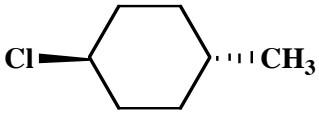
Answers

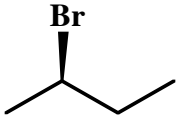
JASPERSE CHEM 350 FINAL EXAM VERSION 1
150 points total

1. Provide names or structures for the following. 2 points each. Specify stereochemistry when appropriate!



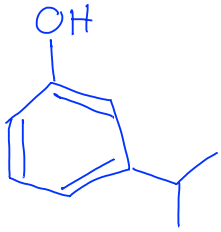
trans-1-chloro-4-methylcyclohexane

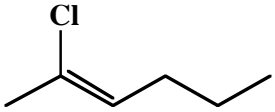
Note: Version 1 is relatively representative in terms of length. Version 2 is longer than the real test will be. But provides lots more practice.



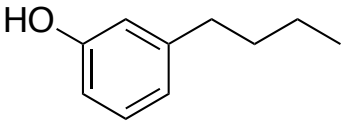
(R)-2-bromobutane

m-isopropylphenol



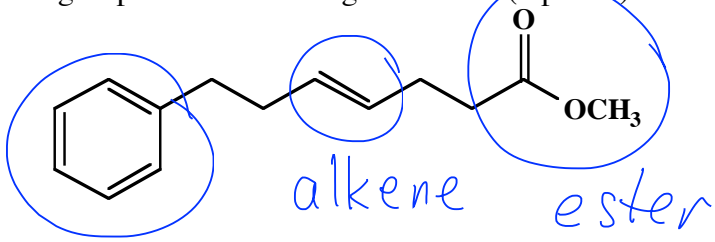


Z-2-chloro-2-hexene

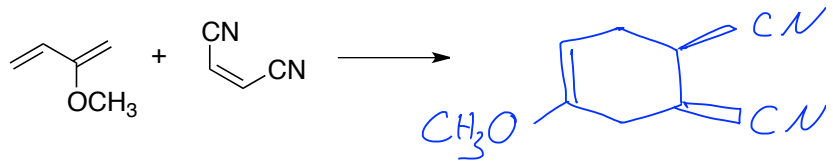


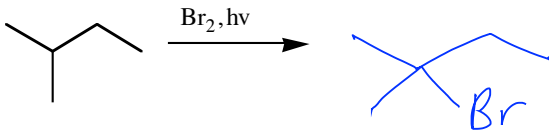
m-butylphenol
or meta-butylphenol
or 2-butylphenol

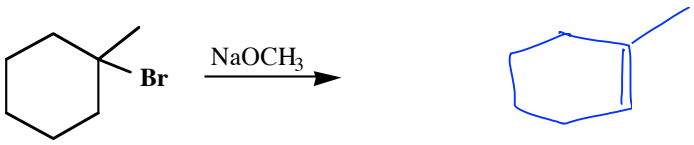
2. Identify the functional groups in the following molecule. (4 points)



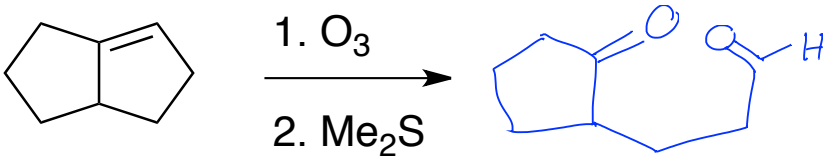
3. Predict the major products for the following reactions. Pay careful attention when orientation is a factor. Draw just one major product in each case. (3 points each)

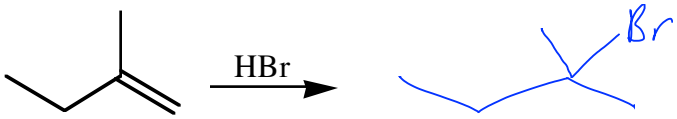




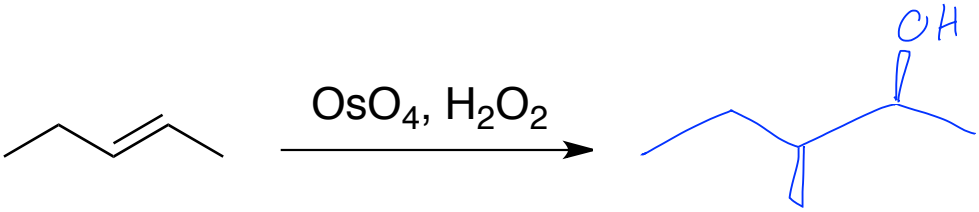


3°, so E2 not SN2. Zaytsev

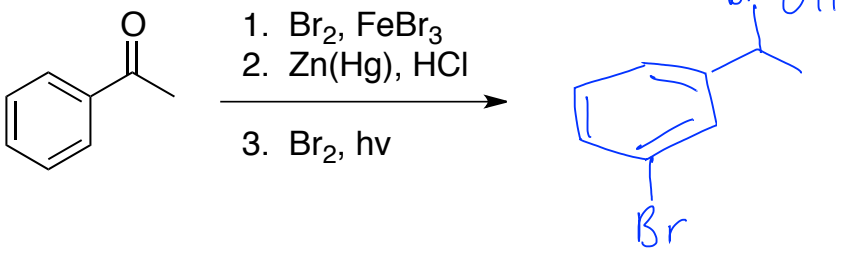


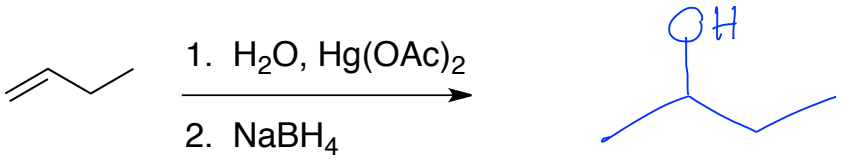


Markovnikov

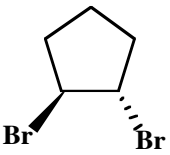
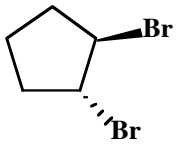


cis addition

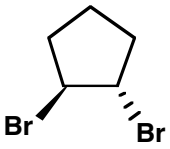
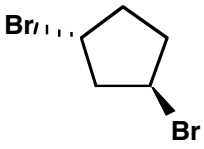




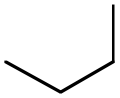
4. Classify the pairs of molecules as totally different, identical, structural isomers, diastereomers, or enantiomers. (2 points each)

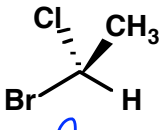
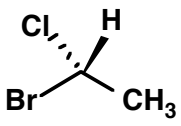
enantiomers

structural isomers

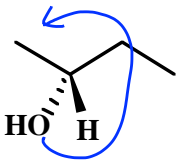
identical

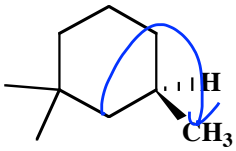
enantiomers

R S

5. Classify each chiral carbon as R or S. (2 points each)

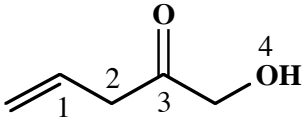


R



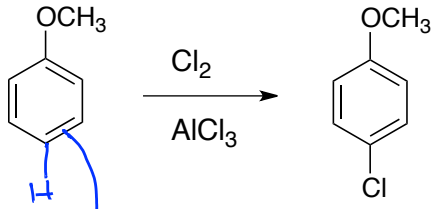
R

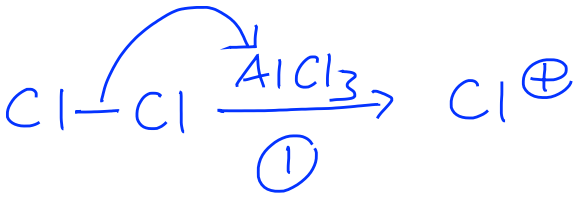
6. Classify the hybridization and bond angles (109, 120, or 180) at the labelled atoms. (5 points)



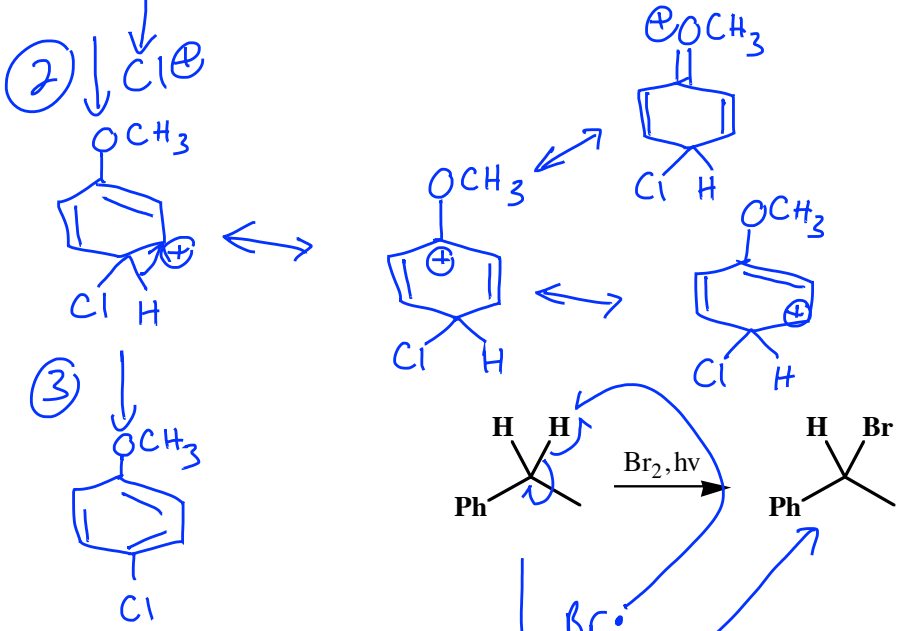
C-1 sp^2 120 C-2 sp^3 109 C-3 sp^2 120 O-4 sp^3 109

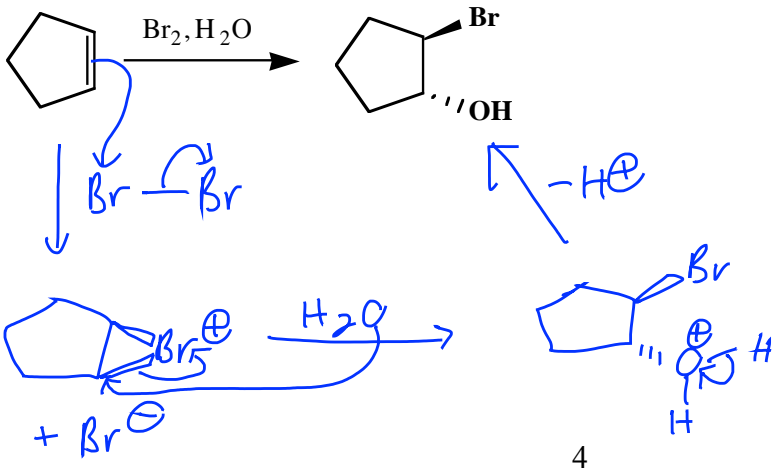
7. Draw the mechanisms for the following reactions. For any radical reactions, draw propagation steps only. 5 points each.



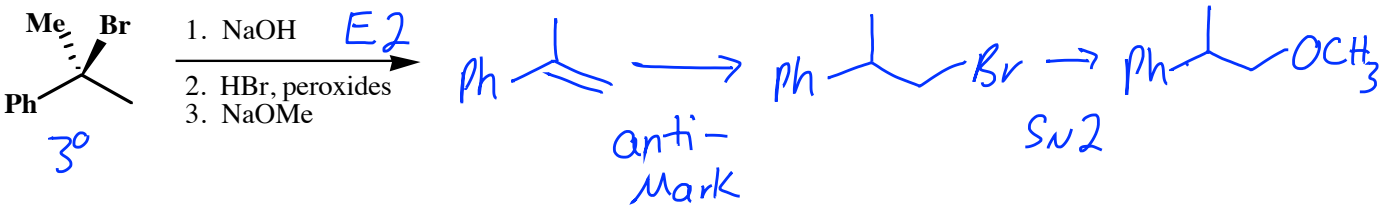


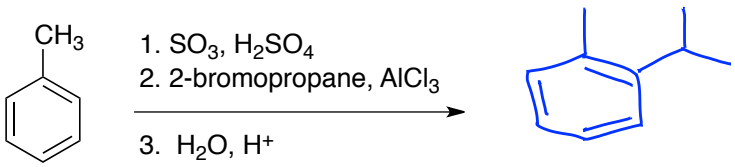
Draw the resonance structures for the cation intermediate.

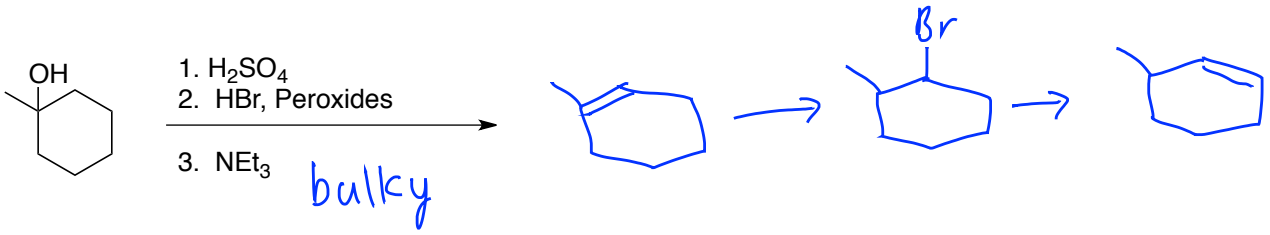




8. Draw the products of the following multi-step sequences. (4 points each)



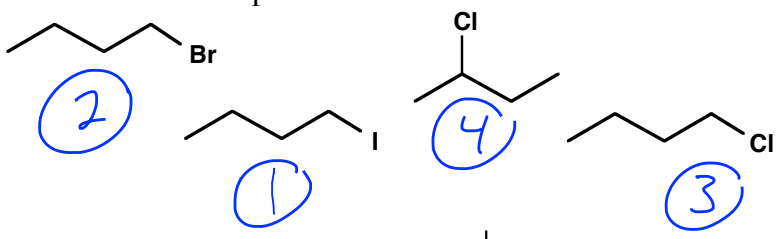




9. Draw as many structural isomers as you can for C_6H_{14}. Circle any that are chiral. (Note: be careful! You will lose points for any repeats!) (6 points)

10. Rank the Following, from most to least. 2 points each.

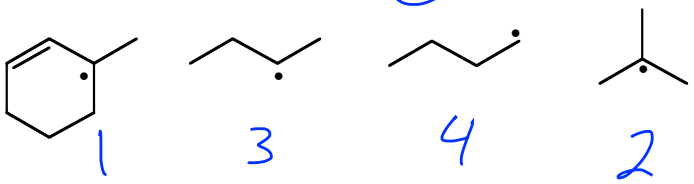
a. Reactivity toward S_N2



I > Br > Cl

1° > 2°

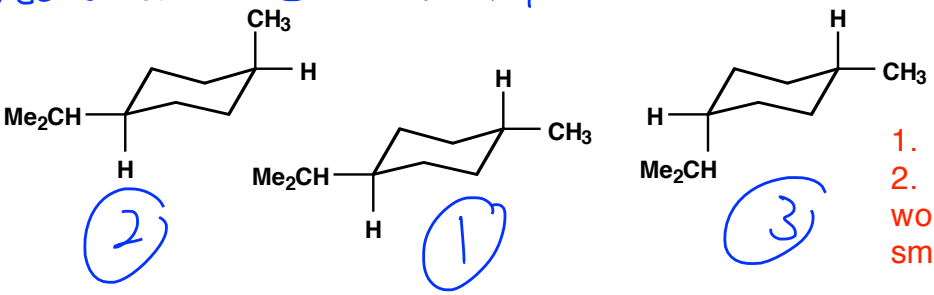
b. Stability



1 3 4 2

① allylic > isolated ② 3° > 2° > 1°

c. Stability



2 1 3

1. Equatorial preferred
2. If forces to be axial, worse for big group than for smaller group

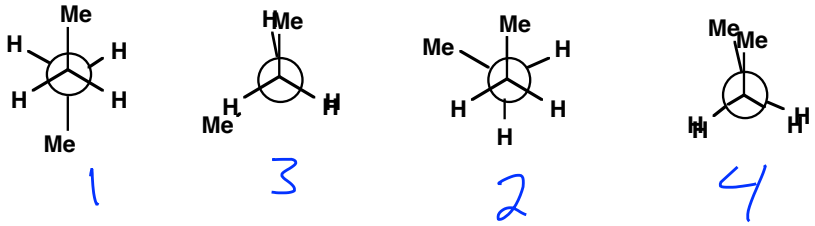
d. Acidity

$PhCO_2H$ $(CH_3)_2NH$ HCl CH_3CH_2OH

2 4 1 3

1. Anion stability
2. HCl by memory is strong
3. Electronegativity factor
4. Resonance factor

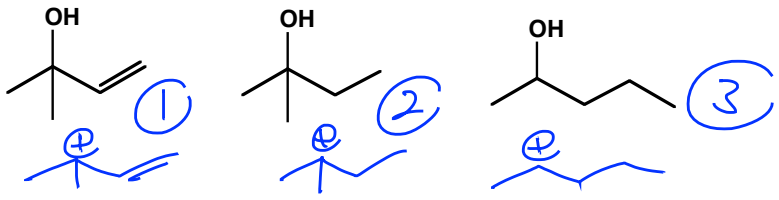
e. Stability



1 3 2 4

1. staggered vs eclipsed
2. Anti > gauche
3. Eclipsed > total eclipsed

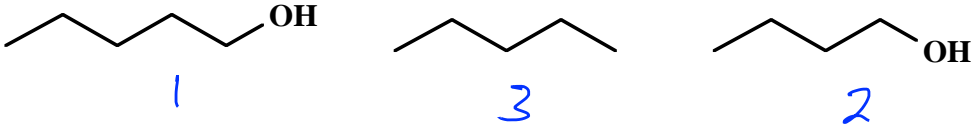
f. Reactivity toward H_2SO_4/Δ catalyzed dehydration



① ② ③

Cation stability is key

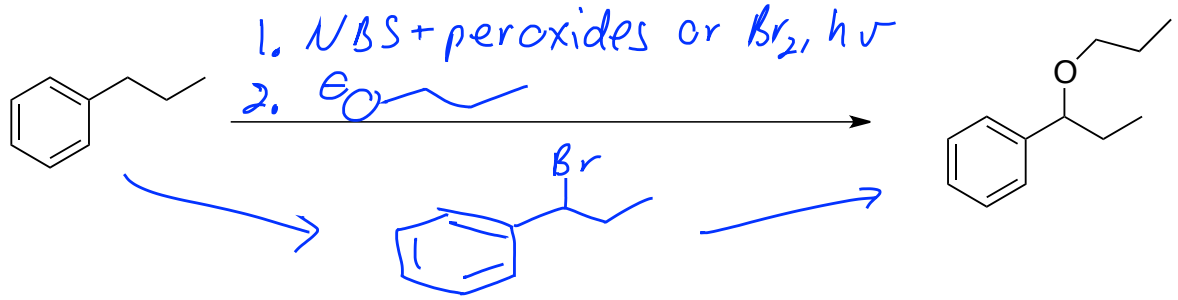
g. Boiling Point

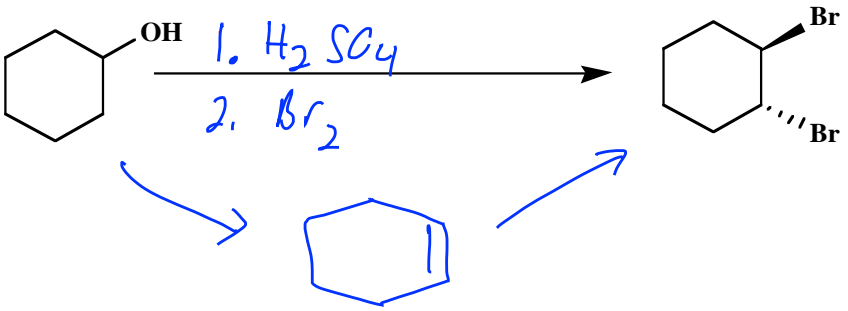


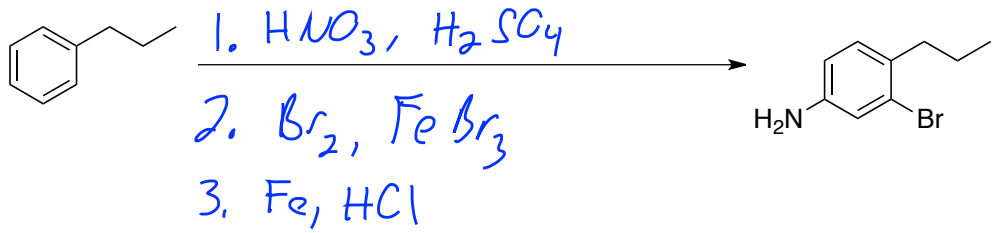
1 3 2

1. Hydrogen bonding
2. Molecular weight factor

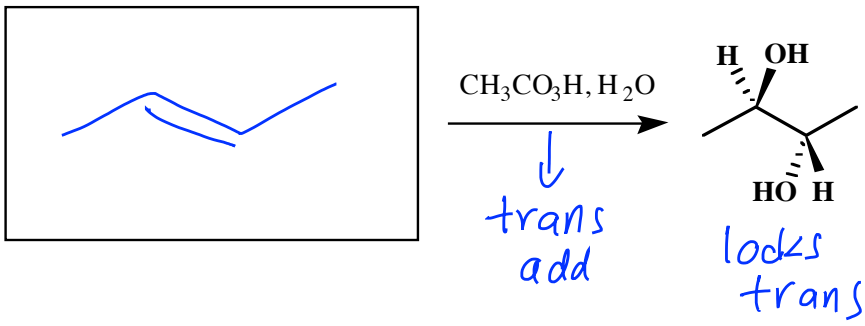
11. Provide reagents for the following transformations. You may use anything you like. Each can be done within ≤3 steps. (4 points each)







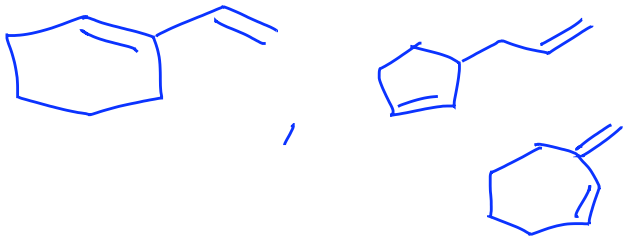
12. Provide the appropriate reactant for the following transformation. (3 points)



13. Suggest a structure for **X**, given the following info: (5 points)

Theory = 18
Actual = 12
Eu = 3

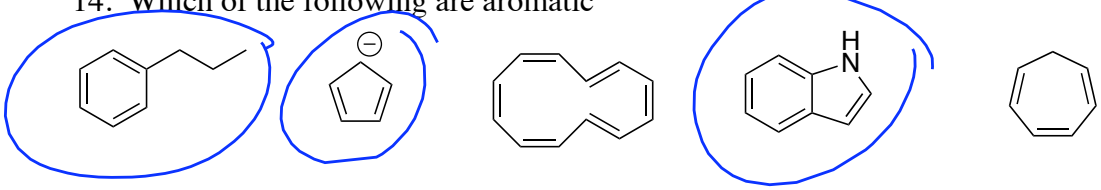
- Formula: C_8H_{12}
- It Reacts With excess H_2/Pt to produce C_8H_{16} → 2 alkenes
- When it reacts with O_3/Me_2S, one of the products is $CH_2{=}O$. → $=CH_2$ 1 ring



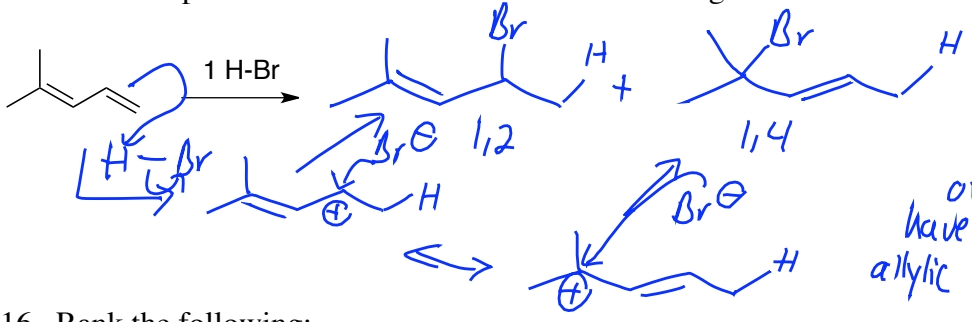
etc.

1 ring
2 alkenes
1 of the alkenes is on an end, $=CH_2$

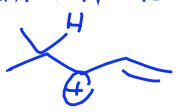
14. Which of the following are aromatic



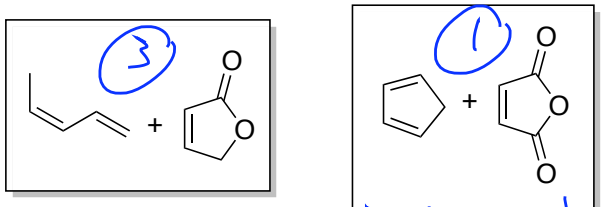
15. Draw the products and mechanism for the following reaction:



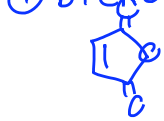
Protonation gives asymmetric allylic cation, leading to two isomers. Protonation on left end would have given an inferior allylic cation



16. Rank the following:

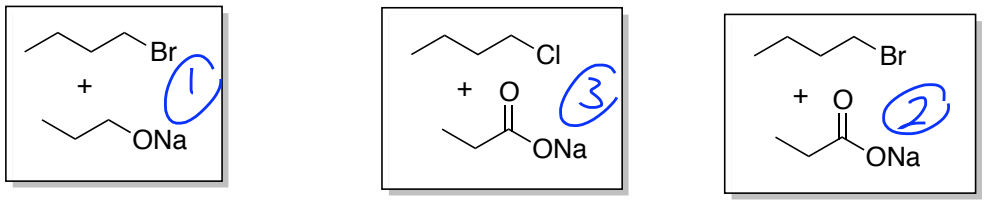


① Dienophile-wise better, two W groups



② Diene-wise

(always s-cis) > > > 2-methyl bad for s-cis's



Combined S_N2 Reactivity

RX: Br > Cl

Nuc: O⊖ > 8