ORGANIC CHEMISTRY 2 LECTURE GUIDE 2019

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Lesson IV.4. Aromaticity: A Highly Stabilizing Effect

Benzene is far more stable than an isolated alkene

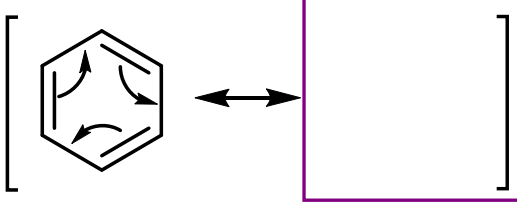
Description: C_6H_6; six sp^2 hybridized carbons in a planar hexagonal cycle

Observations: C-C-C angles: 120º

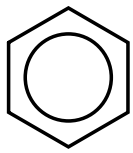
C-C bonds: 1.40 Å

Structure:

A



benzene resonance contributors *resonance hybrid*



another way to represent benzene

B Pi-electron system:

Notes

Lesson IV.4. Aromaticity: A Highly Stabilizing Effect

Criteria for Aromaticity

In order to exhibit aromaticity, a compound must:

1.

2.

3. Conform to **Hückel's Rule:**

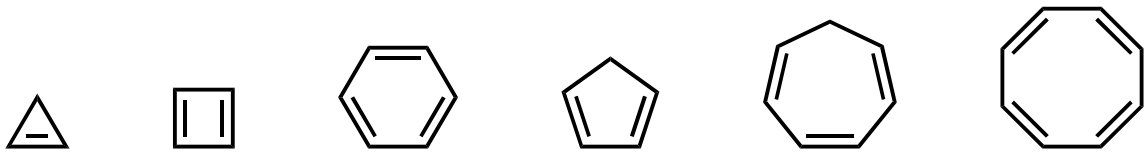
n = 0: 2 electrons
n = 1: 6 electrons (i.e., benzene)
n = 2: 10 electrons

a planar compound with an uninterrupted pi system having ***4n* electrons is said to be "antiaromatic"**

Notes

Lesson IV.4. Aromaticity: A Highly Stabilizing Effect
Aromaticity Practice

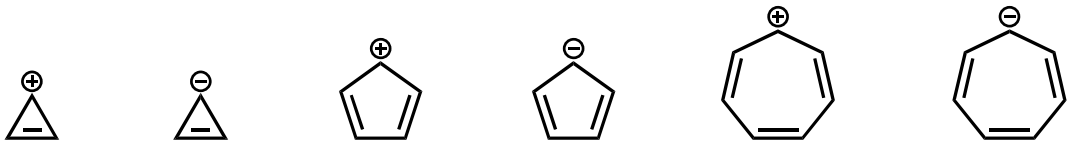
Examine some compounds to assess whether they are aromatic:



Notes

Lesson IV.4. Aromaticity: A Highly Stabilizing Effect
Aromaticity Practice

Consider these charged species. Assuming all are planar and have an uninterrupted pi cloud (sp^2-hybridized atoms), check for Hückel's rule condition:



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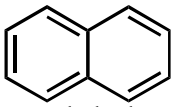
Lesson IV.4. Aromaticity: A Highly Stabilizing Effect

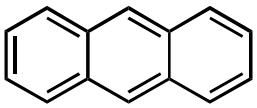
Polycyclic Aromatics

What if you have a polycyclic system?

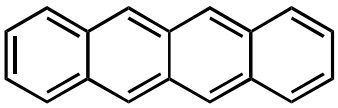
A



Naphthalene



Anthracene



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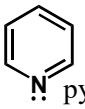
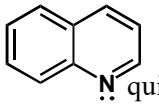
Heteroatom-Containing Aromatics

What if a ring has heteroatoms (any non-carbon atom) in it?

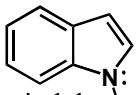
A



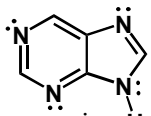
pyridine



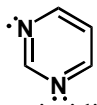
quinoline



indole



purine



pyrimidine

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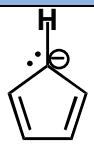
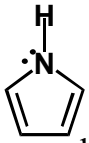
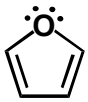
Heteroatom-Containing Aromatics



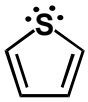
cyclopentadienyl anion



pyrrole



furan



thiophene

******Molecules tend towards the most stable (lowest energy) state***

Notes