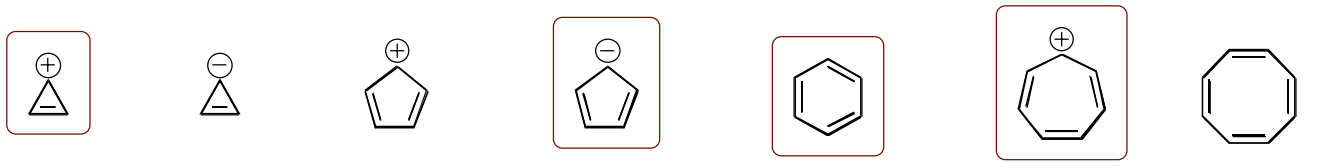
These notes can be obtained at: http://www.ndsu.nodak.edu/instruct/grcook/chem342/notes.shtml

Chapter 15: Benzene and Aromaticity

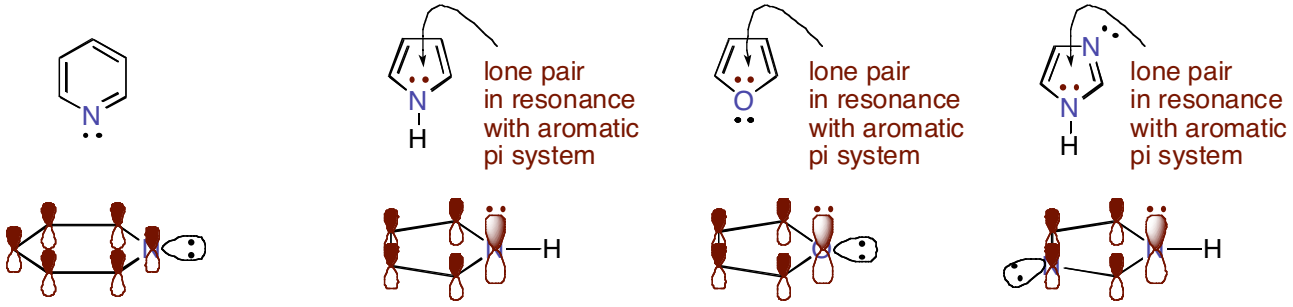
Aromatic Hydrocarbons

Below are some examples of fully conjugated systems which are aromatic or not aromatic. Note that carbocations or carbanions may be included in the conjugation. Thus, if the ring has the proper number of electrons, they can be aromatic.

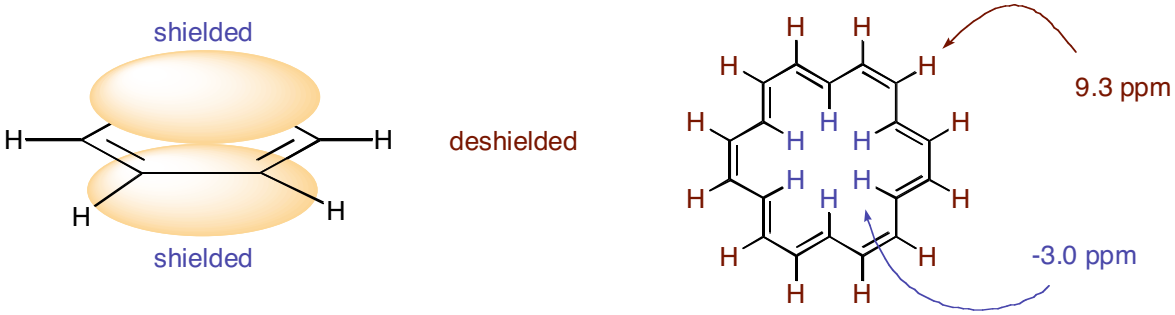


AROMATIC 2 pi electrons | 4 pi electrons | 4 pi electrons | **AROMATIC** 6 pi electrons | **AROMATIC** 6 pi electrons | **AROMATIC** 6 pi electrons | 8 pi electrons

Heteroatoms can also be in aromatic rings. The lone pair on an oxygen may be part of the aromatic pi-electron system. If the heteroatom is drawn with a double bond to it, it's lone pair is orthogonal to the pi-system and is not part of the resonance. If the heteroatom has only single bonds drawn to it, the lone pair is in a p-orbital and part of the aromatic pi-electron system.



The current of the pi-system electrons generates a magnetic field that affects the NMR of aromatic compounds. In the center, protons are shielded, while in the exterior they are deshielded.



Electrophilic Aromatic Substitution - A Stepwise Mechanism

Aromatic rings do not react with electrophiles like typical double bonds. Although the first step is very similar, the second step is very different. An electrophile will add to form an intermediate carbocation (of which you can draw a number of resonance structures). Instead of a nucleophile adding to the carbocation, the intermediate will deprotonate to regenerate the stable aromatic ring. This is a much lower energy pathway than the addition product.