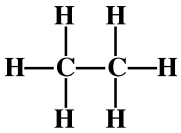
4. (cont.) (8 pts. total) Rank the following species in terms of the stated property from 1 to 4 as described, with intermediate numbers to rank the species of intermediate stability activity. **Please make sure you know what we want, as you will get no credit if you get the numbers backwards!**

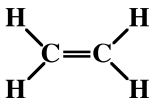
Relative Acidity: Place a **1** under the most acidic moleucle and a **4** under the least acidic molecule.

H—F	H—Br	H—Cl	H—I
4	2	3	1

Relative Acidity: Place a **1** under the most acidic molecule and a **4** under the least acidic molecule.



4



3

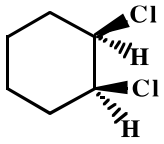
Cl—C≡CH

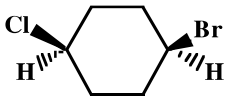
1

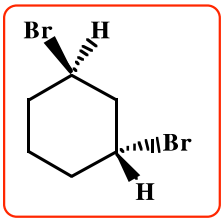
HC≡CH

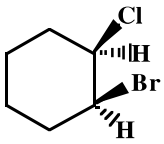
2

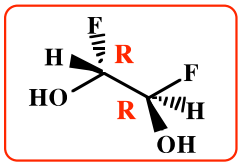
5. (9 pts total) Of the molecules shown below, circle the ones that are optically active, that is the ones for which a sample would rotate the plane of plane polarized light. In other words, circle the molecules that are chiral.

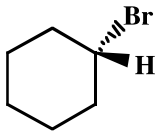


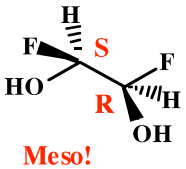




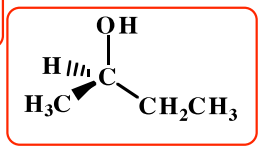


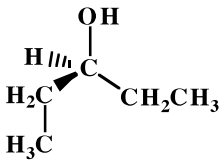






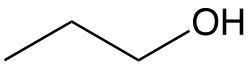
Meso!



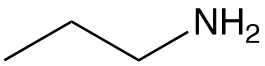


Write the answers to these questions on the answer sheet on page 1

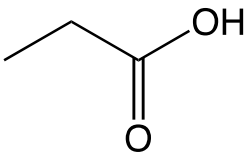
3. (5 pts) Rank the following molecules with respect to overall acidity. **On the answer sheet on page 1, write the letter corresponding to the correct order of acidity,** ranked from most to least acidic for the molecules labeled as (a) - (d).



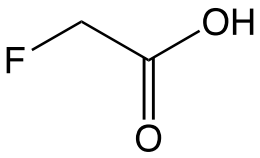
(a)



(b)



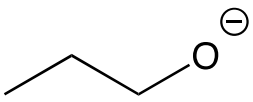
(c)



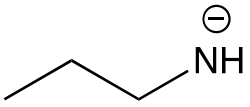
(d)

	most acidic			least acidic
A)	**(a)**	**(c)**	**(b)**	**(d)**
B)	**(a)**	**(b)**	**(d)**	**(c)**
C)	**(c)**	**(a)**	**(b)**	**(d)**
D)	**(d)**	**(c)**	**(a)**	**(b)**
E)	**(d)**	**(b)**	**(c)**	**(a)**

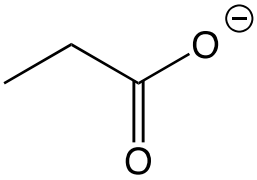
4. (5 pts) Rank the following molecules with respect to overall anion stability. **On the answer sheet on page 1, write the letter corresponding to the correct order of anion stability,** ranked from most to least stable for the anions labeled as (a) - (d).



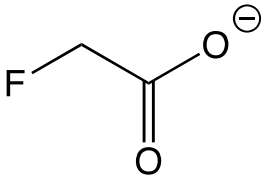
(a)



(b)



(c)



(d)

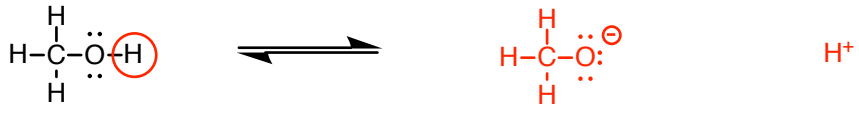
	most stable			least stable
A)	**(a)**	**(c)**	**(b)**	**(d)**
B)	**(a)**	**(b)**	**(d)**	**(c)**
C)	**(c)**	**(a)**	**(b)**	**(d)**
D)	**(d)**	**(c)**	**(a)**	**(b)**
E)	**(d)**	**(b)**	**(c)**	**(a)**

Circle the most acidic hydrogen atom(s) on each structure and draw the corresponding conjugate base that is formed following dissociation of the most acidic proton from the acid.

pK_a = 4.76

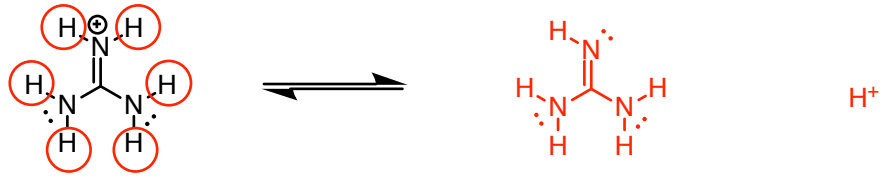
pK_a = 10.64

pK_a = 38



pK_a = 15.5

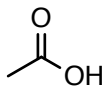
pK_a = 10.6



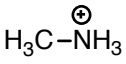
pK_a = 13.6

pK_a = 25

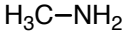
Complete the following three structures by adding appropriate numbers of lone pair electrons, H atoms, and formal charges to the atoms in the boxes. You must adjust your answers to indicate the predominant species at each indicated pH value. (You do not have to add anything such as H atoms to atoms not 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 vaules:**



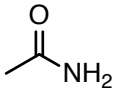
pK_a = 4.76



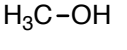
pK_a = 10.64



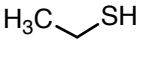
pK_a = 38



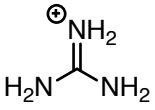
pK_a = 15-19



pK_a = 15.5

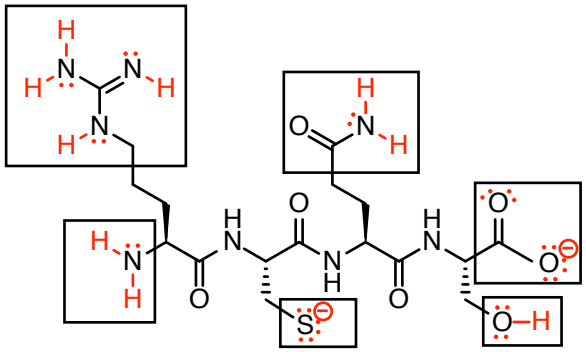


pK_a = 10.6



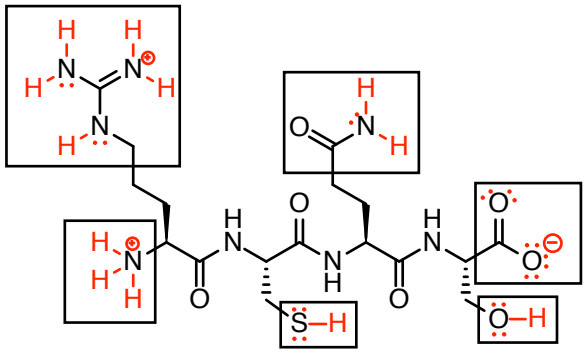
pK_a = 13.6

pH = 14



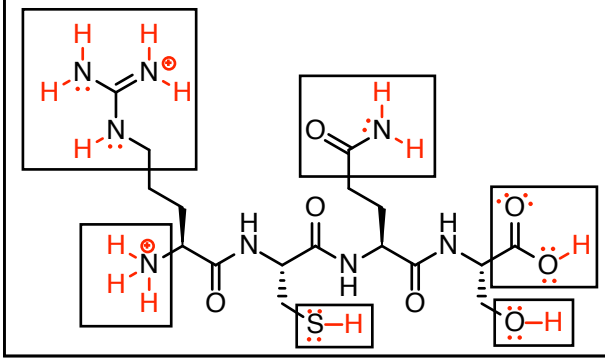
Total Charge on molecule: -2

pH = 7



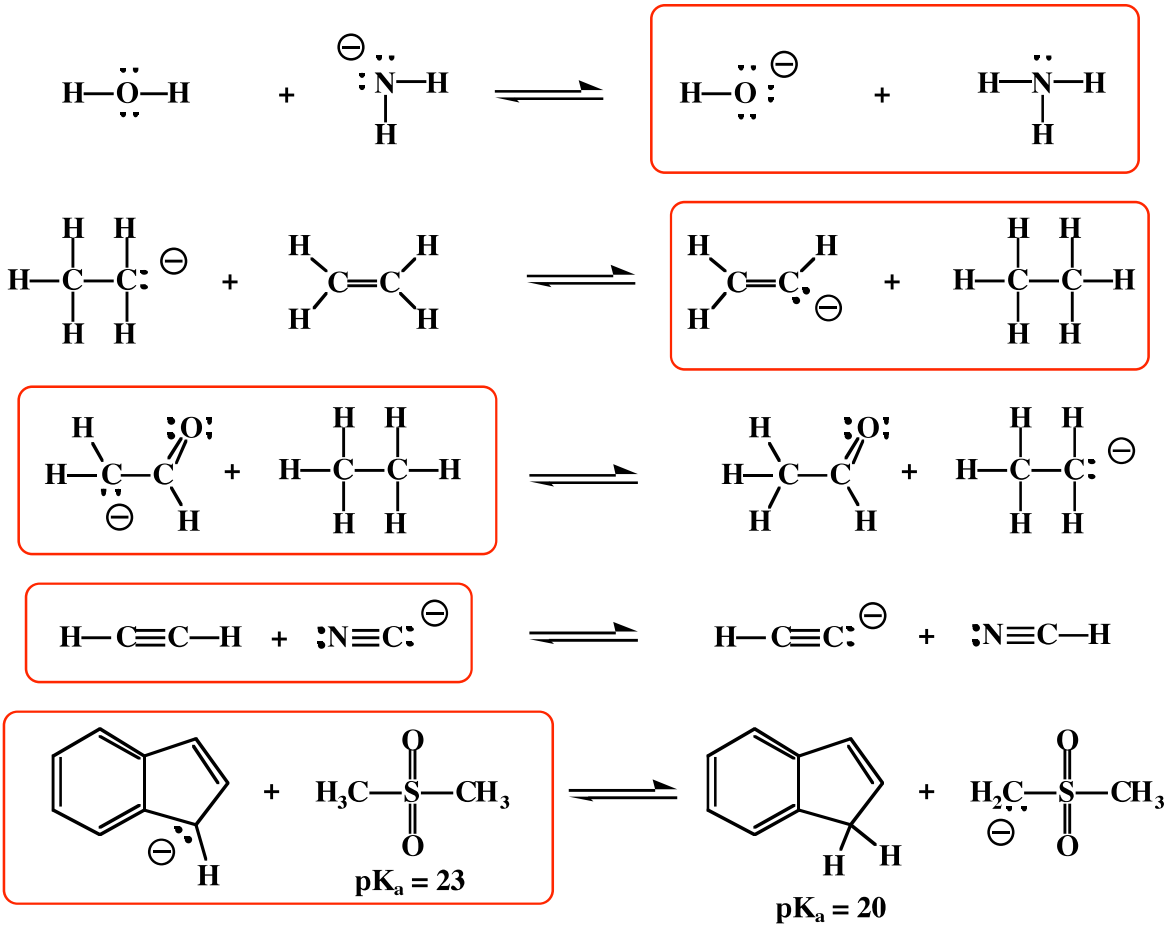
Total Charge on molecule: +1

pH = 1



Total Charge on molecule: +2

6. (15 pts) For each acid-base reaction, **circle the side of the equation that predominates at equilibrium.** **In each case identify the stronger and weaker acids by comparing relative stabilities of the anions which are the conjugate bases of the two acids. Equilibrium favors formation of the weaker acid. You will notice this means you circled the side with the more stable anion.**



7. (4 pts) **Circle all the True statements.** (Do not circle any false statements)

A. The inductive effect involves atoms withdrawing protons through pi bonds in a molecule.

B. The inductive effect involves atoms withdrawing electron density through sigma bonds in a molecule.

C. Hyperconjugation involves the overlap of an empty 2p orbital on a carbocation with sigma bonds on adjacent alkyl groups.

D. Hyperconjugation involves the overlap of an empty sp^2 orbital on a carbocation with pi bonds on adjacent alkyl groups.