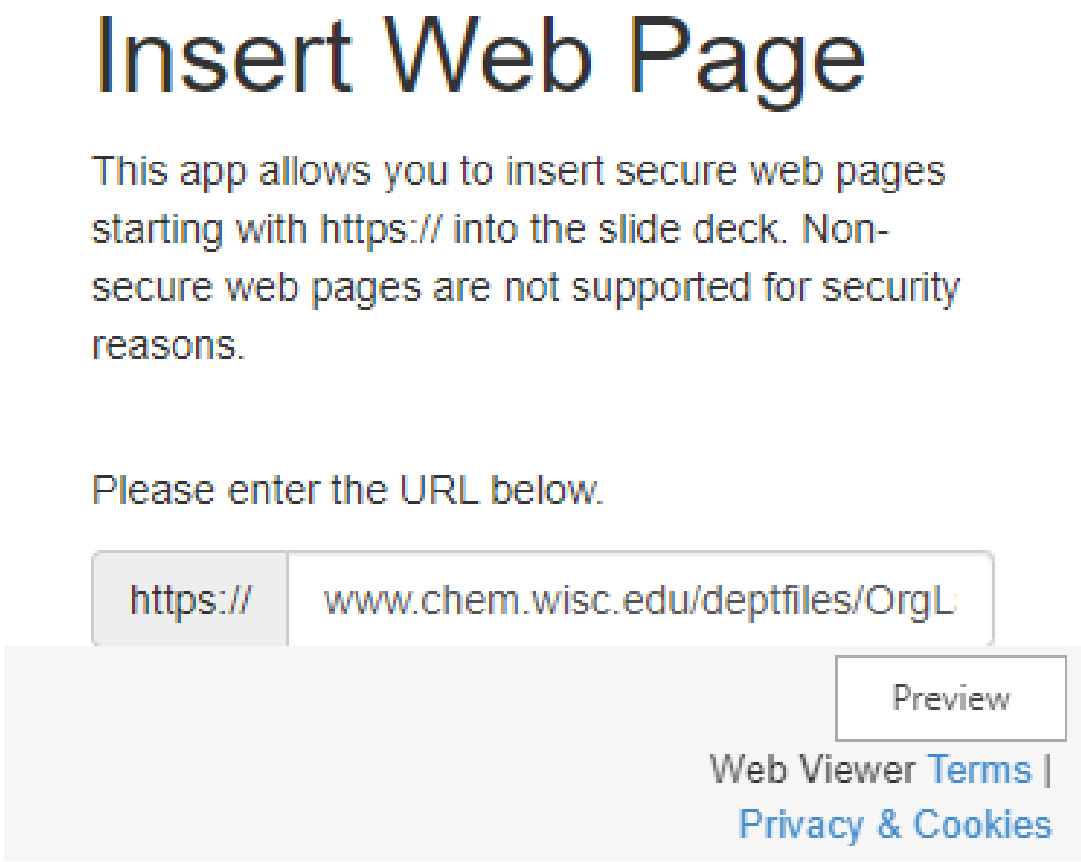
Table 1.1 – Pauling electronegativity values

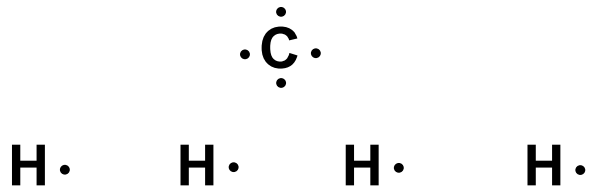
- Ionic Bonds
  - A BIG difference in EN between atoms leading to ionization
  - Dominated by electrostatic attraction
  - No Lewis structures to draw
  - Soluble in polar protic solvents (Ch 8)

- Covalent Bonds (polar and nonpolar)
  - Smaller or no EN difference between atoms
  - Formed by sharing electrons
  - Leads to molecular compounds
  - Well-represented by Lewis structures

How to draw good Lewis structures

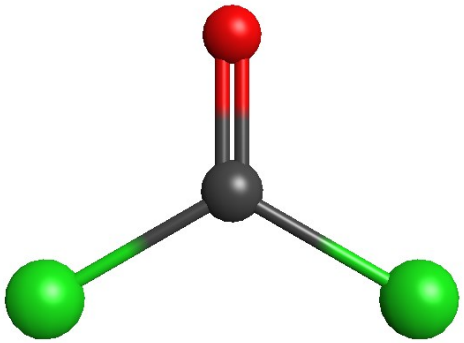
- Obey octet rule (mostly)
- Tend to reduce formal charges
- Match formal charge to EN (when there is a choice)



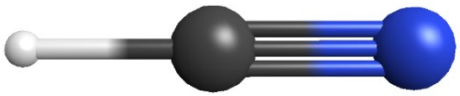


Methane
(CH_4)

phosgene ($COCl_2$)



hydrogen cyanide (HCN)



Formal charge (Ch 1.4)

* Bookkeeping tool
* NOT real charge

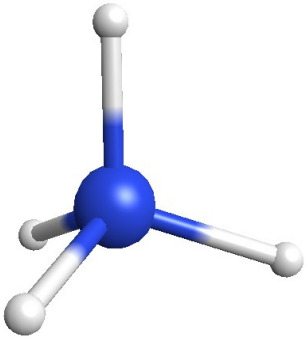
$$formal\ charge = \#\ valence\ e^- - \#\ nonbonded\ e^- - \#\ bonds$$

hydroxide (OH^-)

methyl cation (CH_3^+)

ethoxide ($CH_3CH_2O^-$)

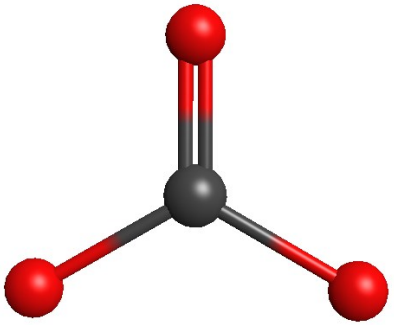
ammonium (NH_4^+)



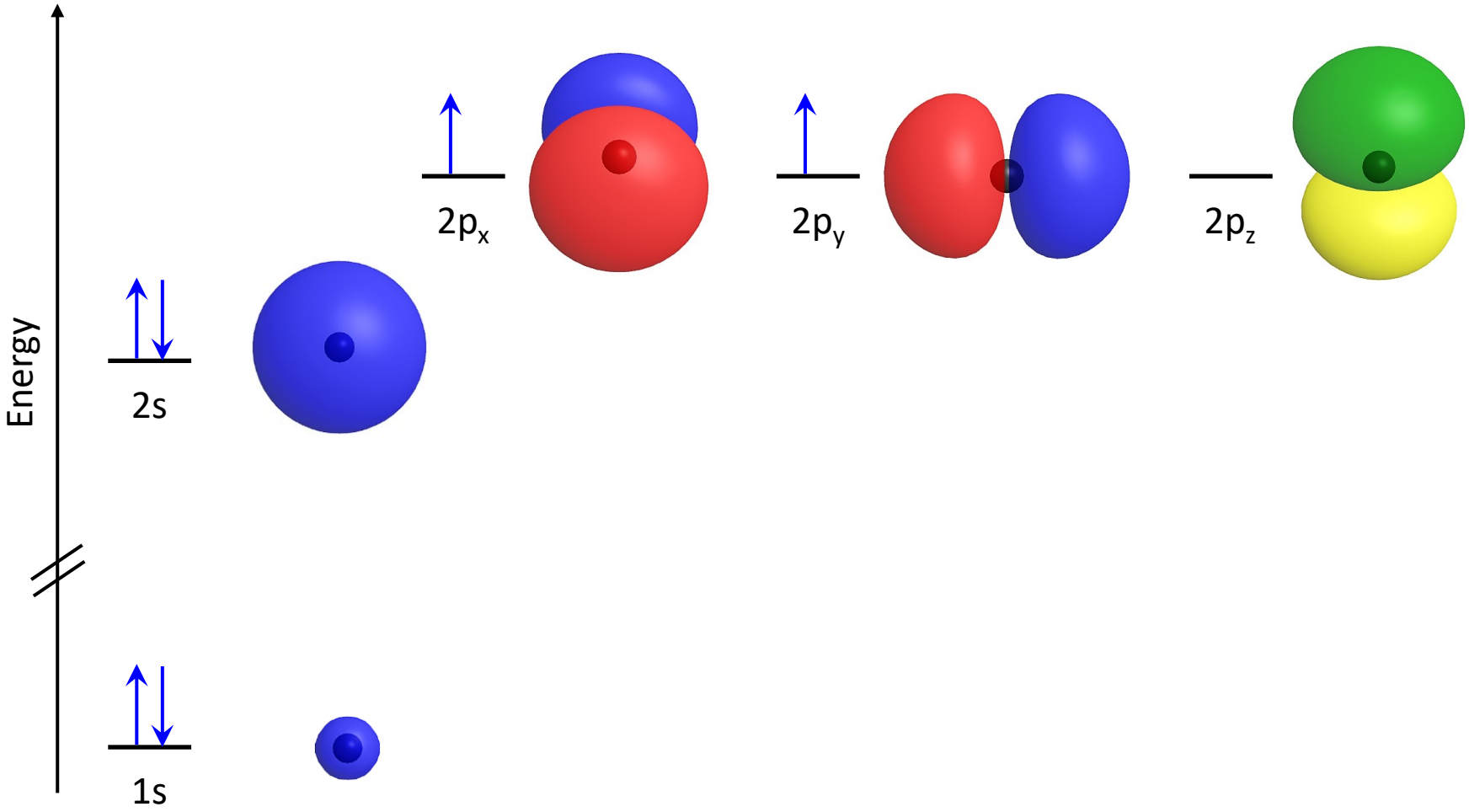
hydronium (H_3O^+)

carbon monoxide (CO)

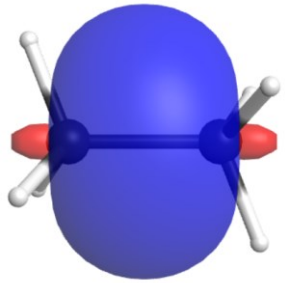
carbonate (CO_3^{2-})



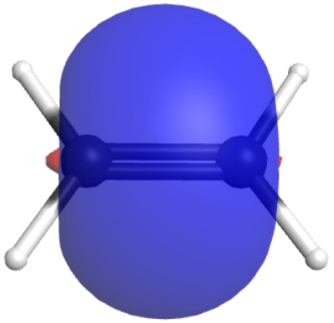
Electron configuration of carbon (ch 1.9)

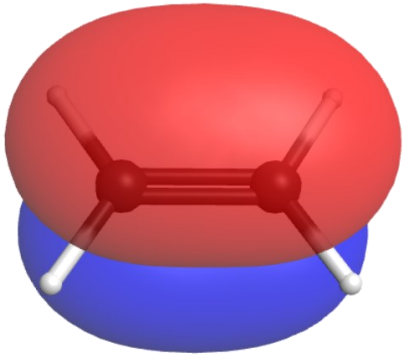


Ethane

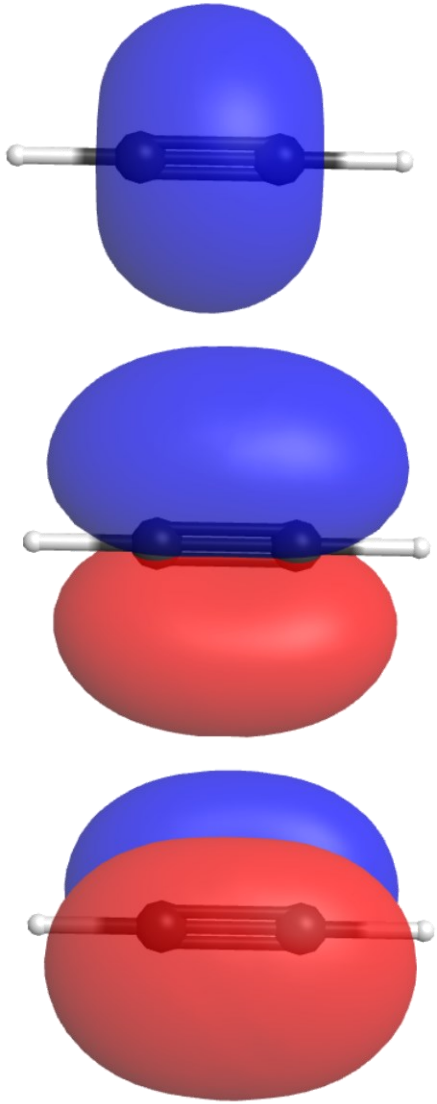


Ethylene



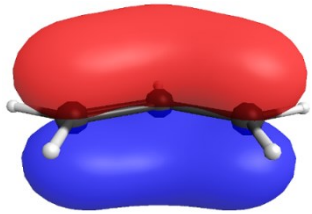


Acetylene

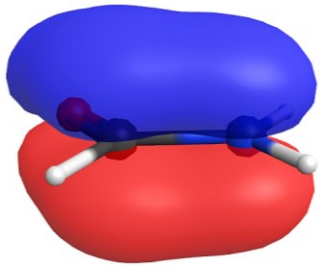


Resonance and conjugation (Ch 1.5)

Allyl cation



Formamide

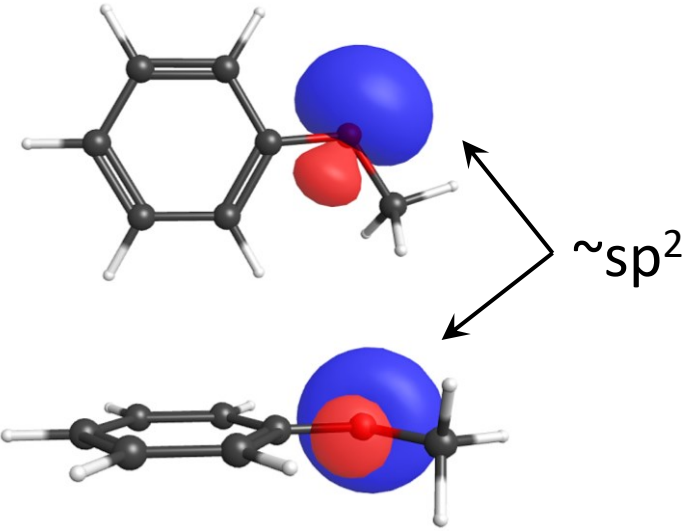


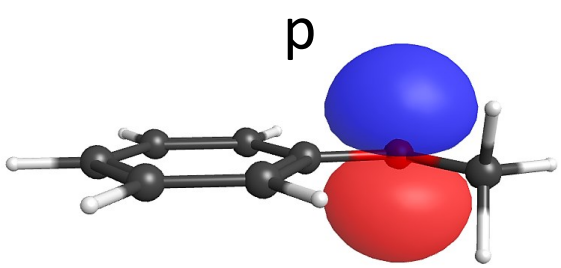
π conjugation

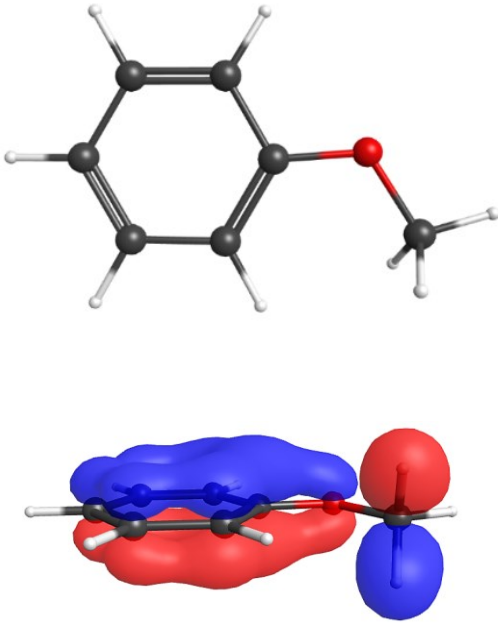
Acrolein (α,β-unsaturated carbonyl compound)

Anisole 

Anisole







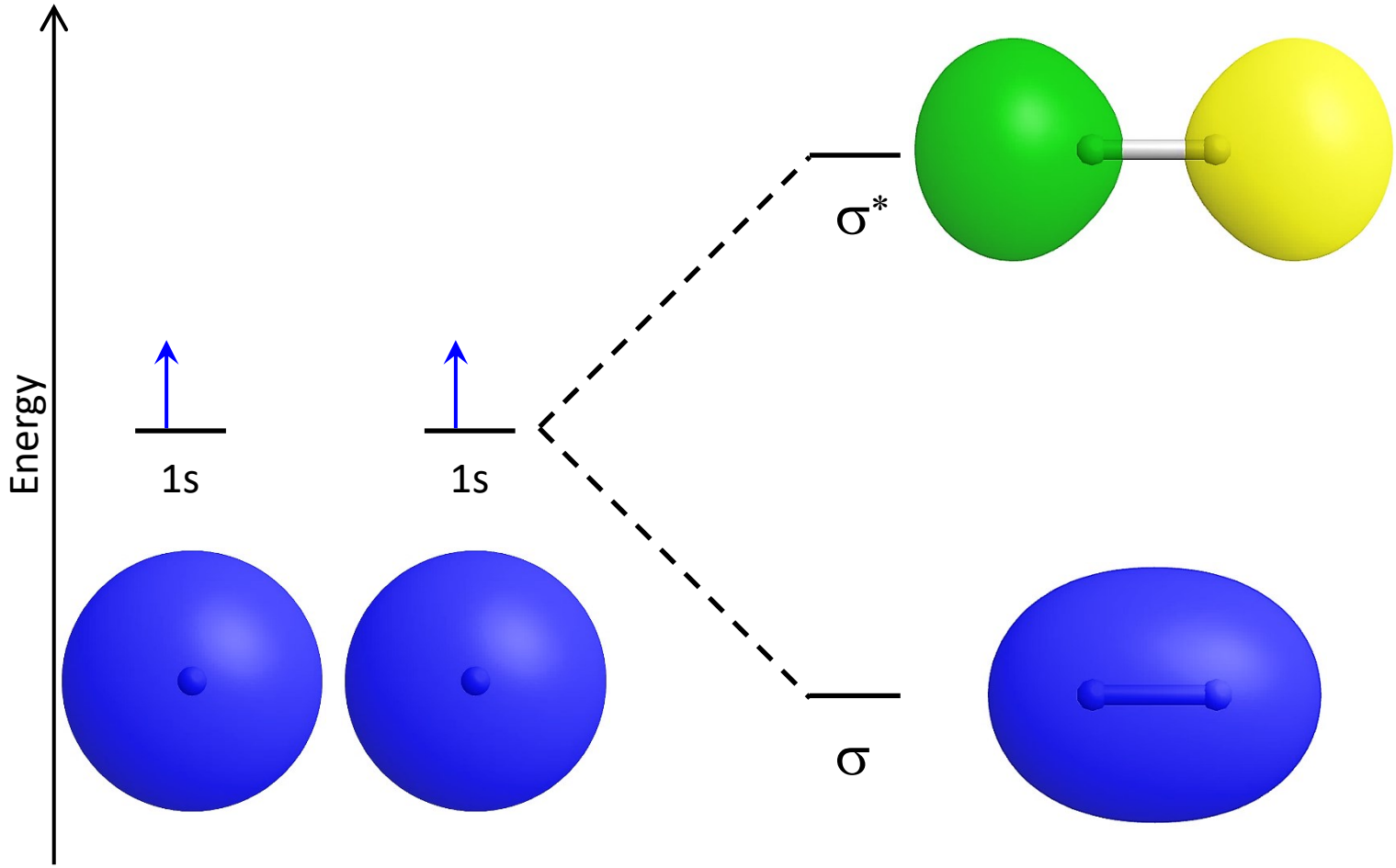
Resonance structures:

- Atoms do not move
- Hybridizations do not change
- Same number of electrons and atoms in all depictions

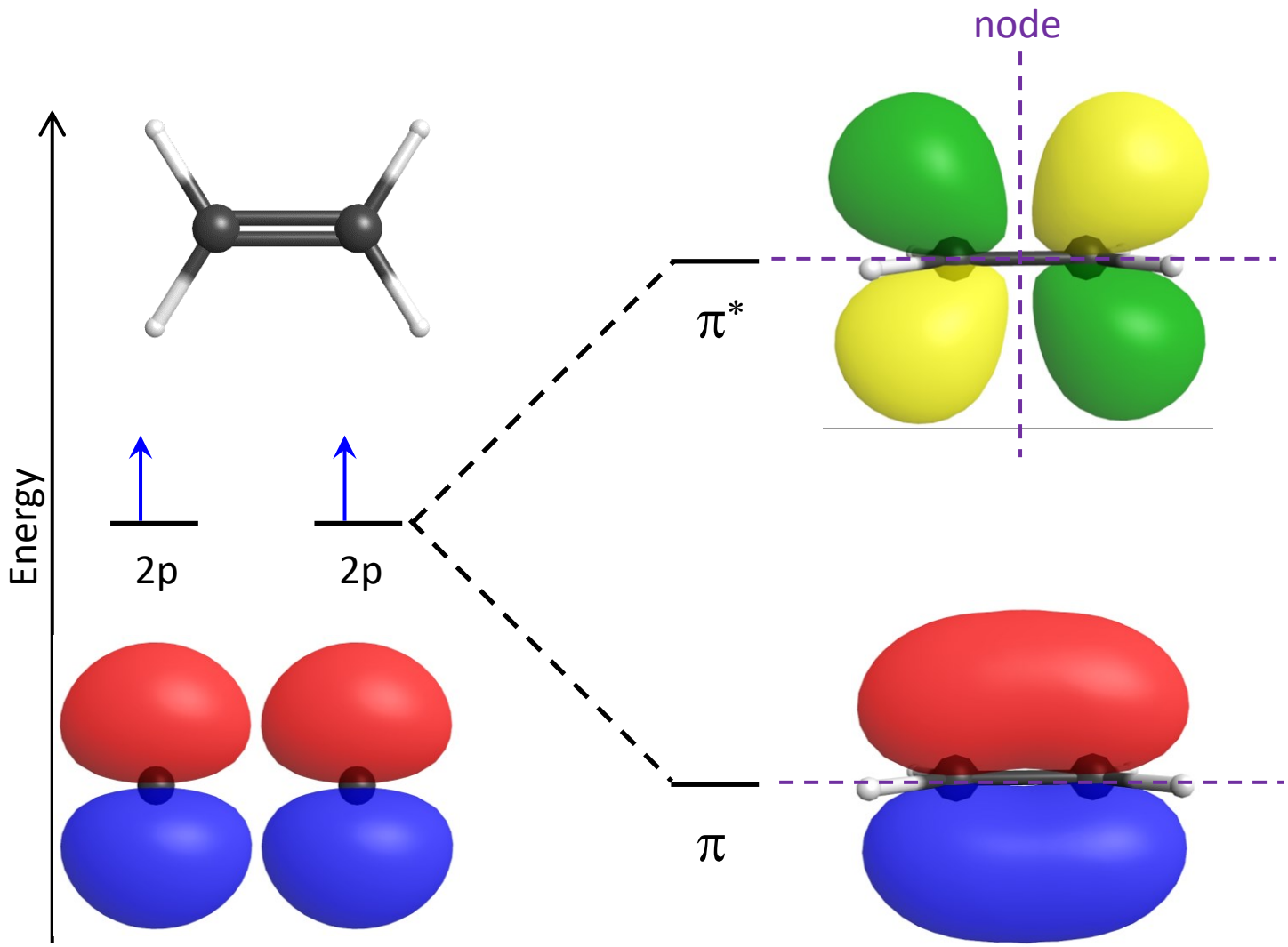
Molecular orbital theory (Ch 1.8)

- From atomic orbitals → generate molecular orbitals
  - Can have bonding, antibonding, or non-bonding molecular orbitals
- Application of quantum mechanics to calculate molecule properties
  - Ex: bond length, relative energies, real charge, etc.
- Easier to understand description of delocalized systems
  - Ex: π-conjugation

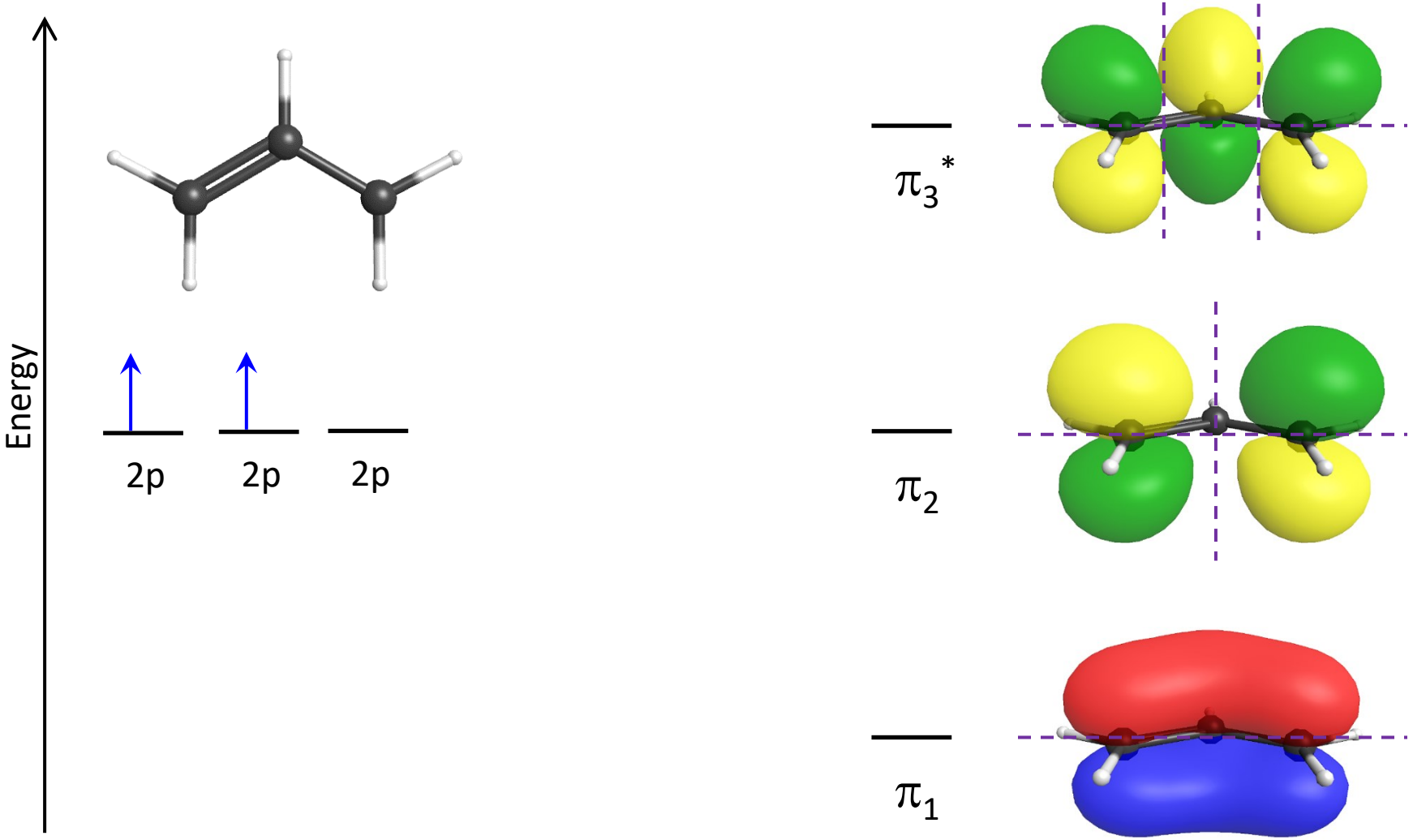
MO – σ-bond (H_2)



MO – π-bond (ethylene, C_2H_4)



MO – π-conjugation (allyl cation, $C_3H_5^+$)



Resonance structures and π-conjugation (Ch 1.5)