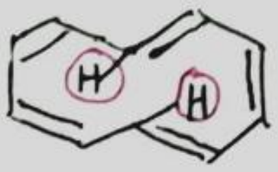
• ANNULENES:

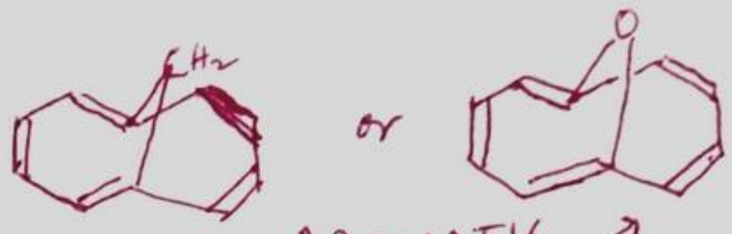
Although [10] annulene has 10 π electrons, the molecule is nonplanar (because of trans-annular interaction) and non-aromatic.

Two trans double bonds



[10]-annulene
non-aromatic

But, where the trans-annular interaction is absent then the said system become aromatic, for example

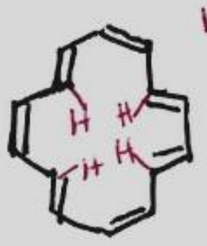


← AROMATIC →

here trans-annular interaction is absent.

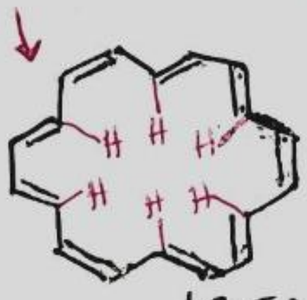
Likewise,

[14] annulene & [18] annulene are aromatic with some olefinic character.



14 πe

more aromatic



18 πe

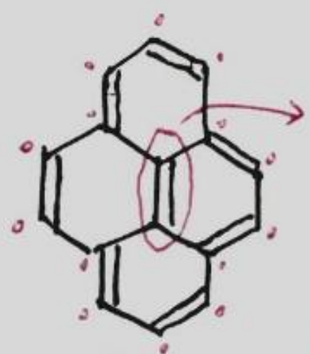
less aromatic

The deviation from planarity is more for [18] annulene. Hence this is less aromatic than [14] annul.

• PYRENE SYSTEM:

Total number of π electrons in pyrene is 16.

However, the number of peripherial π electrons is 14 which obeys Hückel's rule. [4n+2 π, n=3]

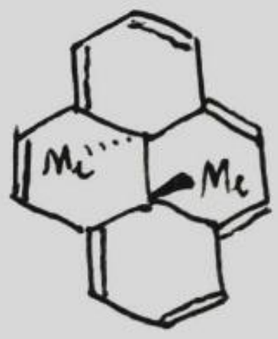


Pyrene

internal π-bond (can be ignored)

no. of peripherial π e's = 14, AROMATIC.

The prediction is confirmed when trans-dimethyl derivative (below) shows aromaticity.

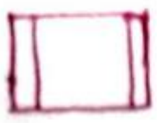


trans-dimethyl dihydropyrene

no. of peripherial π e's = 14
also
AROMATIC

ANTI AROMATICITY

• Cyclobutadiene, a conjugated cyclic polyene with four carbon atoms in the ring, is unstable.



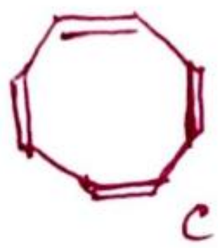
it is $4\pi e$ system, anti aromatic [does not meet Huckels rule]

it escape anti aromaticity by assuming rectangular shape.

rectangular shape

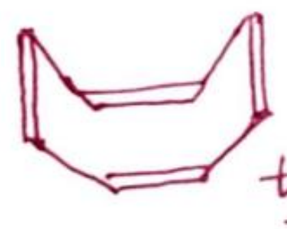
* Cyclooctatetraene (COT) with an eight-membered ring, behaves as a polyene. It is not planar.

It escapes from anti aromaticity by assuming tub-shape.



COT

$8\pi e$ system anti aromatic. (if planar)



tub-shape (non-planar)

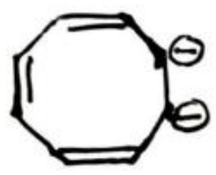
Important reactions of COT

COT (tub shaped)

$8\pi e$ system

$2K$ (potassium metal) → THF

When treated with K metal



COT dianion

$\equiv$ 

$2K^+$

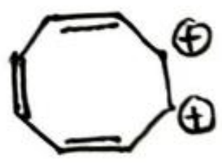
$10\pi e$ system

aromatic

(Olah's super acid)

SbF_5 / FSO_3H

$-78\,^{\circ}C$



$\equiv$ 

$2SbF_6^-$

COT dication

$6\pi e$ system

AROMATIC

Therefore to escape from antiaromaticity COT underwent reactions with potassium metal (K) leading to the formation of COT dianion (aromatic, $10\pi e$) AND upon reaction with Olah's super acid it produced COT dication which is also aromatic ($6\pi e$ system).