Today

Benzene and Aromaticity 8.1, 8.2, 8.16 - 8.18

How aromaticity can affect reactivity

Electrophilic Aromatic Substitution
8.16 - 8.21, 18.1 -18.8

Next Class

Test 3 on Chap 16 and 17

Second Class from Today

Electrophilic Aromatic Substitution
8.16 - 8.21, 18.1 -18.8

Third Class from Today

Electrophilic Aromatic Substitution
8.16 - 8.21, 18.1 -18.8

Prior test that serve a good resources for this year's test 3:

Spring 2019, test 2, questions 3, 7, 8, and 9
Spring 2019, test 3, question 4; and
Spring 2022 test 3.

Review session Thursday 7:30 - 9:00

Check email for location.

Criteria for Aromaticity ← makes π bonds more stable

1.Uninterupted π cloud
- cyclic
- p orbital on every atom
- planar

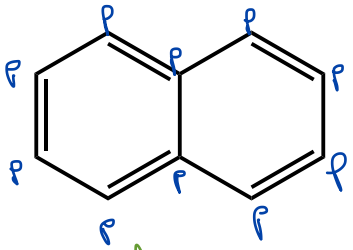
2. odd number of pairs of electrons or 4n+2 e⁻'s

Criteria for Antiaromaticity makes molecule/e⁻'s in π bonds less stable

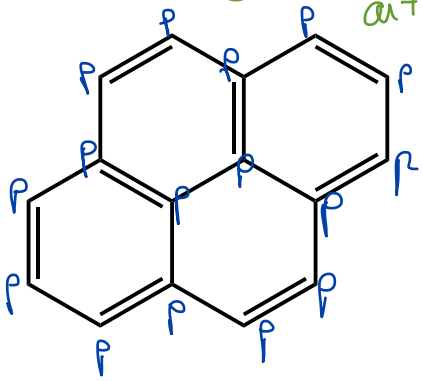
1.Uninterupted π cloud
- cyclic
- p orbital on every atom
- planar

2. even number of pairs of electrons or 4n e⁻'s in the π system

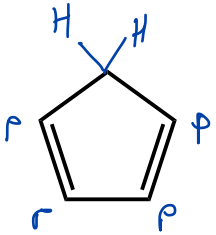
n is just a number not the number of C, H's or anything else



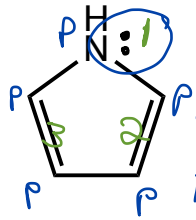
odd
aromatic



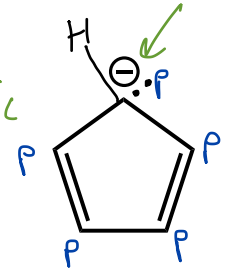
even
antiaromatic



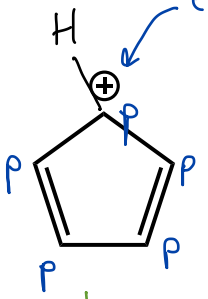
none of
the above



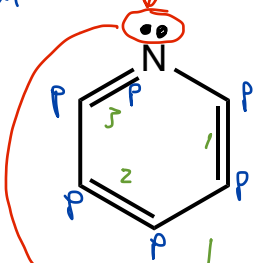
lp e⁻
delocalized
into
π system
3 pairs
odd
aromatic



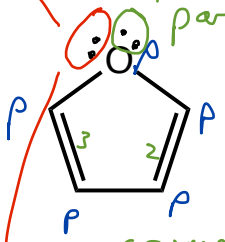
aromatic



empty p
orbital
antiaromatic

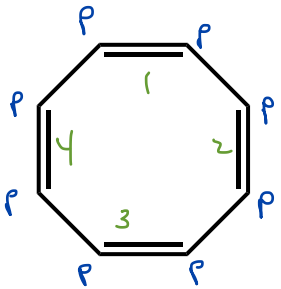


not part of
the π system
aromatic



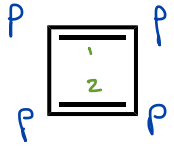
participates in
π bonding
aromatic

these lp e⁻'s are in an sp^2 hybrid that
is ⊥ to the π system



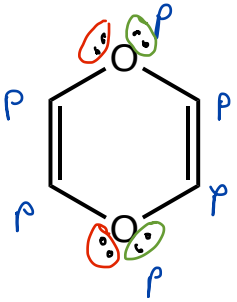
if planar
antiaromatic?

aromatic 5



antiaromatic?

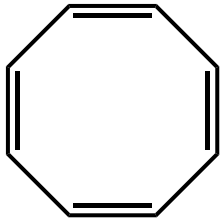
antiaromatic 5?



looks antiaromatic
but is
complicated

n.o.t.a. 1

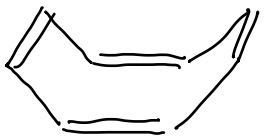
More on Antiaromaticity

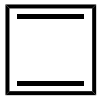


planar = antiaromatic

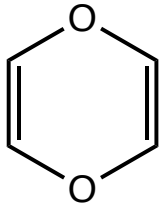
higher in E

to avoid antiaromaticity it avoids being planar by folding into a boat





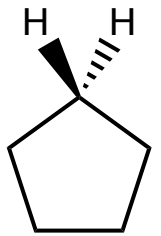
adopts a rectangular shape to avoid antiaromaticity



correction ... 1,4-dioxin is planar, but it lacks the orbital degeneracy to cause it to be antiaromatic

This is an example of how basic rules can help, but not always make correct predictions. The application of MO Theory provides a better prediction but is beyond the scope of our class.

So ... none of the above



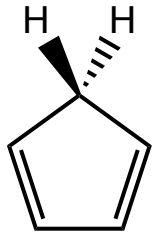
NaH

NR

$+ H_2$

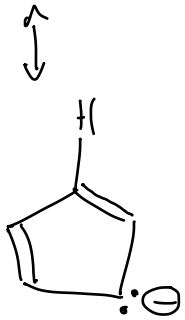
too hard for NaH to do

localized ⊖ charge on C very hard to do...



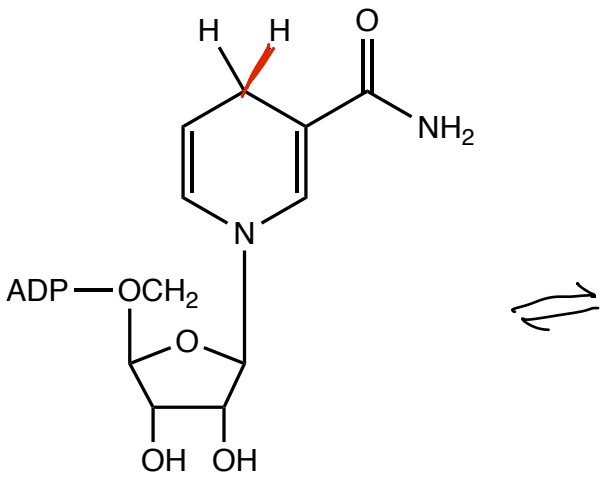
NaH

$+ H_2$

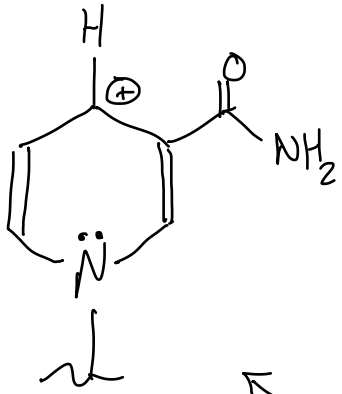


aromatic system forms.
aromatic stabilization lowers the amount of energy required to do the reaction.

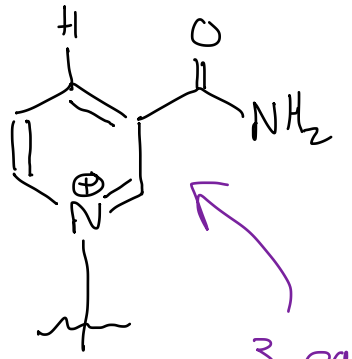
forming an aromatic system can make it easier for a reaction to occur



NADH



$H:^{\ominus}$

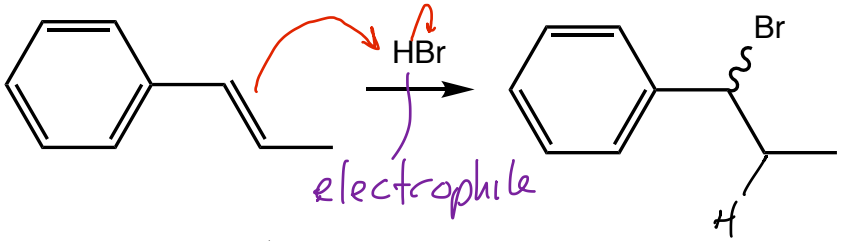


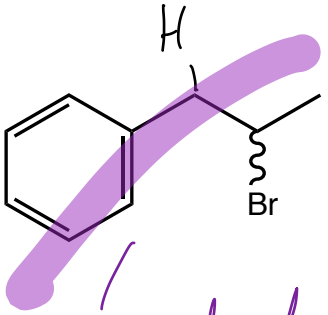
$NAD^{\oplus}$

3 pairs of e^{-}'s in a ring of p orbitals... aromatic...

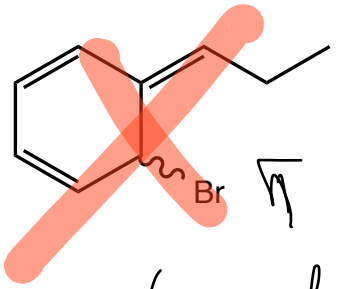
becoming aromatic makes it a bit easier to transfer the $H:^{\ominus}$ to another molecule

electrophilic addition of H-Br to an alkene

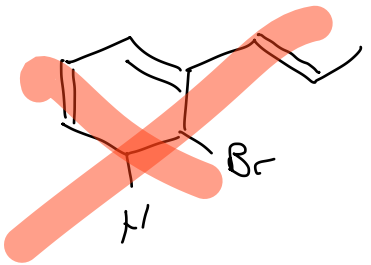


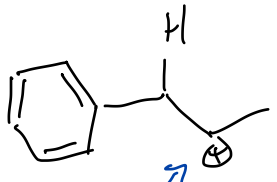


not produced because C+ intermediate is not stabilized by electron delocalization

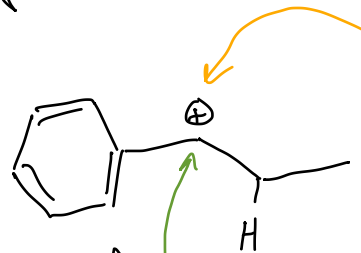


not produced because the loss of aromaticity would make these molecules higher in energy





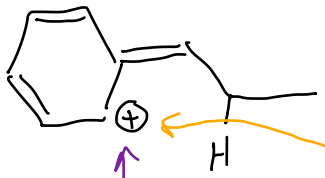
or



carbocation is not stabilized by electron delocalization

empty p orbital next π system

nucleophile will finish reaction here because reacting here would result in a loss of aromaticity



carbocation is stabilized by e⁻ delocalization