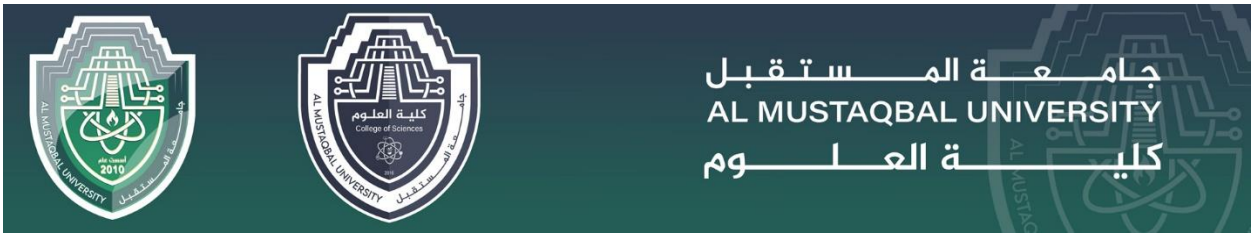

Organic Chemistry

2nd stage

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Lecture 1: Aromatic compound

Department of Bio chemistry

2024-2025

List of Contents

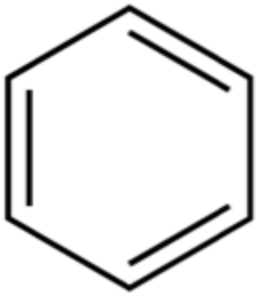
1.1 Aromatic compound

Aromatic compounds are unusually stable and have important chemical and synthetic uses. But, what makes a compound aromatic? A short list of rules, discovered by Eric Huckel in the 1930's, lists the properties of aromatic compounds.

The Huckel aromaticity rules are:

1. Molecule is cyclic
2. Have one p orbial per atom of the ring (conjugated)
3. Be planar, in an sp2 hybridized orbital, over every atom of the ring
4. Have a closed loop of 4n+2 pi-bond electrons, where n is equal to any integer (0,1,2,3,…)

Benzene



Since benzene has 6 pi electrons:

$4n + 2 = 6$

Find n:

$4n + 2 = 6$

$4n = 6-2$

$4n = 4$

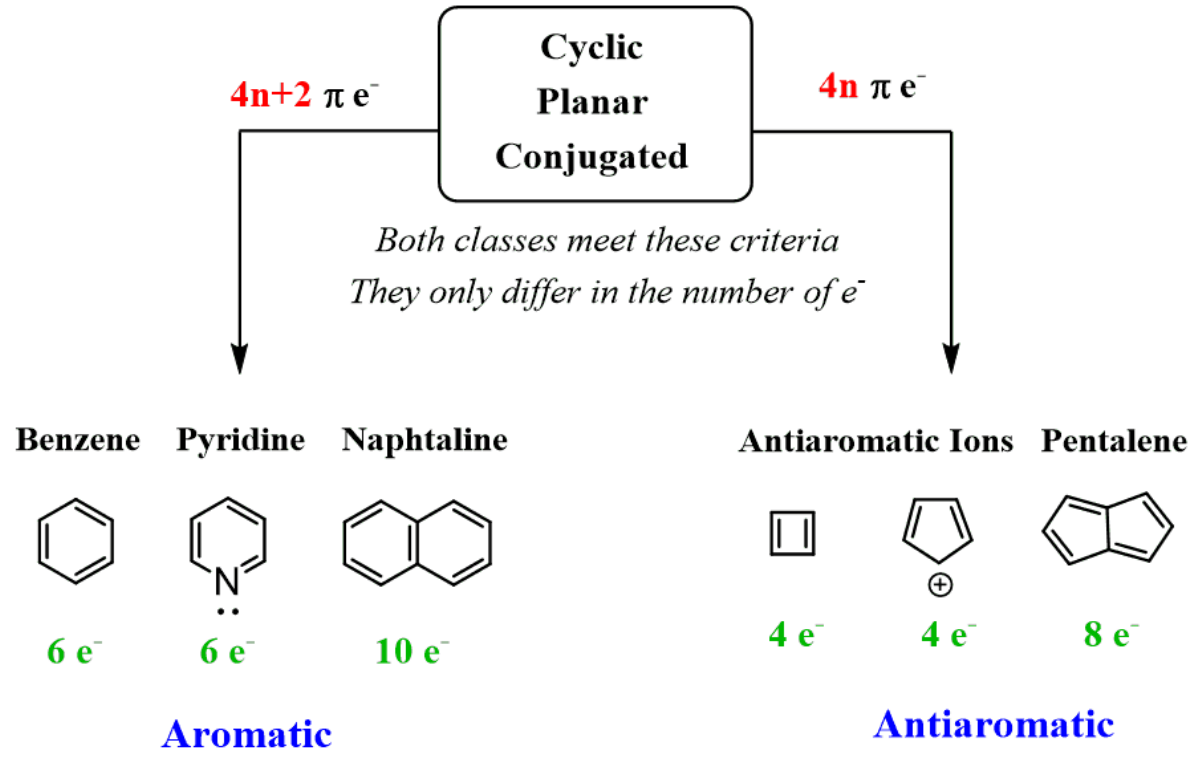
$n = 1$

An aromatic compound follows Huckel's rule if n is equal to zero or a positive whole number.

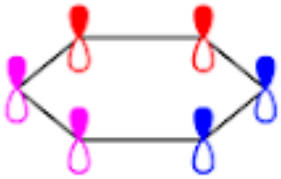
Benzene is aromatic

1.2 Classification of aromatic compound

Classification of Aromatic and Antiaromatic Compounds

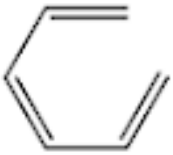


benzene

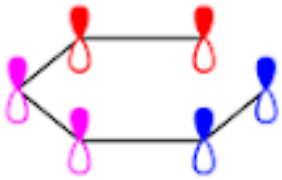


1. Cyclic
2. *p*-orbital for each member of the ring
3. Planar ring (sp^2 hybridized)
4. **4n+2 π–bond electron count.**

Aromatic



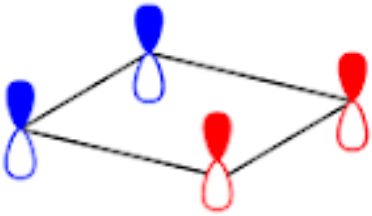
hexatriene



1. NOT Cyclic
2. *p*-orbital for each member of the ring
3. Planar ring (sp^2 hybridized)
4. **4n+2 π–bond electron count.**

Non-Aromatic

cyclobutadiene



1. Cyclic
2. *p*-orbital for each member of the ring
3. Planar ring (sp^2 hybridized)
4. **Closed 4n π–bond electron count.**

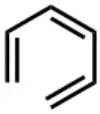
Anti-Aromatic

Four Rules For Aromaticity

Condition #1: The molecule must be cyclic No exceptions!

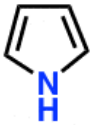
cyclic

Benzene
Aromatic



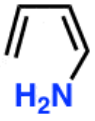
acyclic

(Z)-1,3,5 hexatriene
Not aromatic



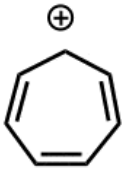
cyclic

Pyrrole
Aromatic



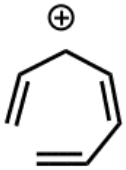
acyclic

Not aromatic



cyclic

"Tropylium" ion
Aromatic

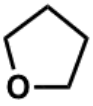


acyclic

Not aromatic

Just to be clear: not all cyclic molecules are aromatic...

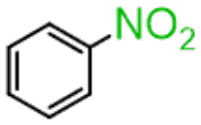
cyclohexene
(not aromatic)



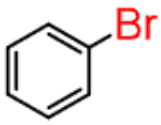
tetrahydrofuran
(not aromatic)

1.3 Nomenclature of aromatic compounds

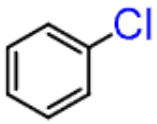
common names



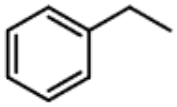
nitrobenzene



bromobenzene

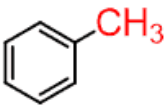


chlorobenzene

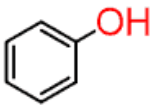


ethylbenzene

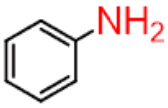
Common IUPAC names of monosubstituted aromatic compounds



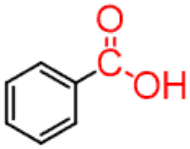
Toluene



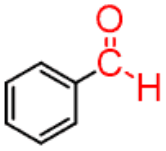
Phenol



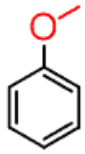
Aniline



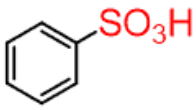
Benzoic acid



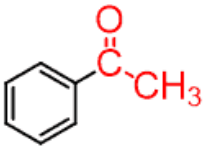
Benzaldehyde



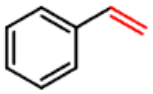
Anisole



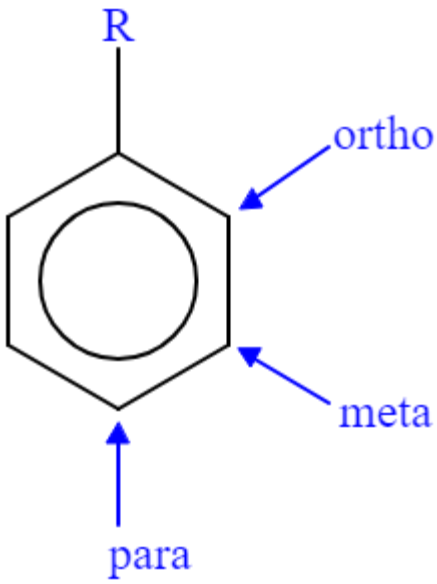
Benzenesulfonic acid

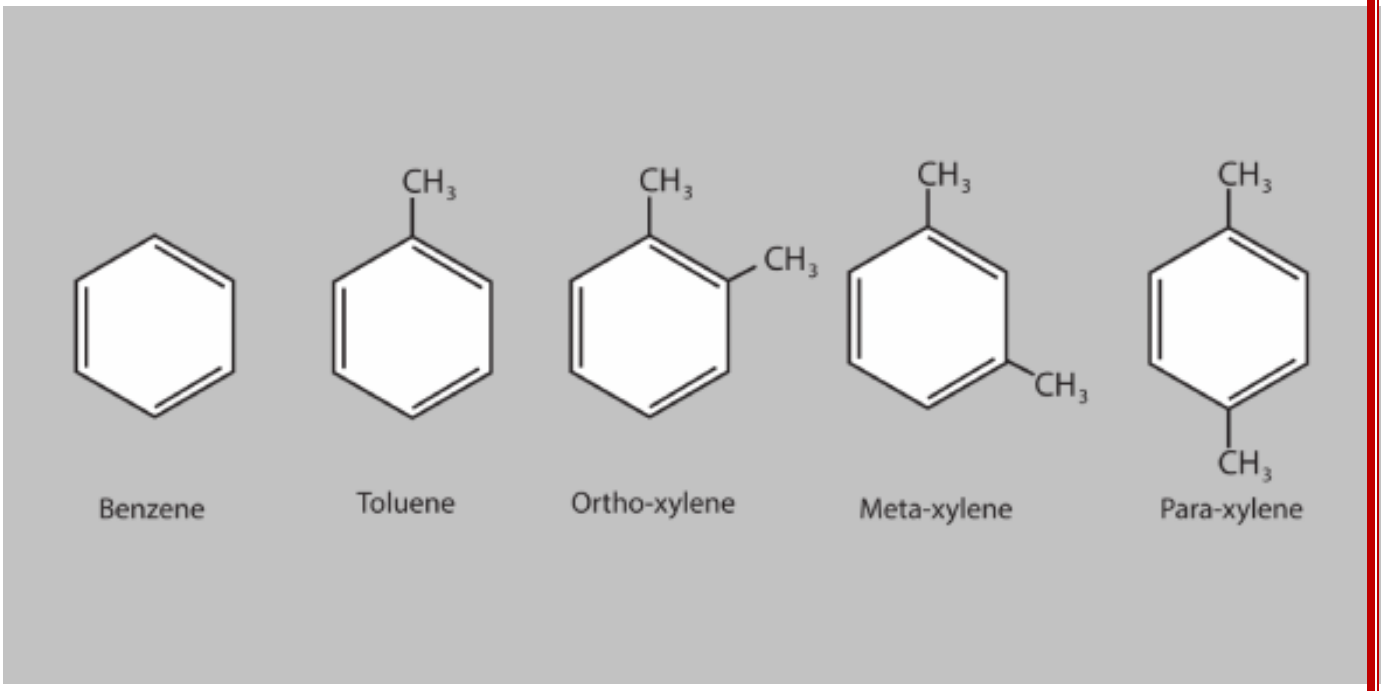


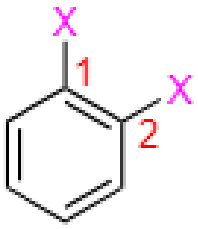
Acetophenone



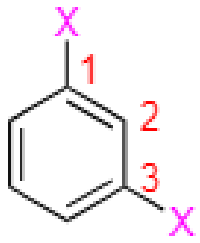
Styrene


R
ortho
meta
para

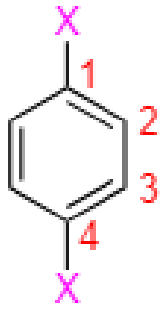

Benzene
Toluene
Ortho-xylene
Meta-xylene
Para-xylene



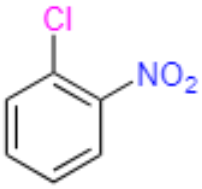
ortho-Disubstituted
(1,2)



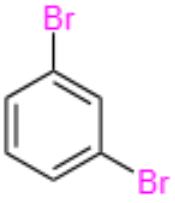
meta-Disubstituted
(1,3)



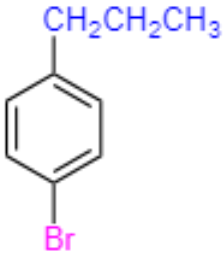
para-Disubstituted
(1,4)



ortho-Chloronitrobenzene



meta-Dibromobenzene



para-Bromopropylbenzene