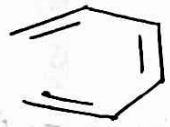
# # AROMATIC, NONAROMATIC AND ANTIAROMATIC

## AROMATIC

Cyclic conjugated polyenes are aromatic provided they contain $(4n+2)$ $\pi$ electrons ($n=0,1,2,3\cdots$). Aromatic compounds are more stable when compared with their open-chain counterparts because aromatic compounds have lower $\pi$-electron delocalization energy.

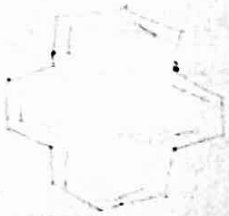
~~For example,~~

Benzene
(Aromatic)



1,3,5-Hexatriene
(Open chain counterpart)

Benzene is more stable than its open chain counterpart 1,3,5-Hexatriene. Benzene has lower $\pi$-electron energy than 1,3,5-hexatriene.



## NONAROMATIC

A cyclic compound, in which continuous overlapping of p-orbitals is disrupted, can not be aromatic. ~~It is termed nonaromatic~~ ~~It is~~ Its stability is same as that of open-chain counterpart i.e. the ring and the chain have the same $\pi$-electron energy. This type of compound is called nonaromatic.

For example,

1,3-Cyclohexadiene

cis, cis-3,4-Hexadiene

Both of them is non-aromatic and having similar stabilities.

## ANTIAROMATIC

A conjugated cyclic system with $4n\pi$ electrons ($n = 0, 1, 2 \cdots$) is called antiaromatic.

In antiaromatic compound, delocalization of $\pi$-electrons results in an increase in the electronic energy leading to destabilization. So, the ring has greater $\pi$-electron energy than the open chain counterpart that means antiaromatic compounds are less stable that its open chain counterpart. In true sense, they are highly unstable molecule.

For example,

Cyclobutadiene

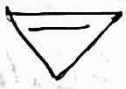
1,3-Butadine

Cyclobutadiene is less stable than its open chain counterpart 1,3-butadiene.

## NOTE

After many unsuccessful attempts over many years, in 1965 cyclobutadiene was synthesized by R. Pettit and his coworkers at the University of Texas, Austin. It is very difficult to synthesize due to its high unstability.

## Cyclopropene

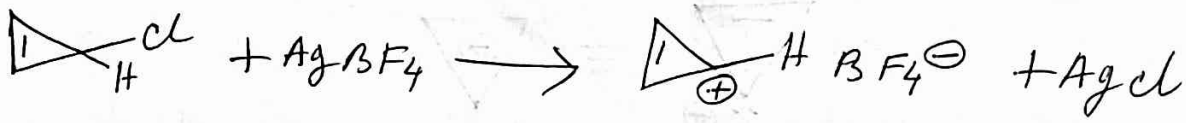


cyclopropene

Cyclopropene has correct number of π electrons (2π electrons) to be aromatic. But it is not aromatic ~~as it has~~ because of the presence of $-CH_2-$ group which does not have an available p-orbital.

If the $-CH_2-$ group becomes $sp^2$ hybridized cation with a vacant p orbital, then the overlap of p-orbitals is continuous and the resulting cyclopropenyl cation is aromatic.

For example, 3-chlorocyclopropene reacts readily with silver tetrafluoroborate to form a stable aromatic salt.



## Cyclopropenyl Anion

Cyclopropenyl anion has $4\pi$ electrons. Therefore, it is antiaromatic, ~~and~~ so unstable.