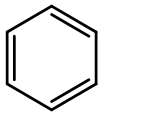
Hückel's Rule of Aromaticity

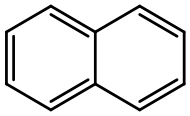
For a continuous, planar circle of *p* orbitals,

- Molecules with (4*n* + 2) electrons (where *n* is an integer) are stabilized, "aromatic".
- Molecules with (4*n*) electrons are destabilized, "anti-aromatic".

aromatic molecules

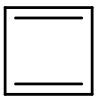


6 π electrons



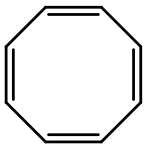
naphthalene
10 π electrons

anti-aromatic molecules



too reactive to isolate

4 π electrons

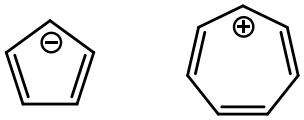


8 π electrons

puckers to avoid conjugation

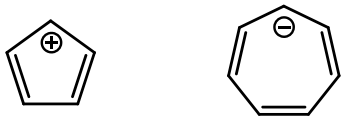
Aromatic and Anti-Aromatic Ions

aromatic (4n+2) ions

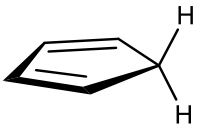


6 π electrons

anti-aromatic (4n) ions

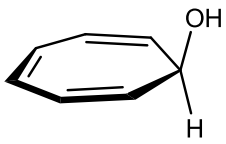


4 π electrons 8 π electrons



$pK_a \approx 16$

acidic for a hydrocarbon!



+ dilute HCl

unusually reactive for an alcohol!

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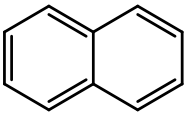
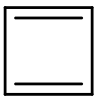
aromatic molecules

6 π electrons



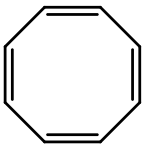
naphthalene
10 π electrons

anti-aromatic molecules



too reactive to isolate

4 π electrons



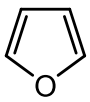
8 π electrons

puckers to avoid conjugation

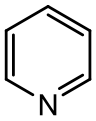
Aromatic Heterocycles

Heterocycle: A ring containing atoms other than carbon. ("Heteroatoms". Typically N, O, S, or P.)

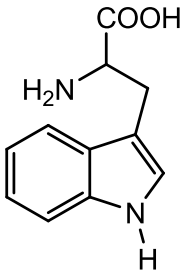
aromatic heterocycles



furan
6 π electrons



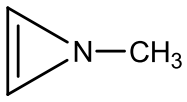
pyridine
6 π electrons



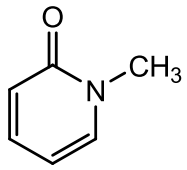
tryptophan
10 π electrons

Hybridization of heteroatoms is determined by aromaticity.

non-aromatic heterocycle



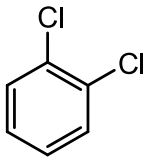
Aromaticity by Resonance



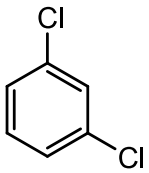
Is this molecule aromatic?

- Check to see if π orbital system is contiguous.
- Check resonance structures.
  If any of them have (4*n*+2) π electrons, the molecule is aromatic.

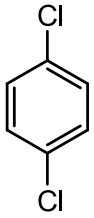
Naming Disubstituted Benzenes



1,2-dichlorobenzene
ortho-dichlorobenzene
o-dichlorobenzene



1,3-dichlorobenzene
meta-dichlorobenzene
m-dichlorobenzene



1,4-dichlorobenzene
para-dichlorobenzene
p-dichlorobenzene