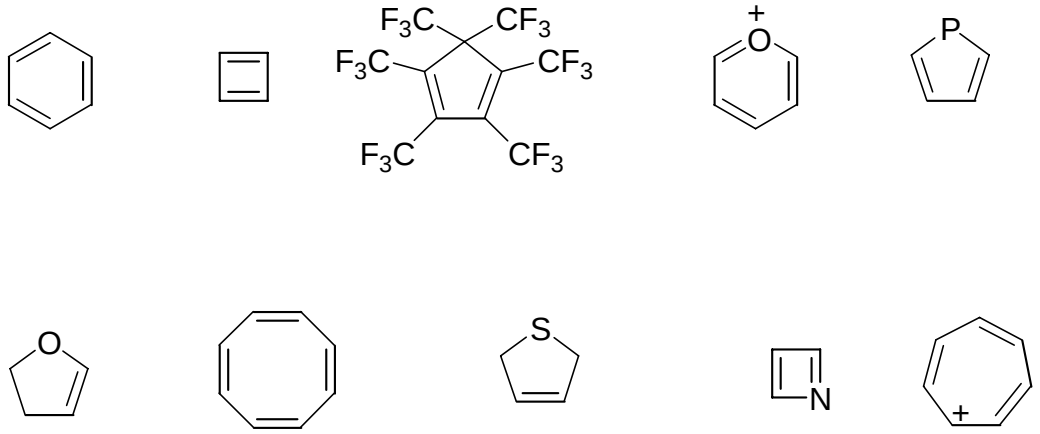
Organic II Exam #1 Ch 14-17 (100 points).

NAME: _____

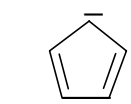
1) Aromatic compounds are defined as having planar structures, containing a certain number of electrons in a continuous overlapping cyclic arrangement of p orbitals. Name two characteristic physical or chemical properties of aromatic compounds. (3pts)

2) Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (20pts)



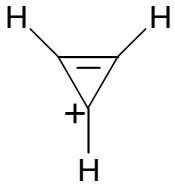
3) Briefly explain your choices for the non-aromatic compounds (4pts)

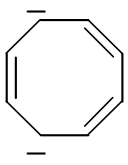
4) Using the polygon rule, draw out and decide whether the following species are aromatic or anti-aromatic. (12pts)



(cyclopentadienide anion)

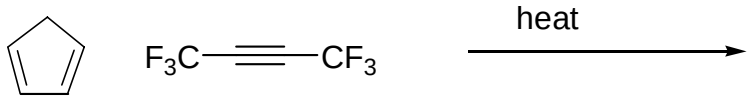
(cyclopropenyl cation)

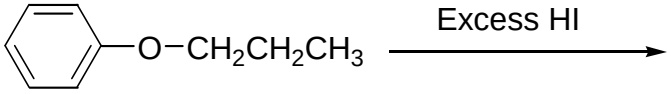


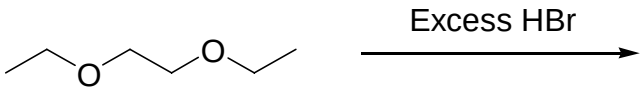


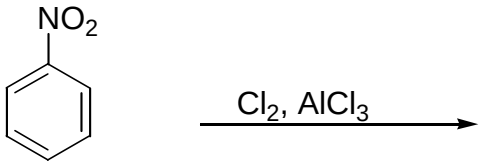
(cyclo-octatriene dianion)

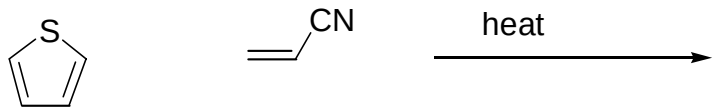
5) Predict the products in the following reactions (if you believe no reaction will occur, indicate this!), paying attention to regio/stereochemistry where applicable. (19pts)

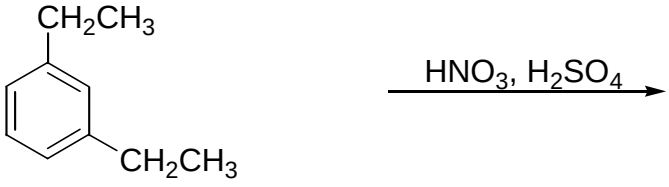




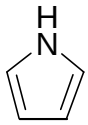


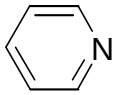






6) Both pyrrole and pyridine are nitrogen containing heterocycles that are 6π Hückel aromatic.

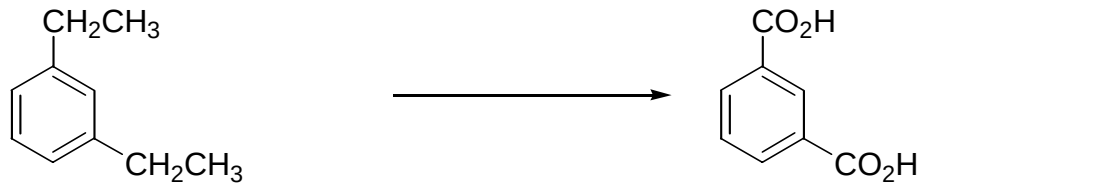


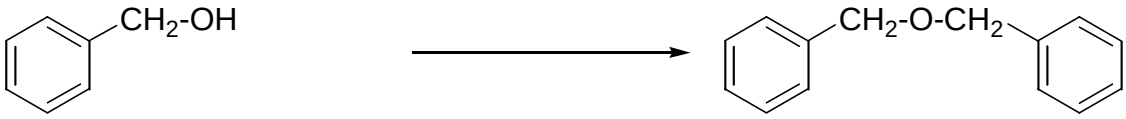


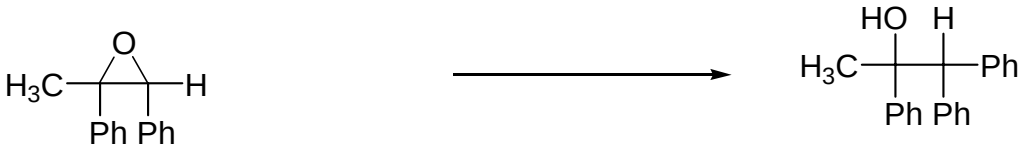
The lone pair on nitrogen plays a different role in each molecule's aromaticity, and consequently pyridine is a strong base and pyrrole is a weak base.

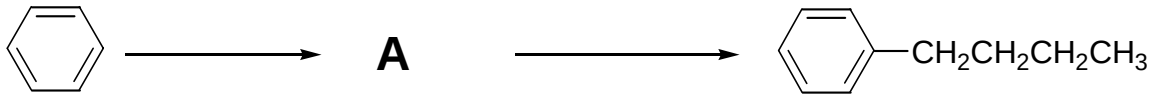
Pick either pyrrole or pyridine and describe the aromaticity and observed basicity for that molecule. (15pts)

7) Give reagents and conditions to accomplish the following transformations. (17pts)

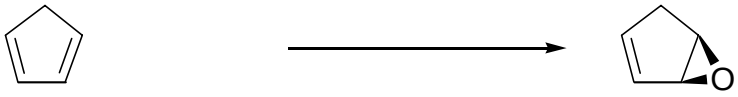


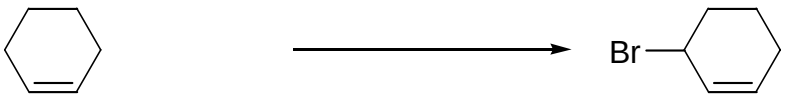




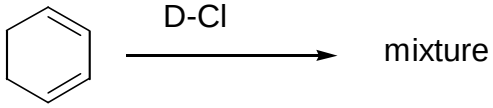


(no marks for A)!!!





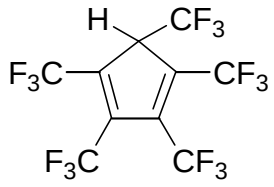
8) The addition of (1 equivalent of) DCl to 1,3-cyclohexadiene generates a mixture of products.



Draw the products, and mechanistically account for the mixture of products. (10pts)

***Bonus question* (2pts!!!)**

Based on arguments of aromaticity, would you expect the following compound to be one of the world's strongest acids or one of the world's strongest bases?



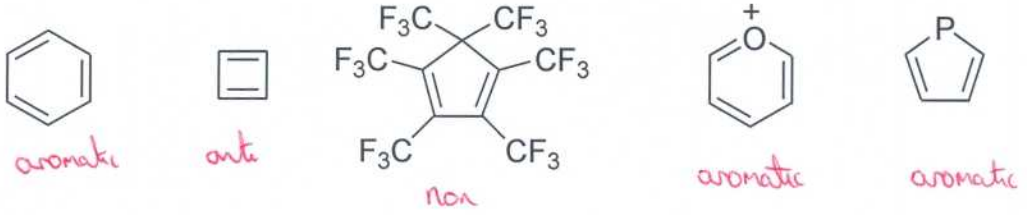
Organic II Exam #1 Ch 14-17 (100 points).

NAME: K. LEPTO-MANIA

1) Aromatic compounds are defined as having planar structures, containing a certain number of electrons in a continuous overlapping cyclic arrangement of p orbitals. Name two characteristic physical or chemical properties of aromatic compounds. (3pts)

- very stable
- unreactive
- delocalized π systems
- more stable than open chain analogue
- e⁻ delocalization lowers energy

2) Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (20pts)



aromatic anti non aromatic aromatic

non anti non anti aromatic

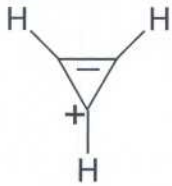
3) Briefly explain your choices for the non-aromatic compounds (4pts)

- do not contain overlapping p orbitals all around the ring

4) Using the polygon rule, draw out and decide whether the following species are aromatic or anti-aromatic. (12pts)

(cyclopentadienide anion)

(cyclopropenyl cation)



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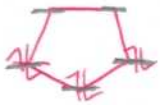


6π e's

closed shell

aromatic

2π e's

closed shell

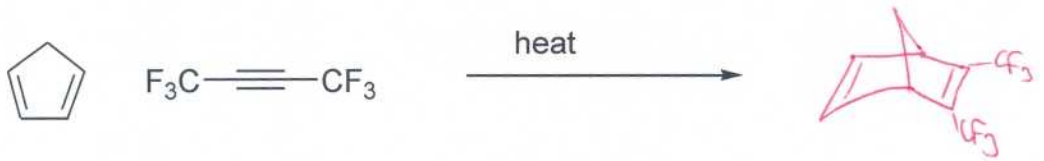
aromatic

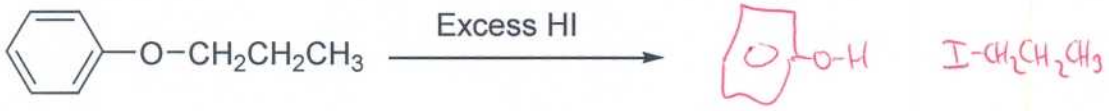
10π e's

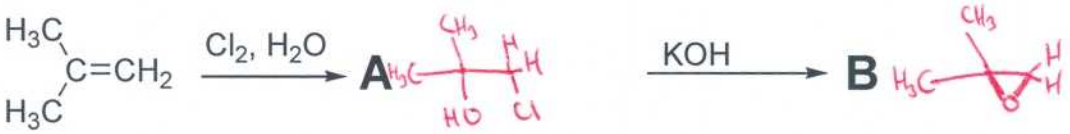
closed shell

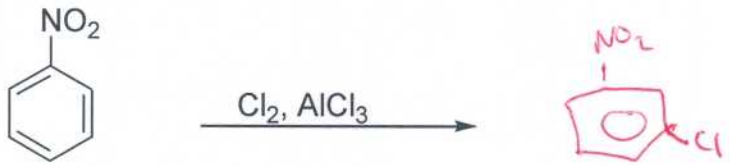
aromatic

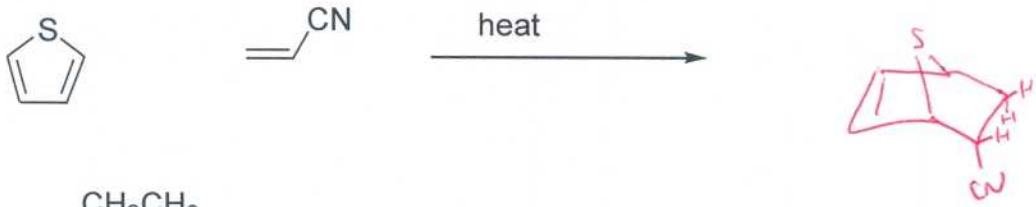
5) Predict the products in the following reactions (if you believe no reaction will occur, indicate this!), paying attention to regio/stereochemistry where applicable. (19pts)

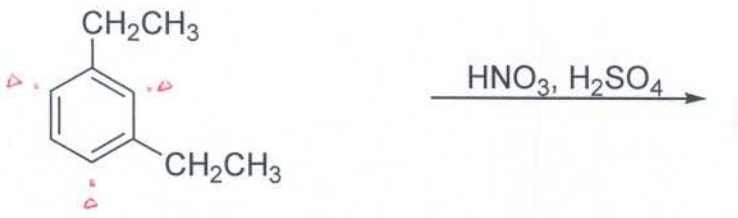












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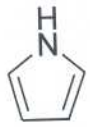
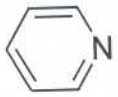
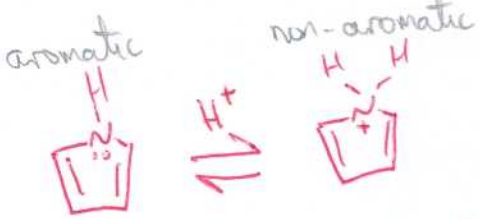



The lone pair on nitrogen plays a different role in each molecule's aromaticity, and consequently pyridine is a strong base and pyrrole is a weak base.

Pick either pyrrole or pyridine and describe the aromaticity and observed basicity for that molecule. (15pts)

6π aromatic: 4π from 2π bonds
2e⁻ from N lone pair

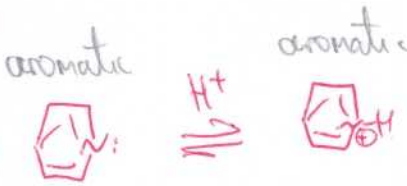
N is sp^2 hybridized, and puts lone pair into p orbital so it can interact with the π system.



Protonation occurs on the lp of the N, thus creating an sp^3 atom in the ring. ∴ aromaticity is lost. ∴ unfavorable
∴ pyrrole = weak base

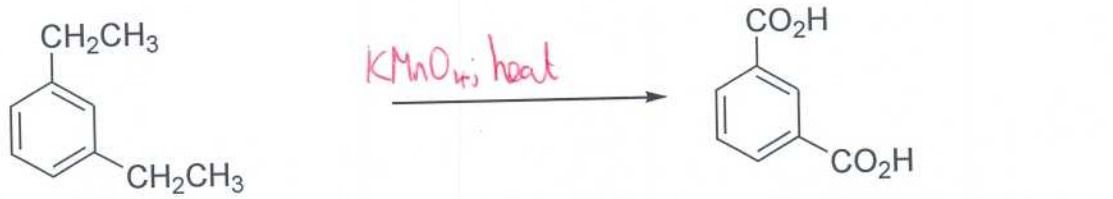
6π aromatic from 3π bonds.

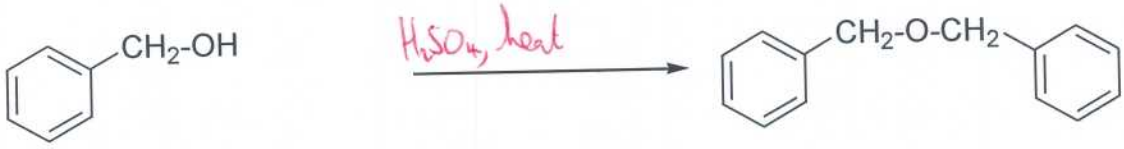
The N is sp^2 hybridized, with the l.p. in an sp^2, and a single e⁻ in the p.

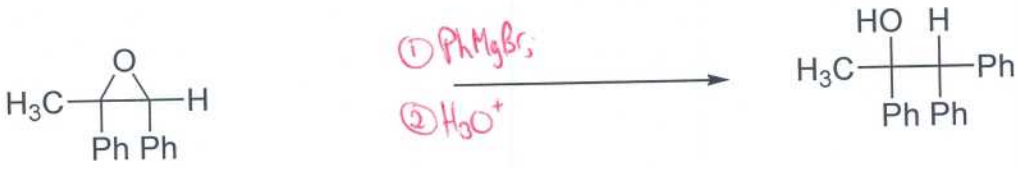


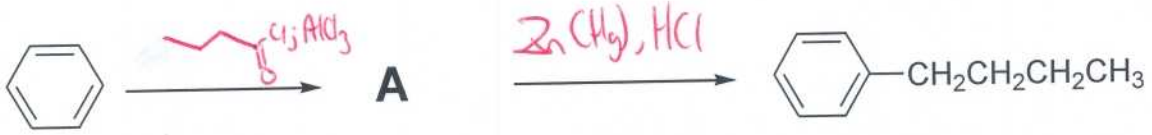
Protonation occurs at the lp on N, the N stays sp^2, still 6π e⁻s.
Aromaticity is unaffected
∴ Pyridine is a good base

7) Give reagents and conditions to accomplish the following transformations. (17pts)

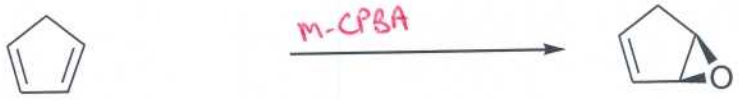


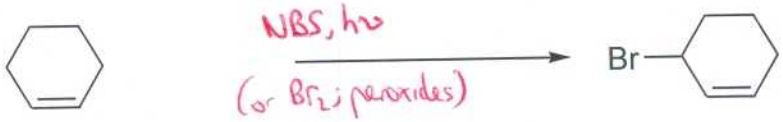






(no marks for A)!!!





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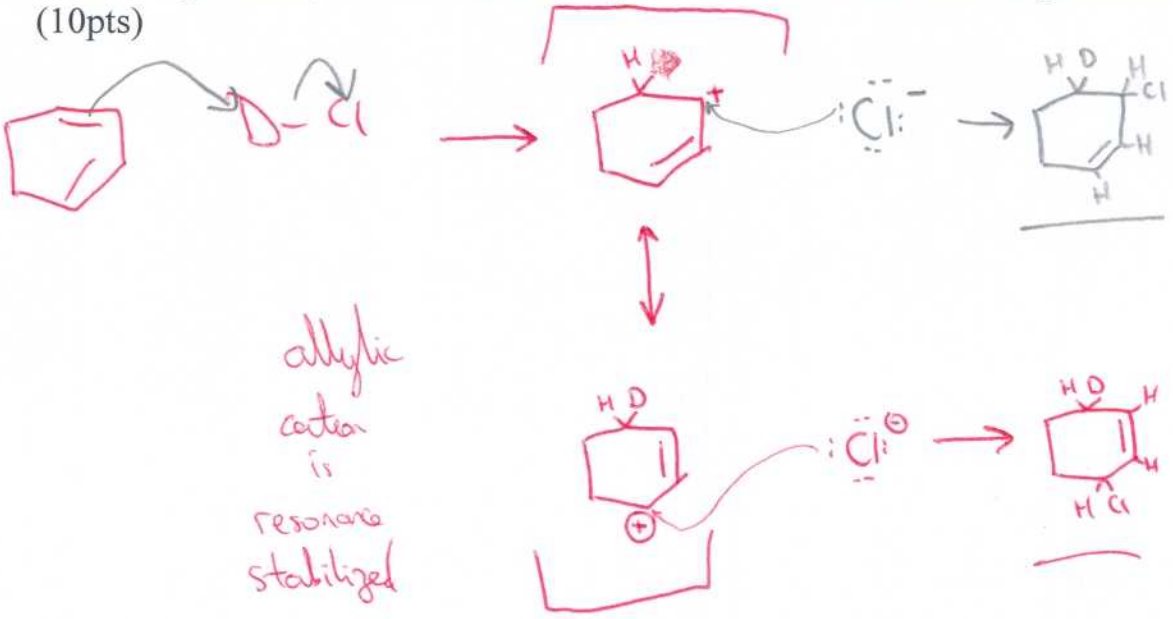
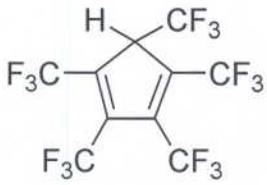
Draw the products, and mechanistically account for the mixture of products. (10pts)



***Bonus question* (2pts!!!)**

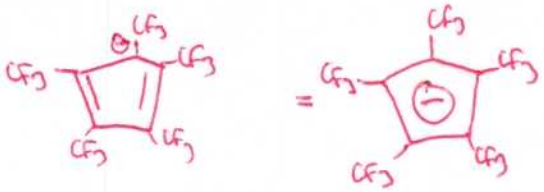
Based on arguments of aromaticity, would you expect the following compound to be one of the world's strongest acids or one of the world's strongest bases?



Acids donate H^+

$\rightleftharpoons$

H^+



aromatic anion

$pK_a < -2$ (stronger than Nitric Acid!!)