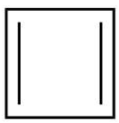
❖ Annulenes

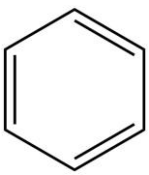
Annulenes are the monocyclic conjugated polyenes that contain the maximum number of non-cumulated double bonds.

Annulenes have the general formula of C_nH_n (when *n* represents an even number) or C_nH_{n+1} (when *n* represents an odd number). The IUPAC nomenclature of annulenes with 7 or more carbon atoms follows as [*n*]-annulene, where *n* represents the number of C atoms in their cycle, though the smaller annulenes are referred to using the same notation sometimes (benzene is also an annulene). The first 3 even annulenes include cyclobutadiene, benzene, and cyclooctatetraene. Many annulenes like cyclobutadiene i.e. [4]-annulene, cyclodecapentaene i.e. [10]-annulene, cyclododecahexaene i.e. [12]-annulene and cyclotetradecaheptaene i.e., [14]-annulene, are not stable, with cyclobutadiene at extreme position. Annulenes may be aromatic (benzene, [6]-annulene and [18]-annulene), non-aromatic ([8]- and [10]-annulene), or anti-aromatic (cyclobutadiene, [4]-annulene). Cyclobutadiene or [4]-annulene is the only annulene with considerable antiaromatic character due to unavoidable planarity. With [8]-annulene takes on a tub shape that permits it to evade conjugation of double bonds making it less unstable. [10]-Annulene has very strange geometry to be planar structure; in a planar conformation, ring strain arising from either steric hindrance of internal H atoms (when some double bonds are trans) or the distortion of bond angle (if double bonds are all cis) is unavoidable. hence, it doesn't get appreciable aromatic character.



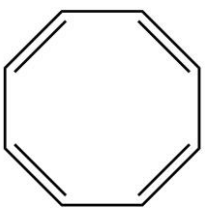
cyclobuta-1,3-diene

[4]-annulene
4 π-electrons, planer
Antiaromatic



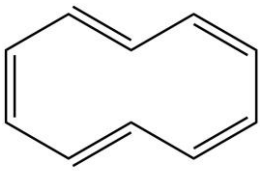
benzene

[6]-annulene
6 π-electrons, planer
Aromatic



cyclooctatetraene

[8]-annulene
8 π-electrons, non-planer
Nonaromatic

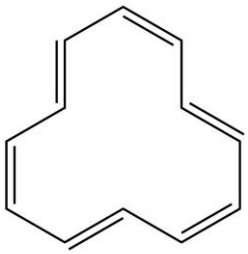


cyclodecapentaene

[10]-annulene

10 π-electrons, non-planer

Nonaromatic

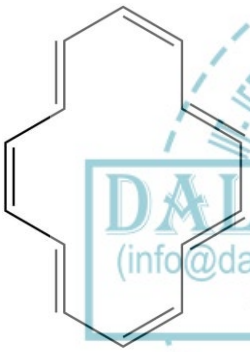


cyclododecahexaene

[12]-annulene

12 π-electrons, planer

Antiaromatic

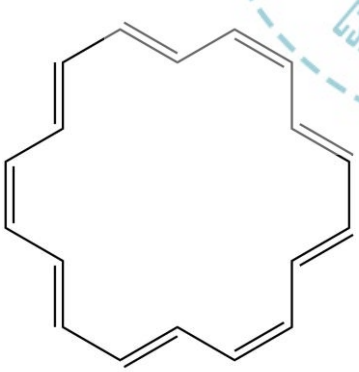


cyclotetradecaheptaene

[14]-annulene

14 π-electrons, planer

Aromatic



Cyclooctadecanonaene

[18]-annulene

18 π-electrons, planer

Aromatic

When the annulene is large enough, [18]-annulene, for example, there is enough room internally to accommodate hydrogen atoms without significant distortion of bond angles. [18]-Annulene possesses several properties that qualify it as aromatic. Nevertheless, no bigger annulenes are as stable as [6]-annulene i.e. benzene, as their reactivity resembles closely a conjugated polyene than a hydrocarbon of aromatic nature.

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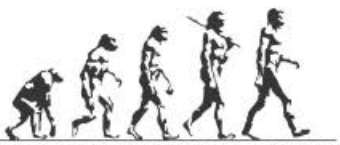

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