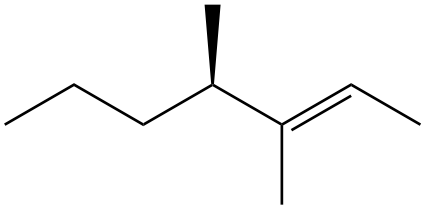
NAME (Print): _____

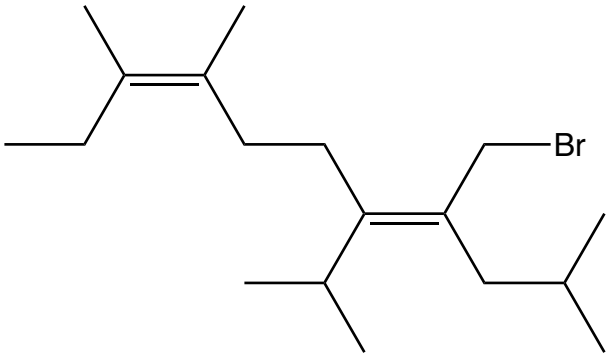
SIGNATURE: _____

Chemistry 320M/328M
Dr. Brent Iverson
4th Homework
September 27, 2022

Please print the first three letters of your last name in the three boxes

1. Name the following alkenes according to IUPAC and the E,Z nomenclature rules.





2. Draw the alkene with the following name:

(*3E,6Z*)-10-chloro-4-ethyl-7-isopropyl-6-methyl-1,3,6-decatriene

3. (6 pts) Draw the following molecule:

(*3S,6S,7S*)-3-Chloro-6-ethyl-7-isopropyl-1,9-decadiene

4. The two important consequences of the pi bond in alkenes is that:

A) _____

_____

and

B) _____

_____

5. (1 pt each) Circle all of the TRUE statements.

A. For a reaction to occur, it must have both "motive" (thermodynamic driving force) and "opportunity" (a relatively low overall energy barrier to reaction).

B. Reactions always go faster if the products are lower in energy than the starting materials.

C. Reactions have a "motive" (thermodynamic driving force) if the products are lower in energy than the starting materials.

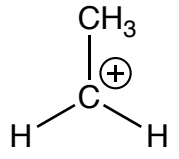
D. Reactions will go faster if they have a lower energy barrier.

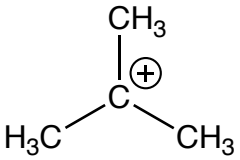
E. Reactions will always have a "motive" (thermodynamic driving force) if they have a lower energy barrier.

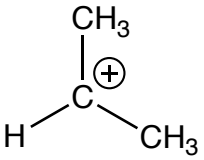
F. Hyperconjugation is due to the overlap of electronegative elements with empty 2p orbitals in pi bonds.

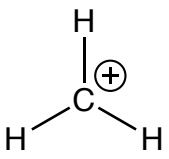
G. Hyperconjugation is due to the overlap of an empty 2p orbital of a carbocation with adjacent sigma bonding electron density.

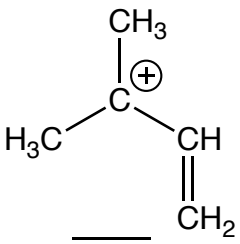
6. (1 pt each) Rank the following carbocations in terms of overall stability, with a 1 under the most stable carbocation, and a 5 under the least stable carbocation.



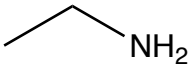


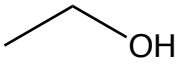


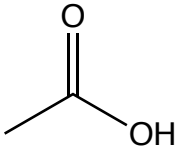


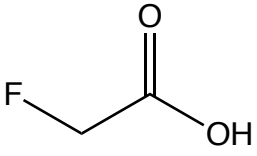


7. (1 pt each) Rank the following molecules with respect to acid strength, with a 1 under the strongest acid and a 4 under the weakest acid.



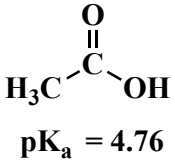






Signature_____

8. (18 pts) **Complete the following three structures by adding appropriate numbers of lone pair electrons, H atoms, and formal charges to the atoms in the boxes.** You must adjust your answers to indicate the predominant species at each indicated pH value. (You do not have to add anything such as H atoms to atoms not drawn in the boxes.) This problem is testing your understanding of the relationship of protonation state to pH to pKa values for certain functional groups we have discussed. **Next, in the space provided, write the overall charge on each structure at the indicated pH. For your reference, here are the relavant pKa values:**

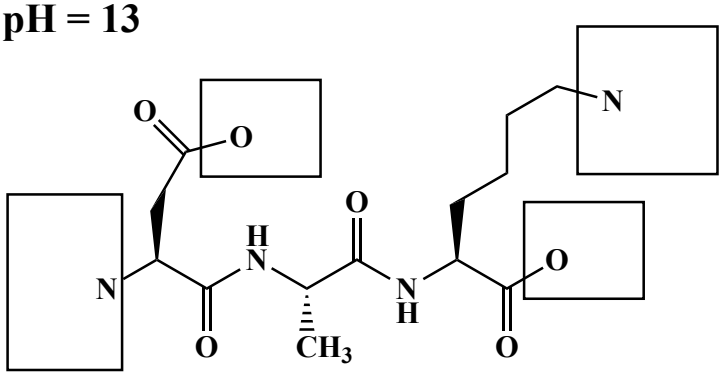


$pK_a = 4.76$

$pK_a = 10.64$

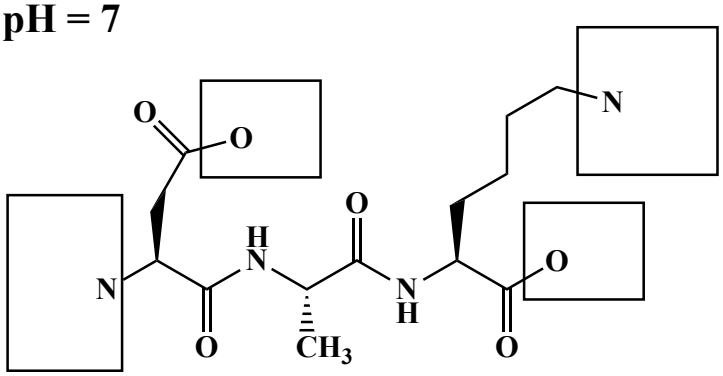
$pK_a = 38$

pH = 13



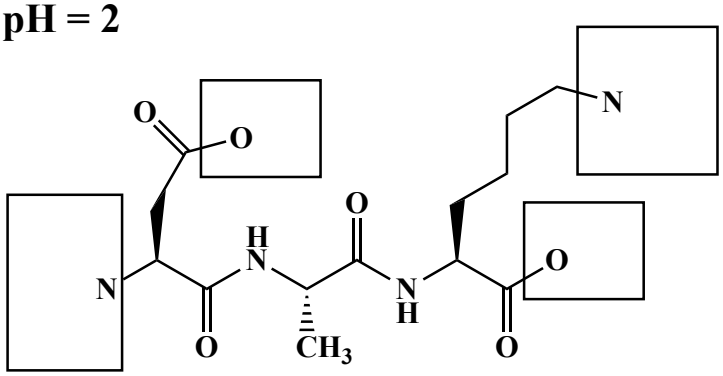
Total charge on molecule:_____

pH = 7



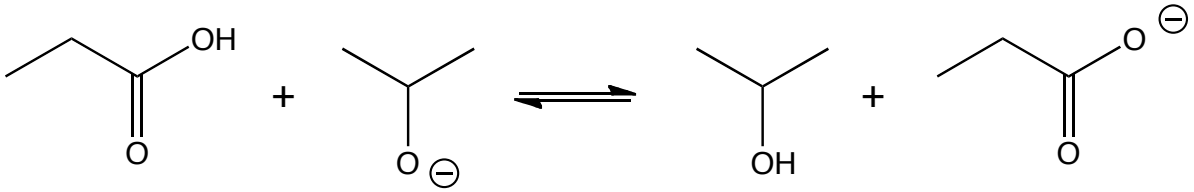
Total charge on molecule:_____

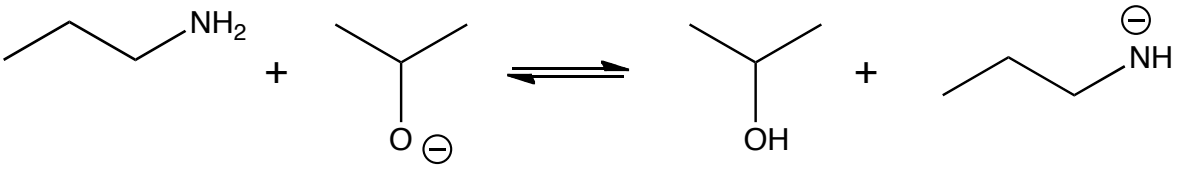
pH = 2

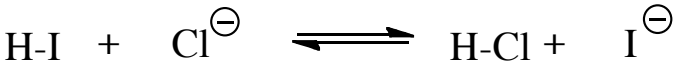


Total charge on molecule:_____

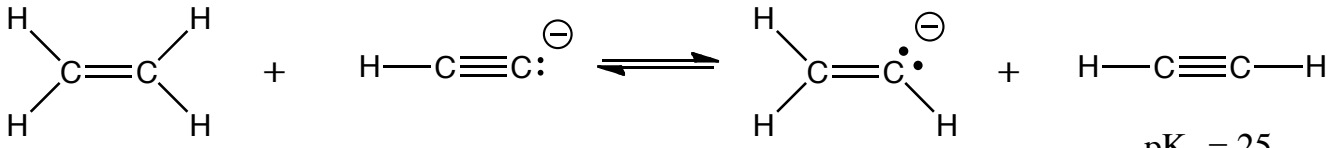
9. For the following acid base reactions, circle the side of the equation that predominates at equilibrium.





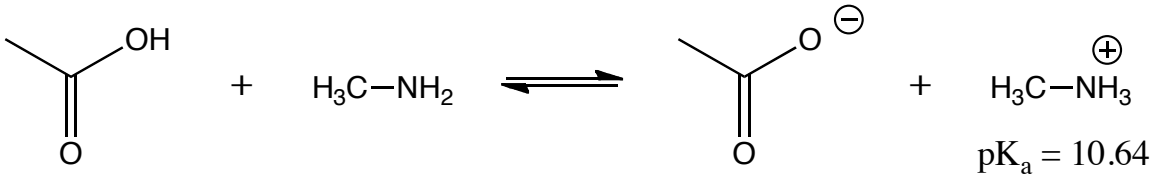


10. For the following two equations, the pKa values are listed underneath each acid. Circle the side of the equation that predominates at equilibrium, and in the space provided estimate the equilibrium constant for the reaction in the direction written.



$pK_a = 44$ $pK_a = 25$

The equilibrium constant for this process is K_{eq} = ☐



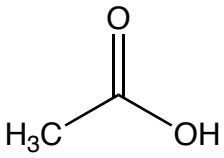
$pK_a = 4.76$ $pK_a = 10.64$

The equilibrium constant for this process is K_{eq} = ☐

11. Rank the following from 1 to 4 with respect to relative acidity, with a 1 under the most acidic and a 4 under the least acidic molecule.

H_2O	CH_4	NH_3	H_2S
___	___	___	___

HF	HBr	HCl	HI
___	___	___	___



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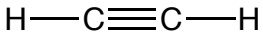

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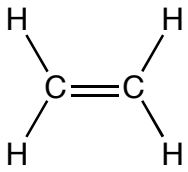

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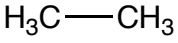

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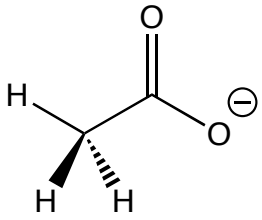
12. Rank the following from 1 to 4 with respect to relative anion stability, with a 1 under the most stable anion and a 4 under the least stable anion.



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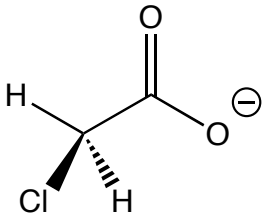

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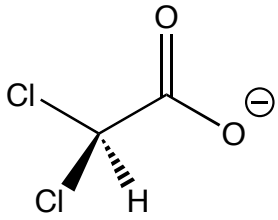

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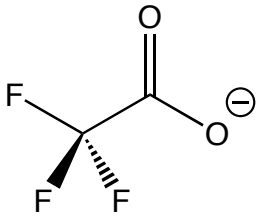

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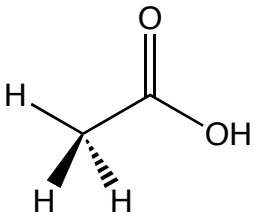
13. Rank the following from 1 to 4 with respect to relative acidity, with a 1 under the most acidic and a 4 under the least acidic molecule.



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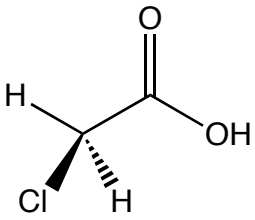

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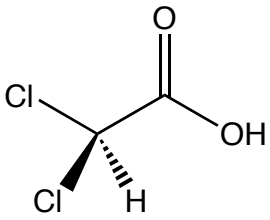

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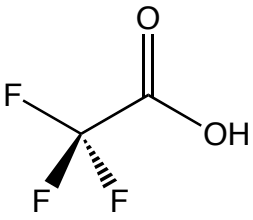

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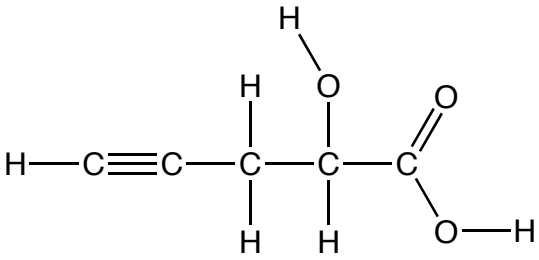
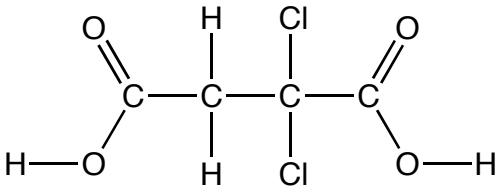
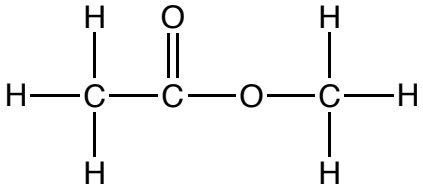
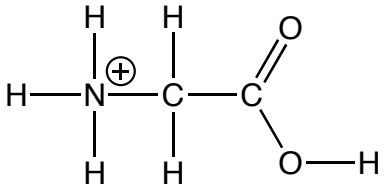
14. For each molecule, draw a circle around the most acidic H atom. Note there might be more than one on the same molecule, and you will get it correct if you circle any of the most acidic H atoms.









15. (8 pts). List the four mechanism elements most commonly found in organic reaction mechanisms. For this you need to list them in the same order presented in class.