

Midterm 2

● Graded

Student

SAMUEL KATZ

Total Points

35.5 / 44.5 pts

Question 1

Question 1

5 / 7 pts

1.1 A through D

3 / 4 pts

- 1 pt a) Incorrect

- 1 pt b) Incorrect

✓ - 1 pt c) Incorrect

- 1 pt d) Incorrect

- 0 pts All correct

1.2 (no title)

2 / 3 pts

- 1 pt e) Incorrect

- 1 pt f) Incorrect

✓ - 1 pt g) Incorrect

- 0 pts All Correct

Question 2

Question 2

4 / 5 pts

- 1 pt 1st Blank

✓ - 1 pt 2nd Blank

- 0.5 pts 2nd - mentioned intermolecular forces

- 1 pt 3rd Blank

- 1 pt 4th Blank

- 1 pt Incorrect Answer

- 0 pts All Correct

Question 3

Question 3

4 / 5 pts

- 0 pts Correct

- 1 pt a) First molecule incorrect

- 1 pt a) Second molecule incorrect

- 1 pt a) Third molecule incorrect

- 1 pt a) Fourth molecule incorrect

- 1 pt b) Incorrect meso compound

- 0.5 pts b) Correct meso compound + 1 incorrect meso compound

Question 4

Question 4

3.5 / 4 pts

- 0 pts Correct

- 0.5 pts a) 1 errors

- 1 pt a) 2 or more errors

- 1 pt b) incorrect

- 0.5 pts c) I. incorrect

- 0.5 pts c) II. incorrect

- 0.5 pts c) III. incorrect

- 0.5 pts c) IV. incorrect

Question 5

Question 5

5 / 6 pts

5 a)

- 0 pts All correct

✓ - 1 pt Wrong or no proton circled

- 1 pt Wrong conjugate base based on circled proton

- 1 pt Wrong factor circled

5 b)

✓ - 0 pts All correct

- 1 pt Wrong or no proton circled

- 1 pt Wrong conjugate base based on circled proton

- 1 pt Wrong factor circled

- 0 pts All correct

- 6 pts All incorrect

Question 6

Question 6

3 / 4 pts

- 0 pts Correct

✓ - 1 pt Incorrect arrow pushing

- 1 pt Circle the wrong acid-base pair

- 1 pt Mentioned the most stable anions but wrong resonance structures or wrong explanation

- 2 pts Incorrect explanations

- 1 pt Exceed words limitation

Question 7

Question 7

2 / 2 pts

✓ - 0 pts Correct

- 1 pt Partially correct

- 2 pts Incorrect

Question 8

Question 8

3.5 / 3.5 pts

✓ - 0 pts Correct

- 0.5 pts 1st molecule incorrect # H's

- 0.5 pts 1st molecule incorrect # C's

- 0.5 pts 2nd molecule incorrect # H's

- 0.5 pts 2nd molecule incorrect # C's

- 0.5 pts 3rd molecule incorrect # H's

- 0.5 pts 3rd molecule incorrect # C's

- 0.5 pts incorrect structure circled

Question 9

Question 9

1.5 / 4 pts

- 0 pts Correct

- 1.5 pts incorrect 1st resonance structure or structure doesn't put positive charge on the carbon attached to proton of interest

✓ - 1.5 pts incorrect 2nd resonance structure or structure doesn't put negative charge on the carbon attached to proton of interest

✓ - 1 pt incorrect explanation

- 0.5 pts partially correct explanation

Question 10

Question 10

4 / 4 pts

✓ - 0 pts All Correct

- 0.5 pts Molecule A Ha Incorrect (d)

- 0.5 pts Molecule A Hb Incorrect (q)

- 0.5 pts Molecule A Hc Incorrect (s)

- 0.5 pts Molecule B Ha Incorrect (d)

- 0.5 pts Molecule B Hb Incorrect (hep)

- 0.5 pts Molecule B Hc Incorrect (s)

- 1 pt Spectrum Assignment Incorrect (A)

- 4 pts All Incorrect/Blank

Name (Last, First): _____

1. For each question, choose the best answer and write your answer in the box(es) provided. For True or False questions, write T for True and F for False.

B

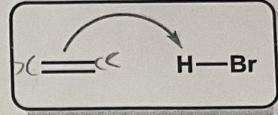
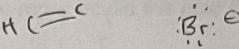
- a) Which of the following terms best describes the role of ethene in the acid-base reaction shown to the right?

A) Brønsted-Lowry acid
donate H⁺

B) Brønsted-Lowry base
receive H⁺

C) Lewis acid
receive LP

D) none of the above



giving LP
L-E getting H

D

- b) Which of the following molecules generally does not behave as an electrophile?

A) BCl_3

B) H_2S

C) H_3O^+
cancel dipole

D) Me_3N

wants electrons

C

- c) Triglycerides are more soluble in oil than water due to (shown below):

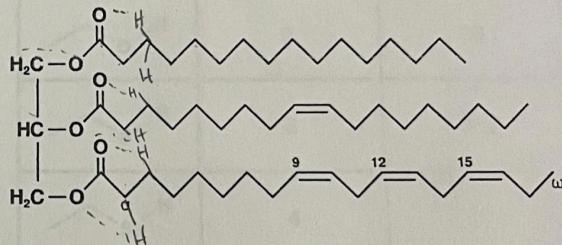
Like dissolves like

A) Hydrogen-Bonding Interactions

B) Dispersion Interactions

C) Dipole-Dipole Interactions

D) All of the above



D

- d) The relative peak intensities of multiplets can be described with the "Pascal triangle." Using the Pascal triangle, what is the correct ratio of the intensities of a quintet?

A) 1:1:1:1:1

B) 1:2:3:2:1

C) 1:3:6:3:1

D) 1:4:6:4:1

E) none of the above.

Name (Last, First): _____

F

e) True or False: The less stable the conjugation base (A^-), the more acidic the acid (HA).

Strong B^- weak acid

F

f) True or False: H-Cl ($pK_a = -8.0$) is $\times 2$ more acidic than H-I ($pK_a = 10$).

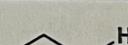
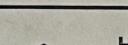
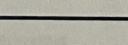
100x

T

g) True or False: K^+ interacts with benzene via pi-stacking interactions.

2. The following questions refer to the chart below which shows the boiling points of ethanol derivatives of various chalcogenide (group 16 elements: O, S, Se, and Te). For questions **a** and **b** complete the sentences using a single word or term. For question **c**, circle yes or no.

a) The steady increase in boiling points in going from Period 3 to Period 5 elements is due to greater atomic radius, which results in stronger dipole-dipole forces.

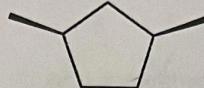
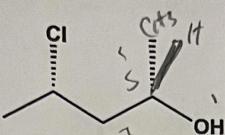
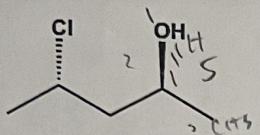
	Chalcogenide Period	Boiling Point (°C)
	2	78
	3	35
	4	53
	5	84

b) The sharp decrease in boiling points in going from Period 2 to Period 3 elements is due to stronger hydrogen bonding resulting from the greater electronegativity of the oxygen atom.

c) Do you expect the melting points to necessarily follow the same trends? Yes or No

Name (Last, First): _____

3. a) Indicate the relationship between the following pairs of compounds by filling in the appropriate bubble.



Identical

Constitutional Isomers

Enantiomers

Diastereomers

Unrelated

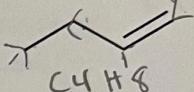
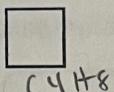
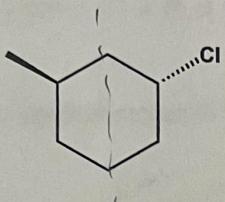
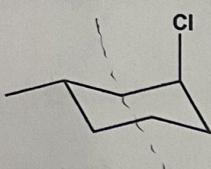
Identical

Constitutional Isomers

Enantiomers

Diastereomers

Unrelated



Identical

Constitutional Isomers

Enantiomers

Diastereomers

Unrelated

Identical

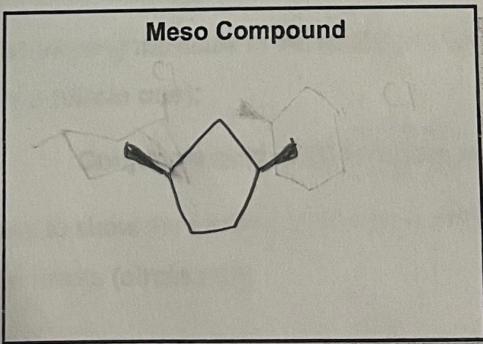
Constitutional Isomers

Enantiomers

Diastereomers

Unrelated

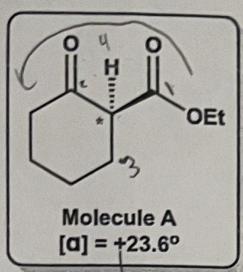
b) At least one of the structures above is a meso compound. Draw the molecule in the box provided below.



Name (Last, First): _____

4. Answer the next few questions about Molecule A, shown below.

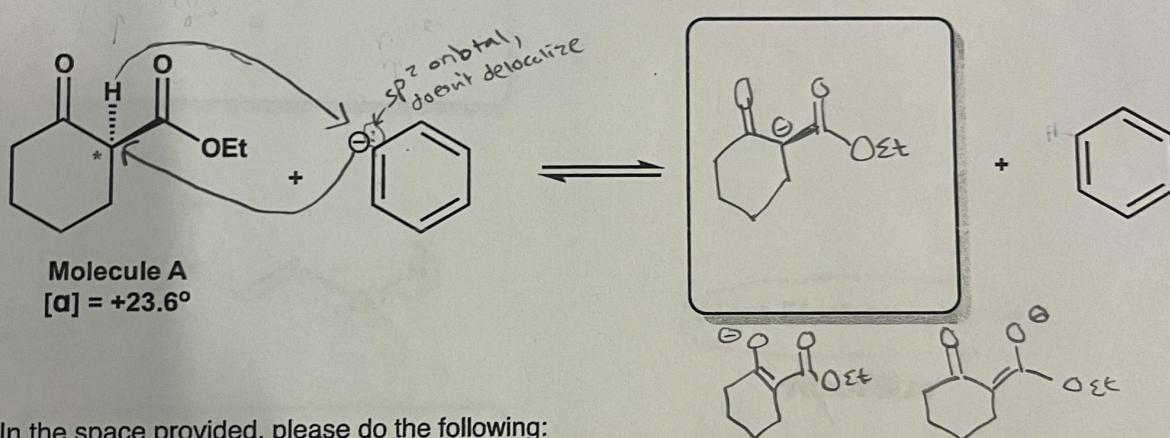
a) Circle the terms that correctly describe the molecule



- Dextrorotatory
Contains an Ester
Levoflatory
Racemic
H-Bond Acceptor
Optically Active
H-Bond Donor
Meso Compound

b) Assign the absolute configuration (*R* or *S*) of the chiral center in Molecule A: *S*

c) Molecule A can react with another molecule in an acid-base reaction (shown below).



In the space provided, please do the following:

I. Draw the structure of the missing molecule in the space provided.

II. The missing molecule is a (circle one):

Conjugate acid Conjugate base

III. Clearly draw curly arrows to show the proton transfer from acid to base.

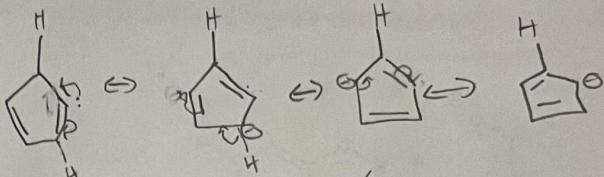
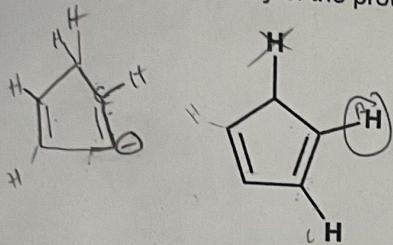
IV. The reaction equilibrium favors (circle one):

Reactants

Products

Name (Last, First): _____

5. a) Circle the most acidic proton in the molecules below and draw the conjugate base in the provided box (implicit hydrogen atoms do not need to be drawn). b) Circle the most important factor contributing to the greater acidity of the proton.



Atom Electronegativity

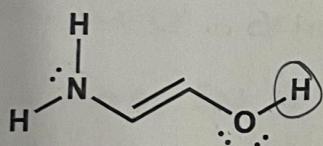
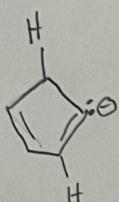
~~Atom Size~~

Resonance Stabilization

~~Induction Effect~~

Orbital Effect

Conjugate Base



Atom Electronegativity

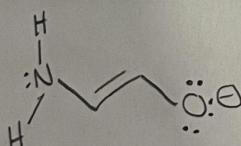
~~Atom Size~~

Resonance Stabilization

~~Induction Effect~~

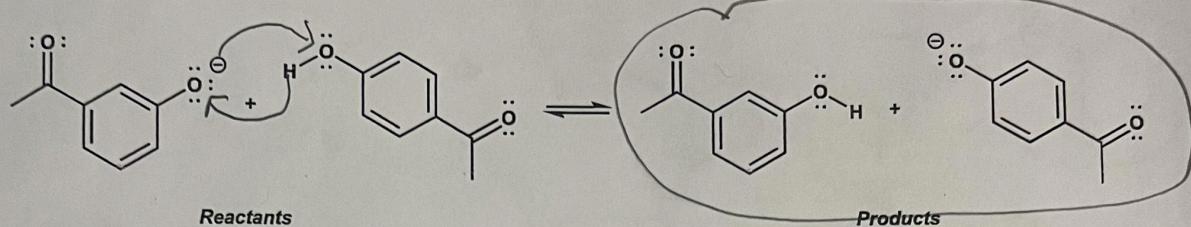
~~Orbital Effect~~

Conjugate Base

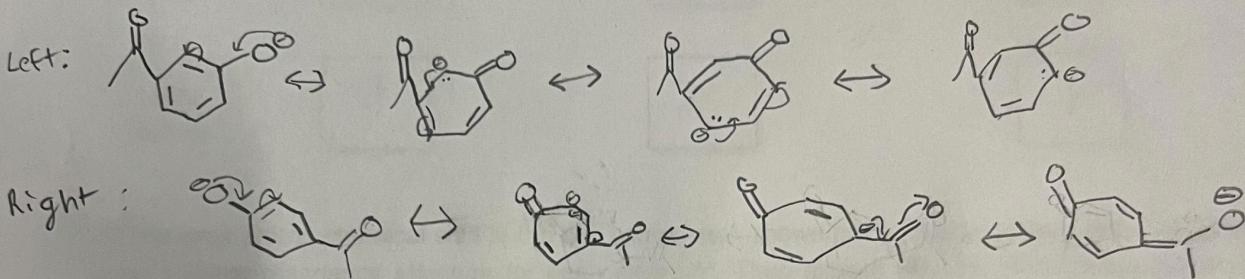


Name (Last, First): _____

6. Use curly arrows to show how the following acid-base pairs form the corresponding conjugate acid-base pair products. Circle the preferred acid-base pair (reactants or products) and provide an explanation (fewer than 30 words) for your selection. Include any relevant resonance structures that support your argument.

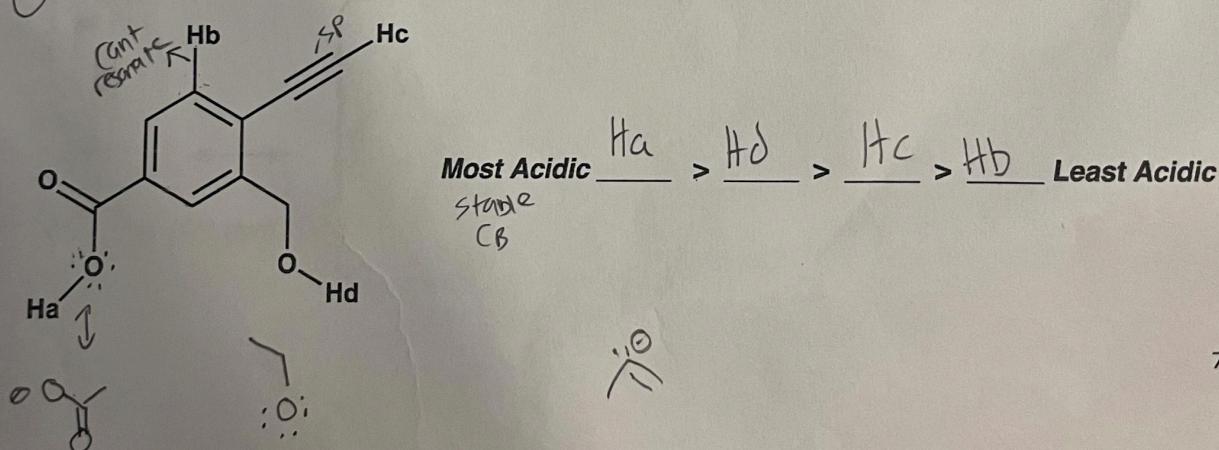


Explanation:



Explanation: LP is delocalized onto an oxygen, which is more EN than a carbon, promoting stability.

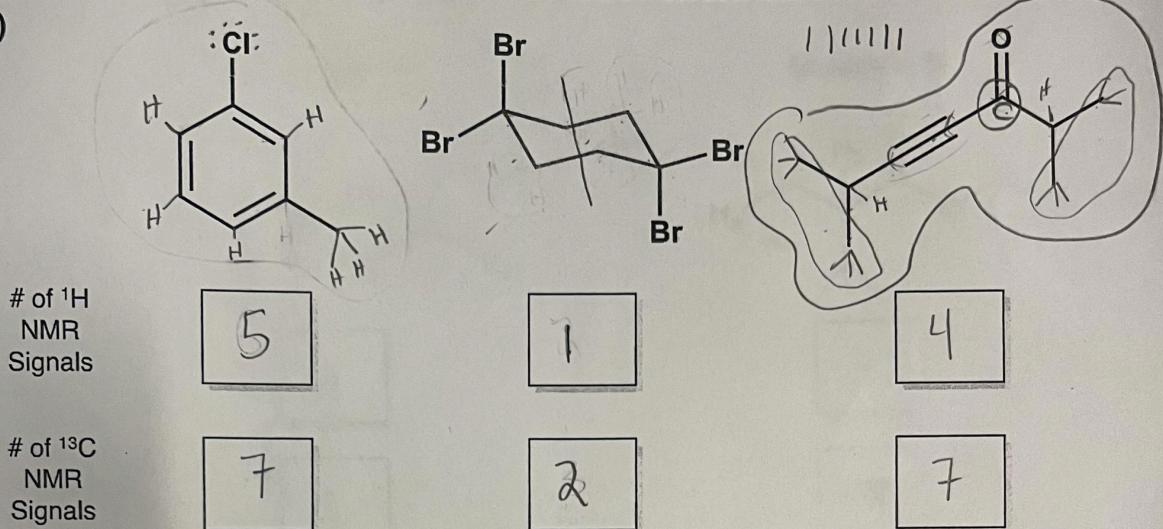
7. Rank the labeled protons in the molecule below from most to least acidic.



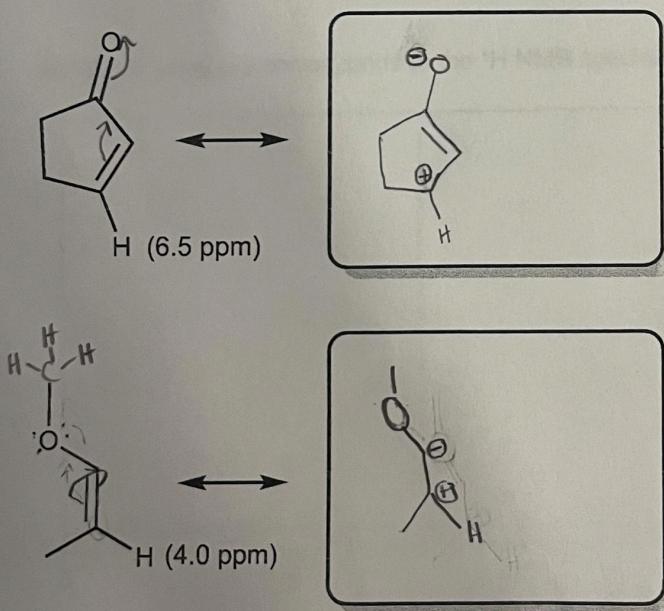
Name (Last, First): _____

8. First, determine the different signals you would expect in the ^1H and ^{13}C NMR spectra for each of the following molecules. Then, circle the molecule with the most deshielded carbon center.

a)



9. The vinyl proton chemical shift in the two compounds shown below is substantially different. First, draw a major resonance structure for each molecule. Then explain why the shifts of the indicated protons are so different from one another in fewer than 20 words.

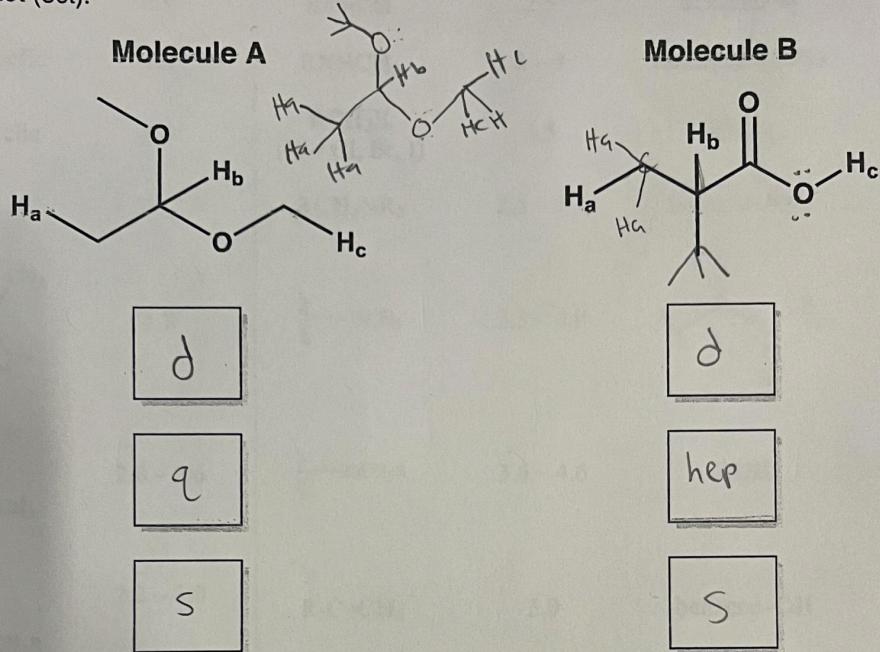


Explanation (Fewer Than 20 Words):

The top structure
is much more deshielded
because the proton
is attached to a
benzene molecule,
electron density
delocalized.

Name (Last, First): _____

10. a) Determine the expected splitting pattern (multiplicity) for the indicated protons using the following abbreviations: singlet (s), doublet (d), triplet (t), quartet (q), quintet (qui), sextet (sex), heptet (hept), and octet (oct).



H_a

d

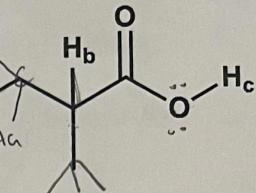
H_b

q

H_c

s

Molecule B



d

hept

s

- b) Which molecule corresponds to the ¹H NMR spectrum below: A or **B** (circle one)

