

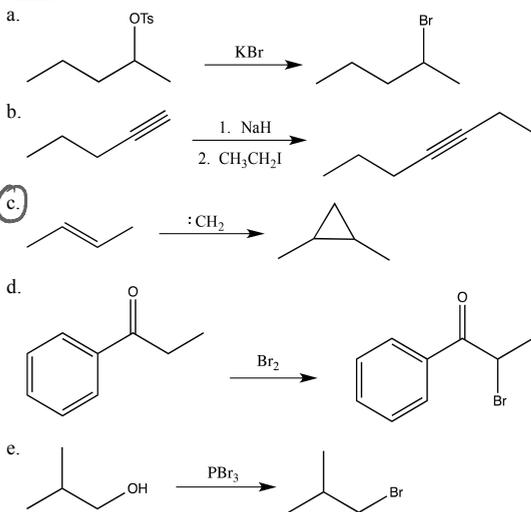
OC2 Exam 1

Name: Maria Vargas Domínguez

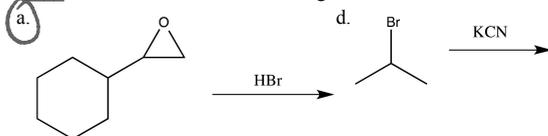
Date: 02/23/2021

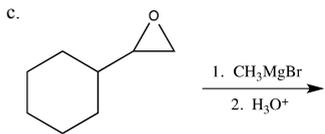
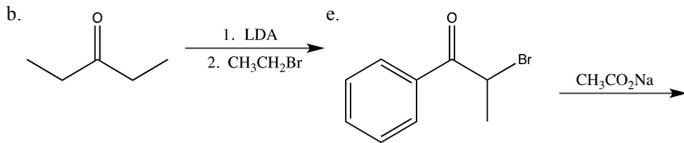
Multiple Choice (3 pts each)

C 1. Which of the following synthetic steps shows a reagent that is written *incorrectly*?

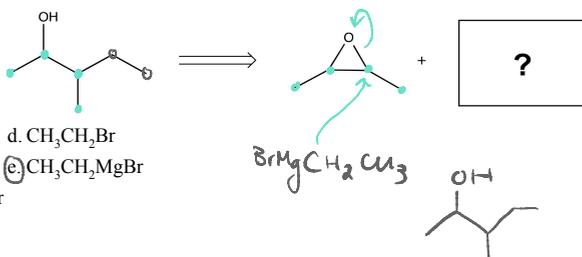


a 2. Which of the following would *not* alter the carbon skeleton of the starting material?



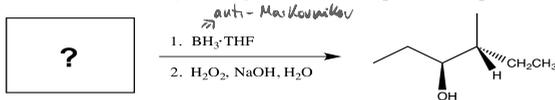


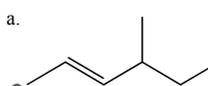
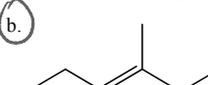
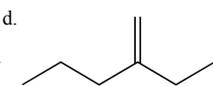
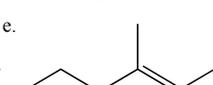
e 3. Fill in the missing precursor to complete the transform below.

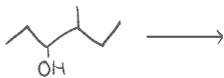


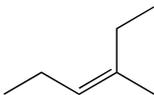
- a. CH_3Br
- b. CH_3MgBr
- c. $(\text{CH}_3)_3\text{MgBr}$
- d. $\text{CH}_3\text{CH}_2\text{Br}$
- e. $\text{CH}_3\text{CH}_2\text{MgBr}$

C 4. Determine the necessary starting material to complete the step below.

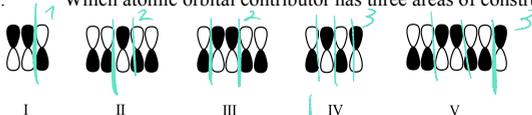


- a. 
- b. 
- c. 
- d. 
- e. 





e 5. Which atomic orbital contributor has three areas of constructive interference?



- a. I d. IV
 b. II **e. V**
 c. III

f 6. Which term can be used to define a molecule that is cyclic, planar, completely conjugated, and has four π electrons.

- a. Aromatic d. Semiaromatic
b. Antiaromatic e. None of the above
 c. Nonaromatic

c 7. Assuming all of the following molecules are planar, which one can be labeled antiaromatic?



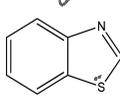
I



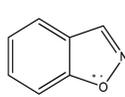
II



III



IV

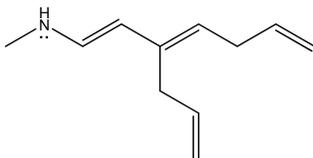


V

- a. I d. IV
 b. II e. V
c. III

$$8 \neq 4n + 2$$

C 8. How many electrons are in the following molecule's largest conjugated π system?

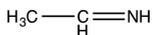


a. Two d. Eight

b. Four e. Ten

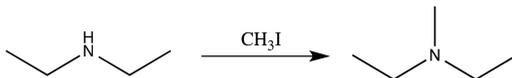
c. Six

d 9. What type of electron transition would create an absorption band at the longest wavelength in the UV-vis spectrum of the molecule below?



- ~~a. $\sigma^* \rightarrow \pi^*$~~ **$\pi \rightarrow \pi^*$** ~~b. $\pi \rightarrow \pi^*$~~ $\text{HOMO} \rightarrow \text{LUMO}$
~~c. $\sigma \rightarrow \pi^*$~~ ~~d. $\sigma \rightarrow \pi$~~ *transition*

C 10. If we wished to monitor a frequency to determine whether the reaction below had taken place, which frequency would be the best choice?



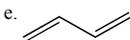
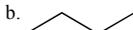
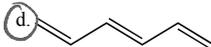
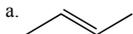
a. 2200 cm^{-1} d. 1050 cm^{-1}

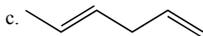
b. 1600 cm^{-1} e. 2950 cm^{-1}

c. 3300 cm^{-1}

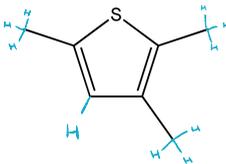
no N-H stretching

d 11. Which of the following would you expect to have the longest λ_{max} ?



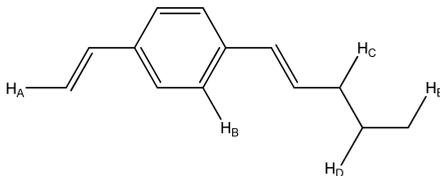


4 12. How many chemically distinct hydrogen atoms are in the following molecule?



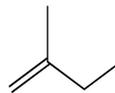
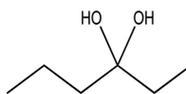
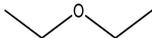
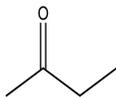
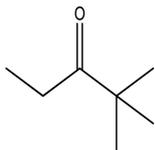
- a. Two types d. Five types
 b. Three types e. Six types
 c. Four types

e 13. Which hydrogen type has the smallest integration value?



- a. H_A d. H_D
 b. H_B e. H_E
 c. H_C

C 14. Which of the following molecules would have a quartet at 3.5 ppm?



- a. I d. IV
 b. II e. V

c. III

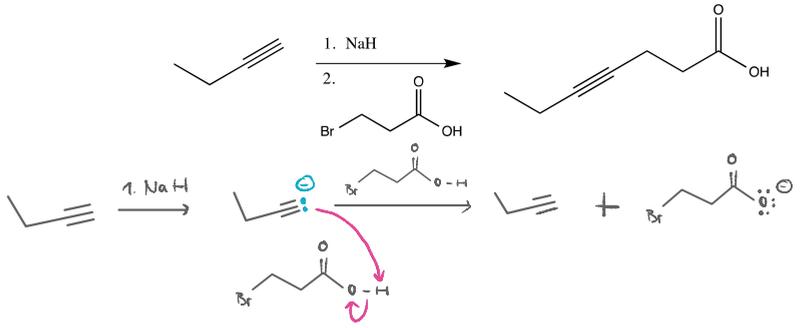
15. The mass spectrum for an unknown molecule has an M^+ peak with a relative intensity of 50 and an $M+1$ peak with a relative intensity of 1.65. How many carbons are in the unknown molecule?
- a. One carbon
 - b. Two carbons
 - c. Three carbons
 - d. Four carbons
 - e. Six carbons

$M^+ = 50\%$
 $M+1 = 1.65\%$

$$\frac{1.65}{50} \cdot \frac{100\%}{1.1\%} = 3.3 \Rightarrow \approx 3 \text{ Carbons}$$

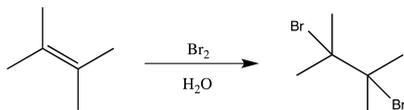
Short Answers (5 pts each)

1. A student proposes the following synthesis. Explain why this reaction would not work as intended.



The alkyne ion will not attack the carbon adjacent to the bromine, it will attack the hydrogen on the carboxylic due to the big difference of partial charges, and therefore Electronegativity.

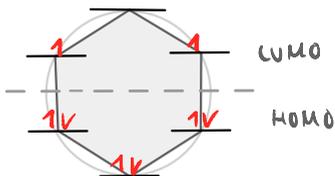
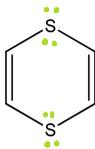
2. A student proposes the following synthetic step. Explain the potential error in this proposed step, and suggest a better alternative to carry out the desired synthetic transformation.



Water is not the best solvent to use in this case, because it will produce also the addition of a hydroxy gr.

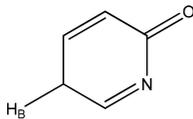
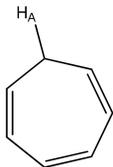
Instead, the student could use CCl_4 , which is a non-nucleophilic solvent, & it will not produce the synthetic trap seeing in the example.

3. Assume that the following molecule is planar. Use the Frost method to explain whether it is aromatic, antiaromatic, or nonaromatic. In your Frost diagram, fill in all π electrons, and label the HOMO and the LUMO.



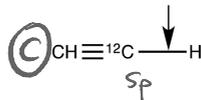
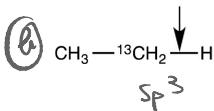
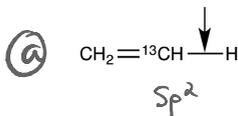
Not Aromatic, number of π electron is 8 \Rightarrow it does not follow Huckel's rule

4. Which is more acidic, H_A or H_B ? Explain.



H_B is more acidic than H_A due to the presence of electronegative atoms in the compound.

5. Rank the following bonds in order of increasing stretching vibration frequency. Explain the reason.



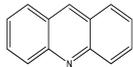
$b < a < c$

Compound (c) has the higher stretching vibration frequency, due to its sp hybridization. Because it is sp hybridized, it possesses more s character, so it has a higher energy, & it is stronger than sp^3 & sp^2 . The molecular mass of compound c is also lower, & as molecular mass decreases vibrational frequency increases.

6. Assuming all of the following molecules are planar, which one can be labeled antiaromatic, and why?



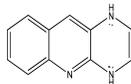
I
10



II ✓
14



III ✓
10



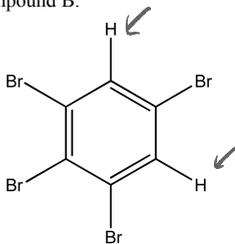
IV
16 ✗



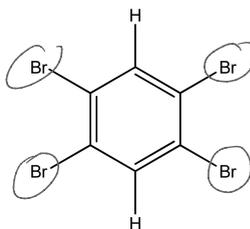
V ✓
10

Compound IV has 6 π electrons & it is therefore antiaromatic.

7. Explain how coupling constants can be used to determine whether an NMR spectrum represents compound A or compound B.



Compound A



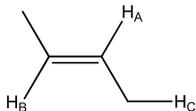
Compound B

equivalents

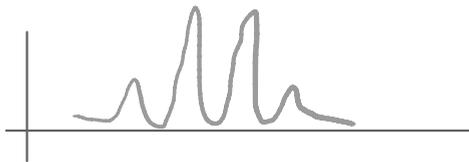
In Compound A the two hydrogens are in meta position from each other. However, in Compound B, the hydrogens are in para position from each other.

Therefore, Compound A the protons will couple & show peaks on the spectrum, while Compound B will not (doublets) couple & will not show anything

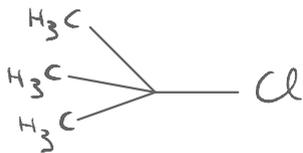
8. Draw a splitting diagram for H_A and indicate the expected splitting pattern.



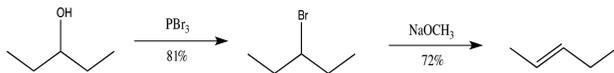
The splitting pattern will be a quartet



9. A molecule has the formula C_4H_9Cl , and its 1H NMR spectrum has only one singlet at 1.49 ppm. Give the structure of this molecule.

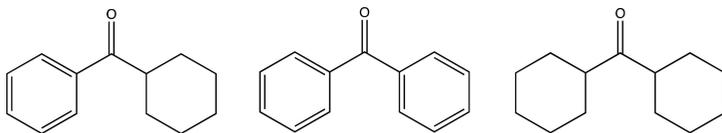


10. Calculate the overall percent yield of the following synthetic sequence.



$$0.81 \cdot 0.72 = 58\%$$

11. Rank the following in order of increasing C=O stretching frequency, and explain the reason.



1

2

3

$$3 > 1 > 2$$

The least conjugated compound will represent the highest C=O stretching. Compound two passes two benzene rings, which are more stable than the other two compounds. All the carbons in compound 2 are sp^2 -hybridized, so, as said before, it will have a higher s character overall, and it will have a lower stretching frequency.

