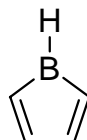
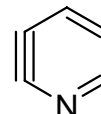
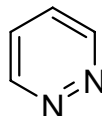
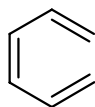


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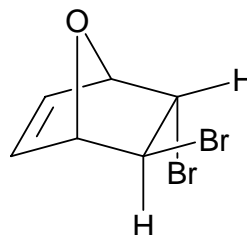
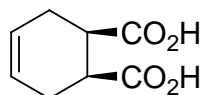
To **not** have your graded script placed outside my office please check this box

1) Draw a Lewis structure for a chemical species whose bonding is not accurately described by a Lewis Structure, and draw a more realistic delocalized / hybrid representation of that species. (3pts)

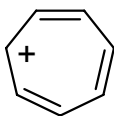
2) Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (15pts)



3) How many chiral centers are in each of the following molecules? (4pts)

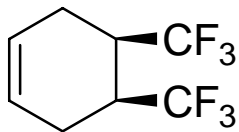


4) By applying the polygon rule to the below cyclic hydrocarbon:



- draw out the MO energy level diagram
- label the MO's using $\pi_1 \dots \pi_7^*$
- circle one pair of degenerate orbitals
- draw in the electrons and predict whether this compound is aromatic or antiaromatic. (8pts)

5) The following compound was produced in a Diels-Alder reaction.

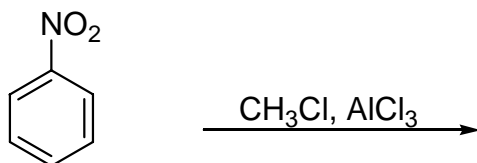
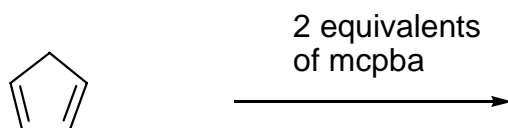
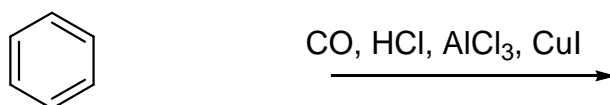
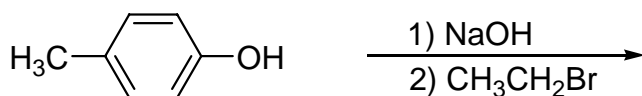
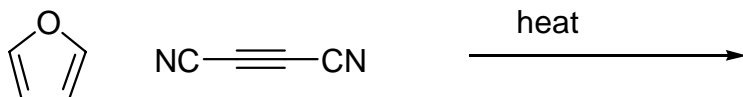


How many sp^3 hybridized carbons are in this molecule?

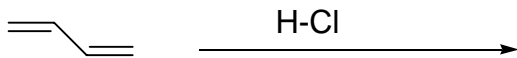
Are trifluoromethyl substituents *electron donating* or *electron withdrawing*?

Draw the diene and dienophile which react together to give this product.
(10pts)

6) Predict the products in the following reactions (if you believe no reaction will occur, indicate this!), paying attention to regio/stereochemistry where applicable. (21pts)

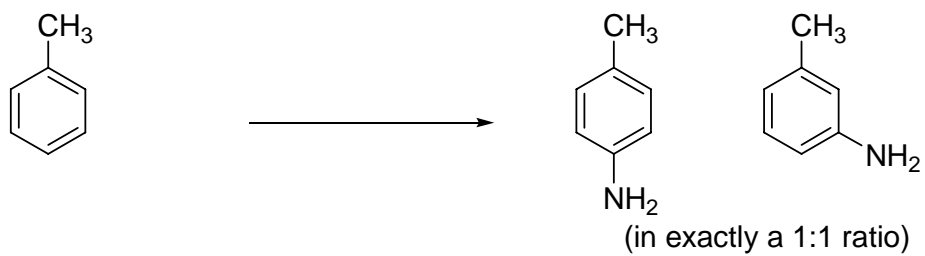
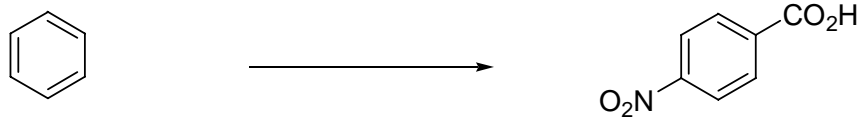


7) When one equivalent of hydrogen chloride is added to the following conjugated diene, a mixture of two products is formed.

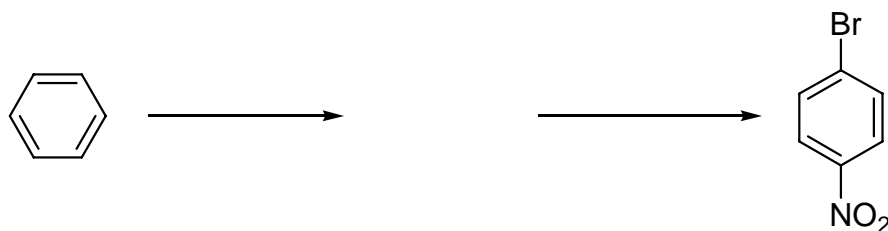
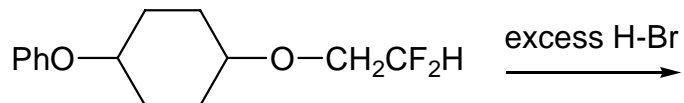
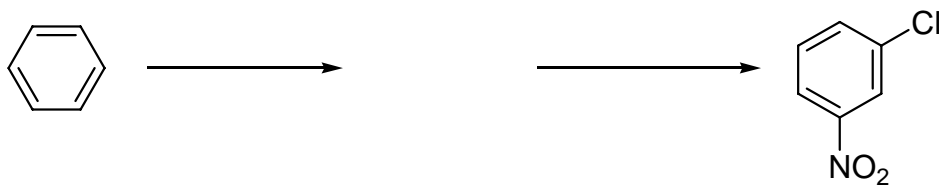
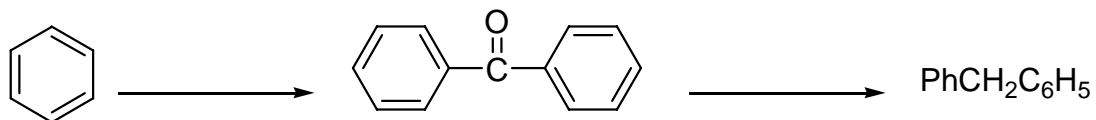
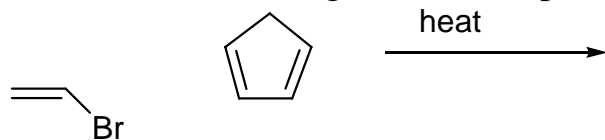


- i) Draw the two products
- ii) Provide the step-by-step mechanism which explains the generation of both products.
- iii) If the reaction temperature was increased by 69°C , which product would increase in yield? (9pts)

8) Design synthetic routes for the following two transformations. (12pts)

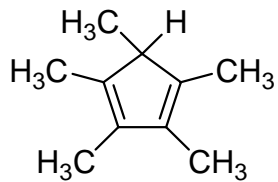
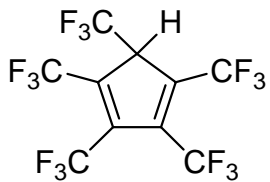


9) Please fill in the blanks (reagents and compounds). (18pts)



***Bonus question* (up to 3pts)**

Predict, with an explanation, which of the two below compounds is the most acidic.

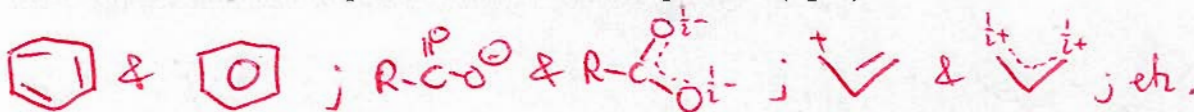


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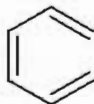
1) Draw a Lewis structure for a chemical species whose bonding is not accurately described by a Lewis Structure, and draw a more realistic delocalized / hybrid representation of that species. (3pts)



2) Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (15pts)



Non



Non



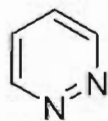
Non



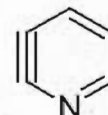
Anti



Anti



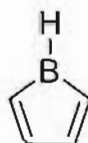
Aromatic



Aromatic



Aromatic

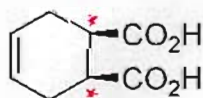


Anti

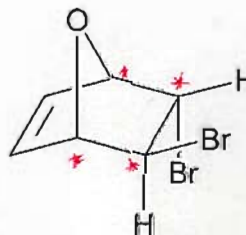


Aromatic

3) How many chiral centers are in each of the following molecules? (4pts)



2



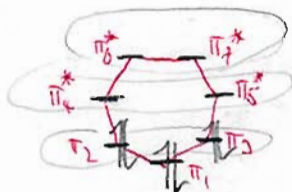
4

4) By applying the polygon rule to the below cyclic hydrocarbon:



- draw out the MO energy level diagram ✓
- label the MO's using $\pi_1 \dots \pi_7^*$ ✓
- circle one pair of degenerate orbitals ✓
- draw in the electrons and predict whether this compound is aromatic or antiaromatic. (8pts) ✓

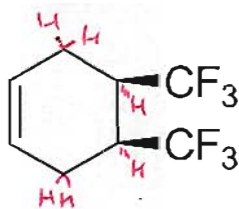
degenerate = same energy



$6\pi e^- \Rightarrow$ closed bonding shell

\Rightarrow AROMATIC

5) The following compound was produced in a Diels-Alder reaction.



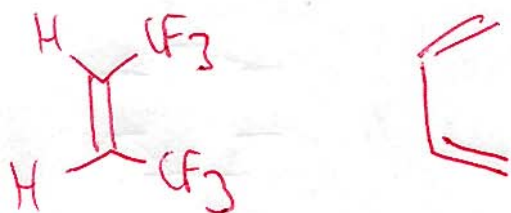
How many sp^3 hybridized carbons are in this molecule?

6

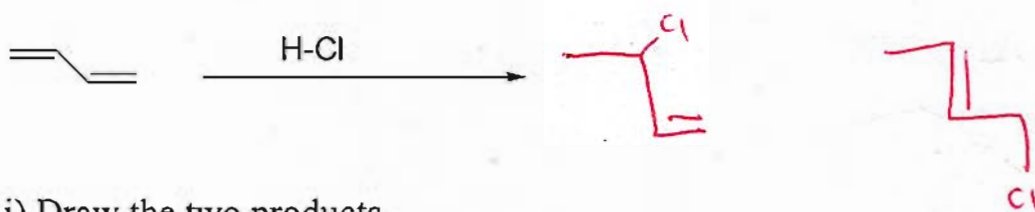
Are trifluoromethyl substituents *electron donating* or *electron withdrawing*?

Electron Withdrawing

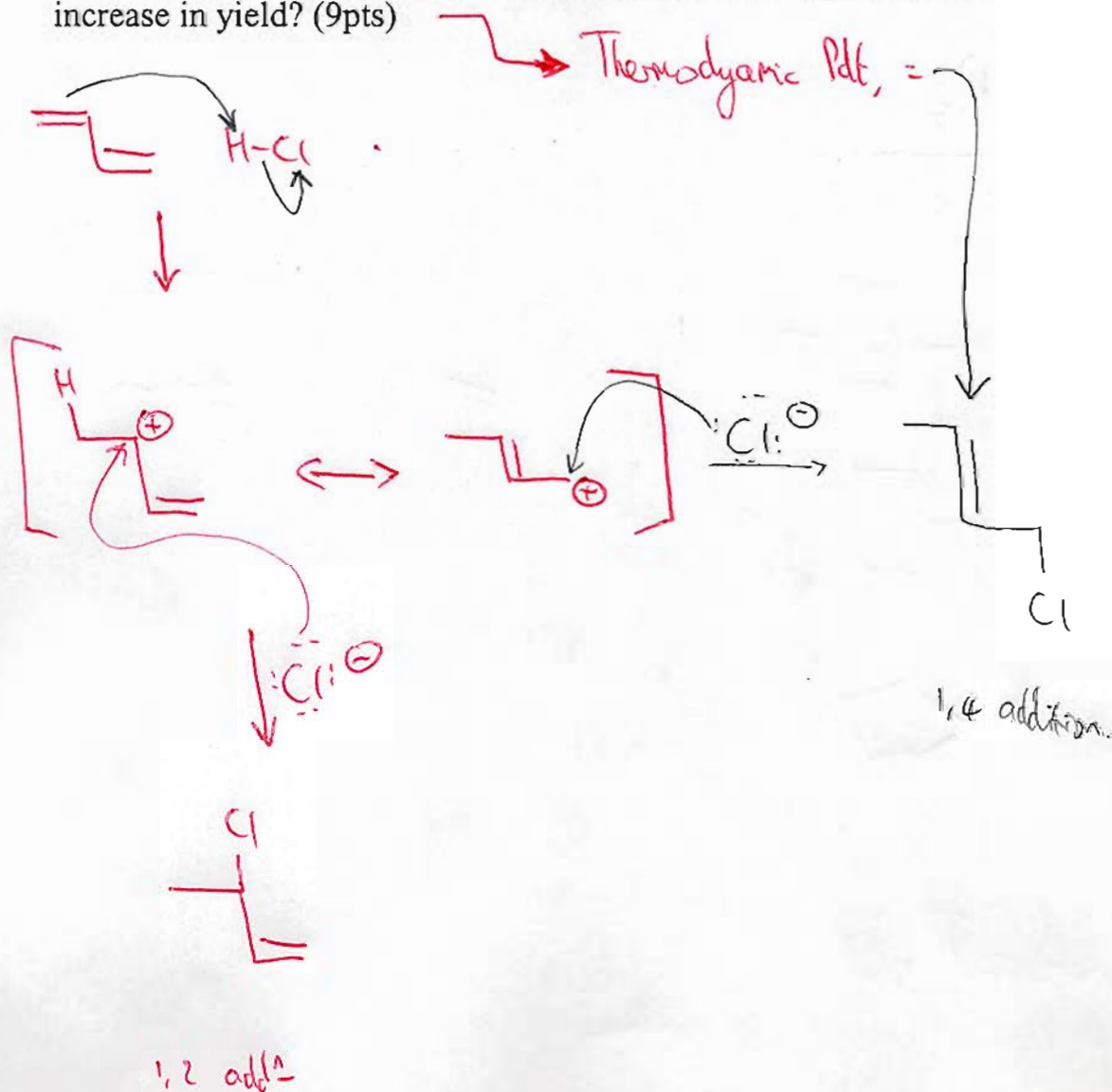
Draw the diene and dienophile which react together to give this product.
(10pts)



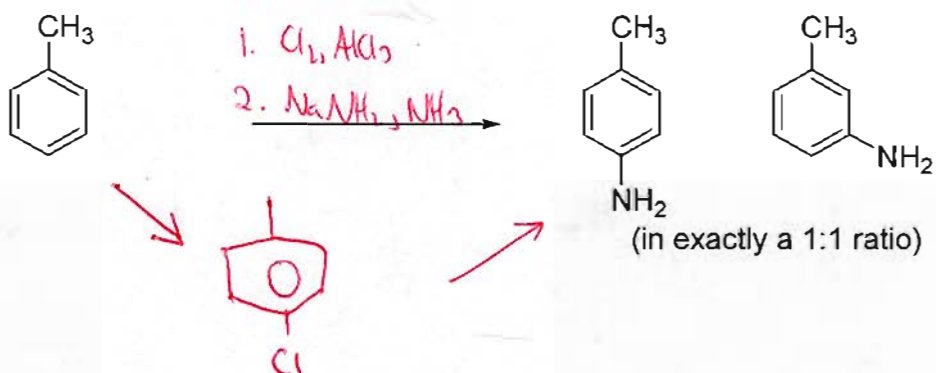
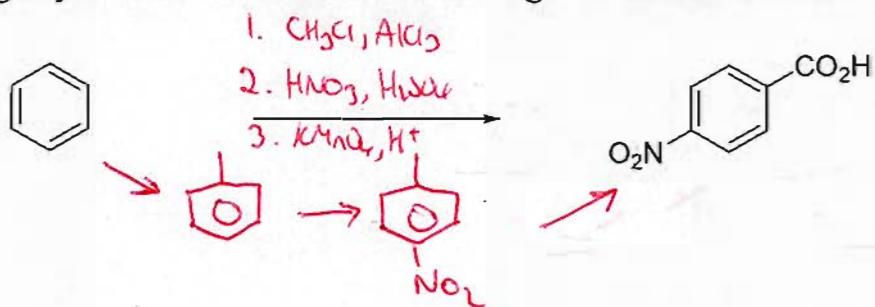
7) When one equivalent of hydrogen chloride is added to the following conjugated diene, a mixture of two products is formed.



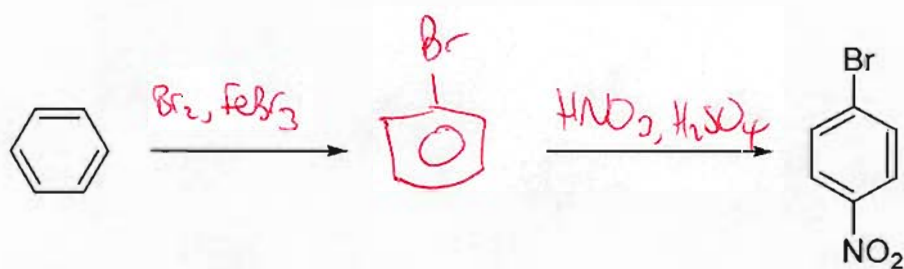
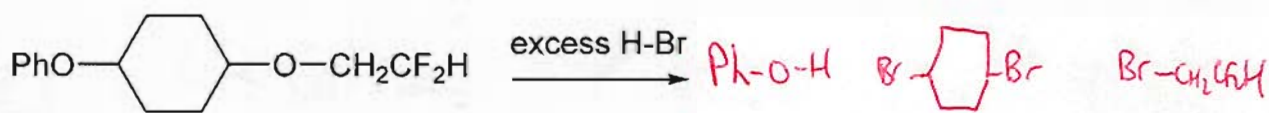
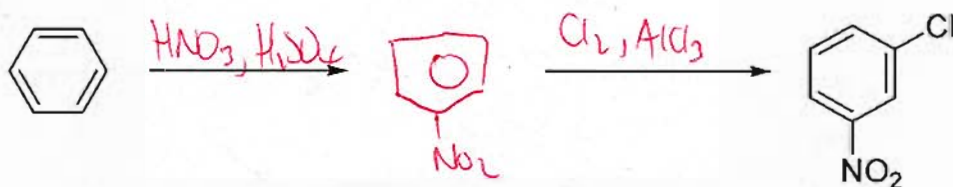
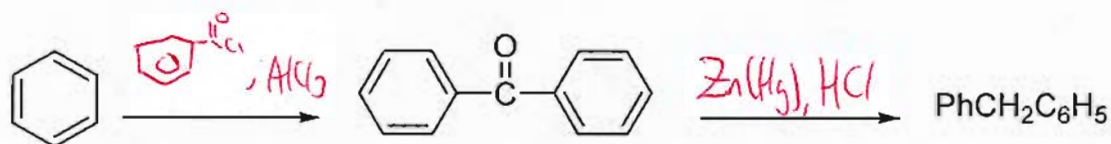
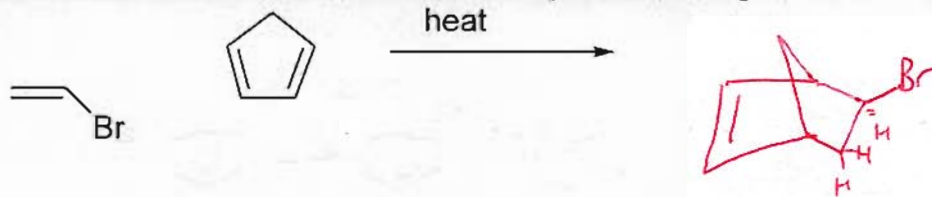
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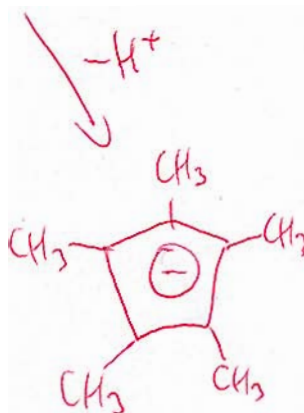
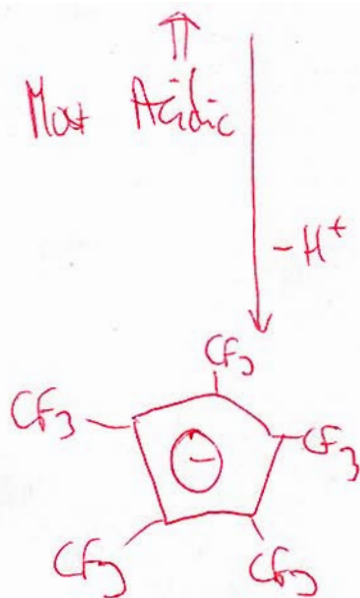
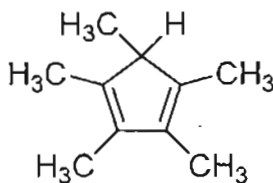
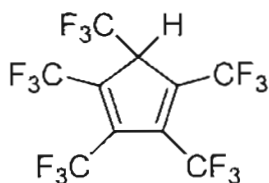


9) Please fill in the blanks (reagents and compounds). (18pts)



***Bonus question* (up to 3pts)**

Predict, with an explanation, which of the two below compounds is the most acidic.



Both compounds yield AROMATIC Anions upon proton donation. But the CF_3 groups are e^- withdrawing, and therefore the anion is further stabilized.

This is the more stable anion, & \therefore its conjugate acid is more Acidic.