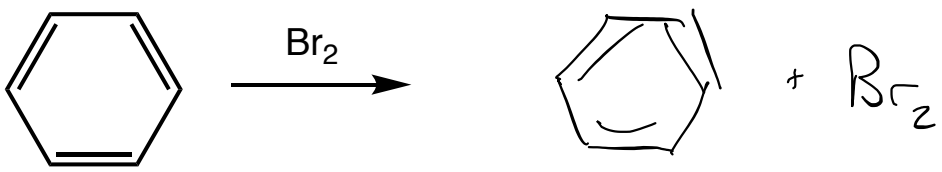
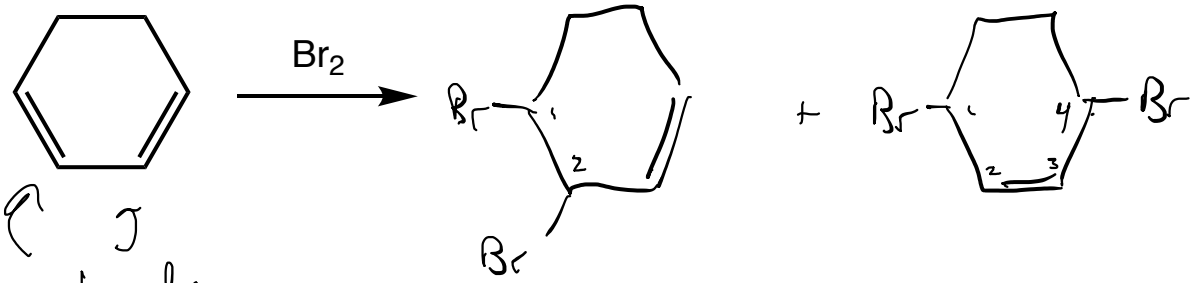
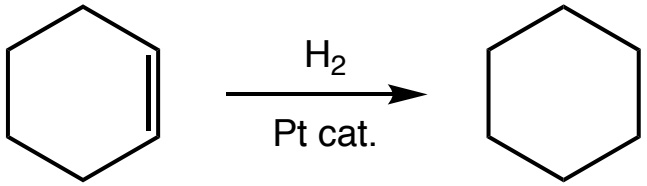
Test 3 Postponed until May 3



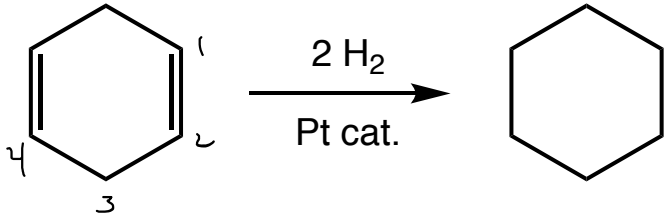
benzene is aromatic



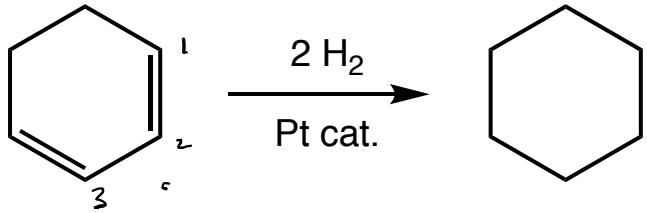
π bonds available For E Add



	$\Delta H_{reaction}$ (kcal/mol)	per bond (kcal/mol)
cyclohexene	–28.6	–28.6



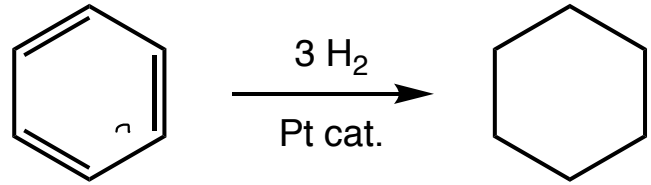
1,4 cyclohexadiene	–57.4	–28.7



resonance stabilized

1,3-cyclohexadiene	–55.4	–27.7

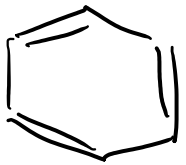
less E out

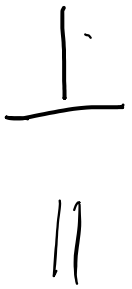


benzene	–79.8	26.6 per π bond

π bonds in benzene are even more stable than simple resonance stabilized systems. Hydrogenation of first π bond in benzene only releases 24.4 kcal

1. ring of planar atoms
2. each atom must have a p orbital perpendicular to the plane
   (all p orbitals need to be parallel so they can overlap in an extended π system)
3. odd number of pairs of e^-'s
   ($4n+2$ e^-'s in the π system)



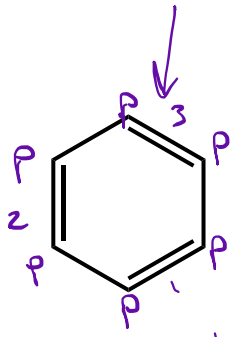


$n=0$ $4n+2 = 2 \leftarrow$ 1 pair
$n=1$ $4n+2 = 6 \leftarrow$ 3 pair
$n=2$ $4(2)+2 = 10 \leftarrow$ 5 pair
$n=4$ $18e^- \leftarrow$ 9 pair

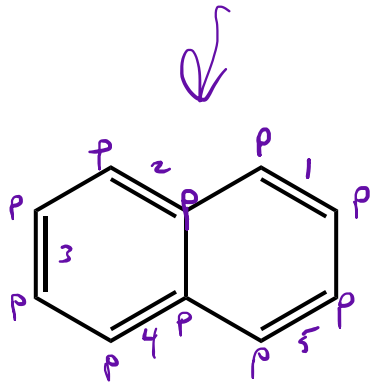
p orbitals... lone-pair e^-'s can be in p orbitals
sp^2 hybridized C atoms have a p orbital
π bonds
carbocation ⊕ empty p orbital

Aromatic?

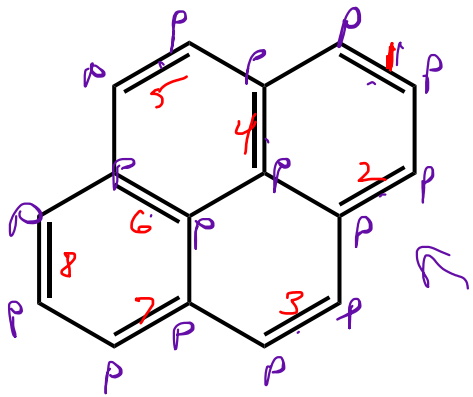
Section 8.16, 8.17, 8.18 8.20



aromatic

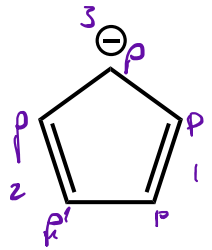


aromatic

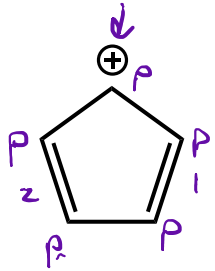


antiaromatic

excluded

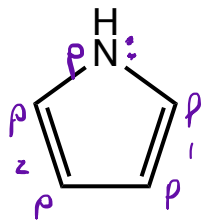


aromatic



no

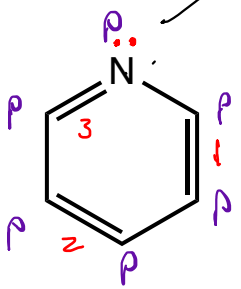
planar ✓
ring of p ✓
odd # pairs no



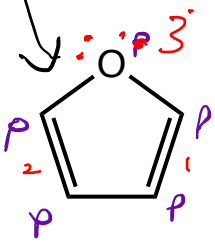
yes

yes
planar ✓
ring of p ✓
odd # ✓ pairs

why can't less e⁻'s be part of the π system? The lone-pair e⁻'s are in an sp^2 hybrid... perpendicular to the π bond.



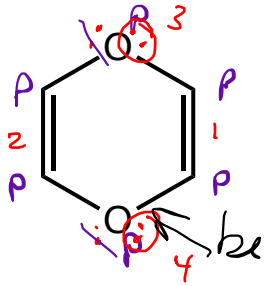
4 pairs of e⁻'s? aromatic



aromatic

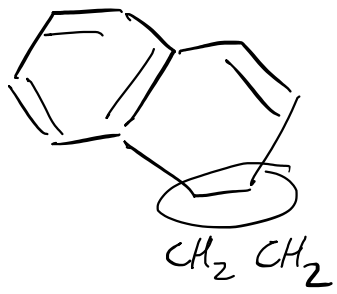
only 1 pair participates in π system.

1 set of lp e⁻'s in p orbital the other set is stuck in an sp^2 hybrid

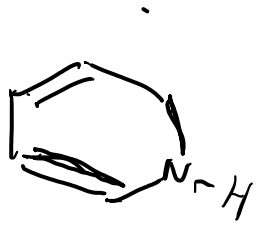


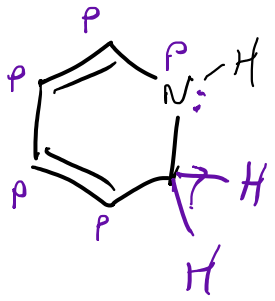
not aromatic

antiaromatic



not aromatic
of p
ring ∧ doesn't
make it all
the way around



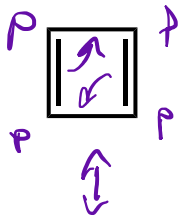


ring of p ?

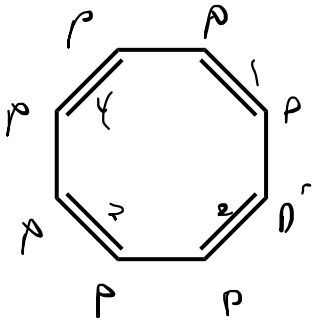
not aromatic

uninterrupted ring of p orbitals

even # of pairs of π bonds – destabilized



antiaromatic



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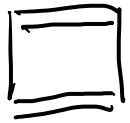

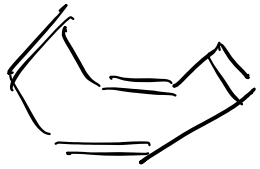

not a square

avoids being planar