

Huckel's rule  $\Rightarrow$

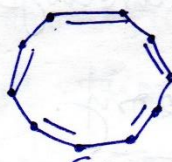
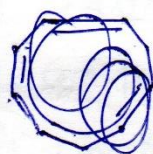
Planar, monocyclic, completely conjugated hydrocarbons would be aromatic when the ring contains  $(4n+2)\pi$  electrons, where  $n$  is any integer including zero.

Limitations  $\Rightarrow$

(a) Monocyclic conjugated system  
But heterocyclic compds are considered aromatic  
 $\Rightarrow$  bicyclic, polycyclic aromatic hydrocarbons like naphthalene, phenanthrene are considered to be aromatic

(b) [10] annulene contains  $10\pi$  e<sup>-</sup>s, but it is not aromatic

Although it contains  $10\pi$  electrons, but the molecule cannot adopt the necessary planar conformation. If all the double bonds are all cis (a) or one is trans (b), the angle strain is excessive

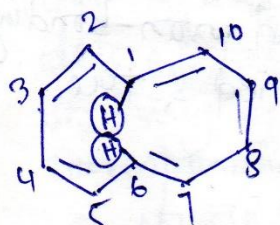


(a)

Internal  $\angle C-C-C = 144^\circ$   
suffers from serious angle strain - unstable

(b)

Suffers from angle strain also.



(c)  $\rightarrow$

Suffers from strong steric crowding between the two H atoms at 4 and 6 - unstable.

Isomer with two trans double bonds cannot be flat because two of the H-atoms interfere with each other.



Yes, this is aromatic. Because the internal "Hs" in [10]-annulene which prevent it from achieving coplanarity, are replaced by methylene bridge permitting it to be flat.

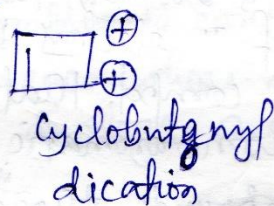
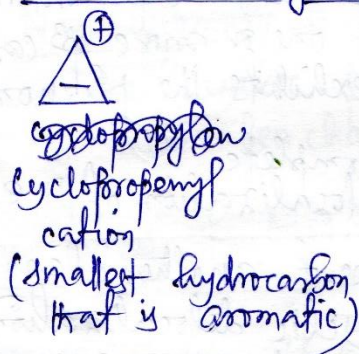
Since the bridgehead 'Cs are still  $sp^2$  hybridized their "p" electrons are available for extended delocalization in a 10-electron system.

✓ Antiaromatic  $\Rightarrow$  Planar, conjugated, carbocyclic polyenes that are especially less stable than their open chain analogs are called antiaromatic  $4n+2$  electron system.

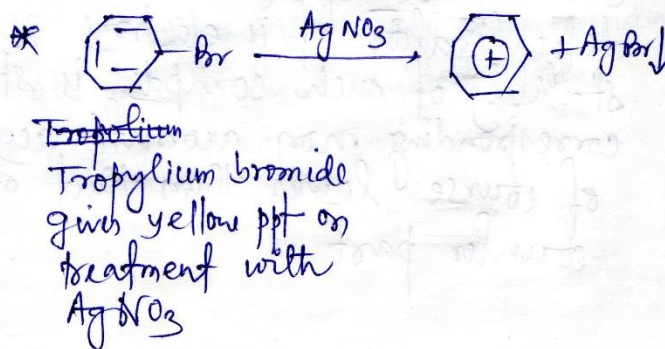
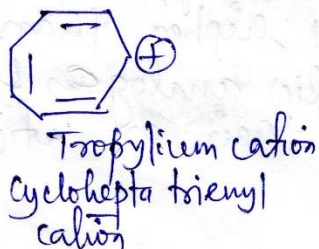
✓ Non-aromatic  $\Rightarrow$  Completely conjugated, non-planar carbocyclic polyenes whose stability are comparable to their open chain analogs are called non-aromatic.



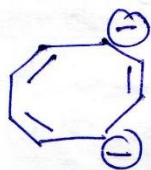
Examples of aromatic compd  
2 $\pi$  electronic system.



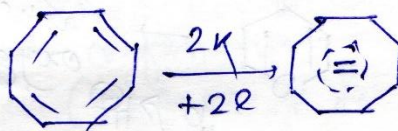
6 $\pi$  e<sup>-</sup> system



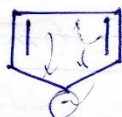
10  $\pi$  - electrons.



Cyclooctatetraene dianion



\*



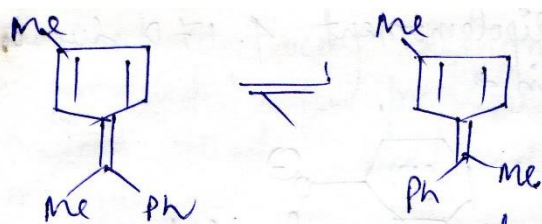
H of  $-CH_2-$  of cyclopentadiene is more acidic than 1,3-cyclohexadiene

6 delocalised  $\pi e^-$ . This aromaticity stabilizes the cyclopentadienyl anion, causing cyclopentadiene to be much more acidic.



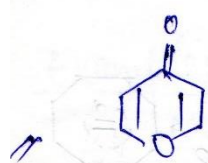
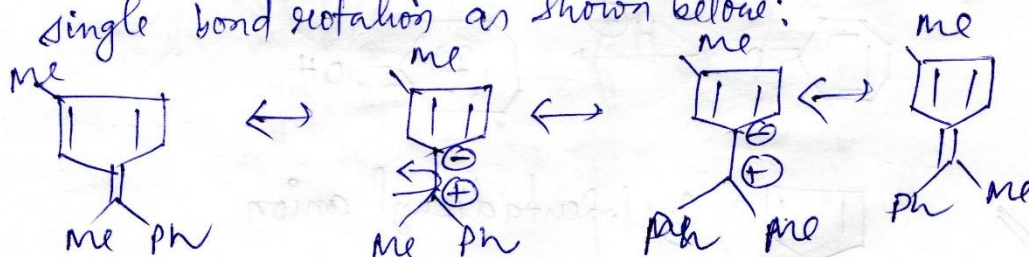
Removal of  $H^+$  from cyclohexadiene also gives anion with 6  $e^-$  in a ring. However, presence of  $sp^3 C$  prevents continuous cyclic overlap & the anion is not aromatic.



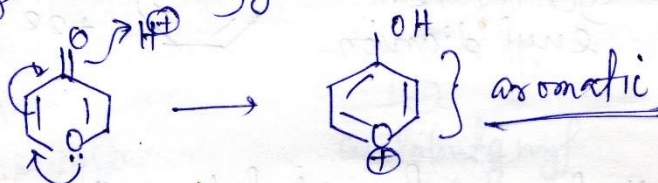


Due to gain in aromaticity, the exocyclic double bond has considerable single bond character.

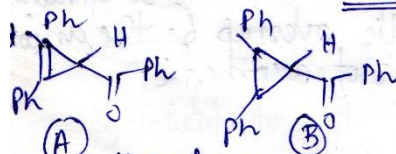
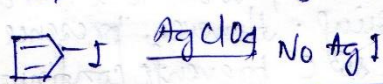
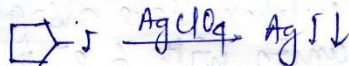
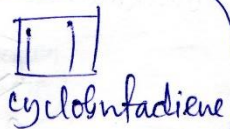
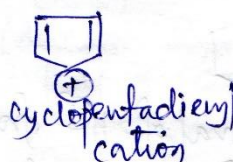
Two isomers are easily interconvertible by 'c-c' single bond rotation as shown below:



Due to gain in aromaticity, the carbonyl oxygen is more basic



Antiaromatic compound.



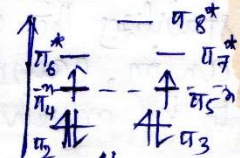
H-exchange  
several thousand times  
faster than B

Non-aromatic compd



cyclooctatetraene.

Since non-bonding orbitals are half-filled, it seems to be antiaromatic but it is tub shaped



it is not planar,



p-orbital of one C=C are not coplanar with that of a neighboring C=C so there can be no effective overlap for delocalization.