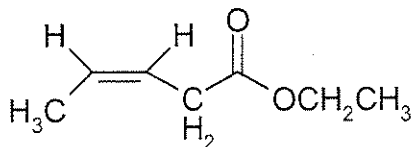
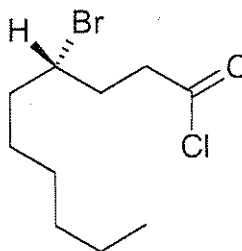


1. (12 pts, 3 each) Give the IUPAC name of the following compounds (except c). (*Be sure to use R/S and E/Z when necessary*).

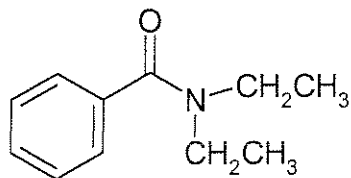
a)



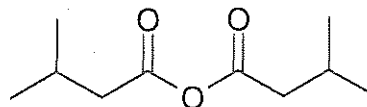
b)



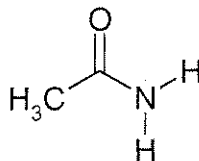
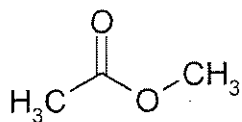
c)



d)



2. (7 pts) a) Write ALL the resonance contributors for the following carboxylic acid derivatives:

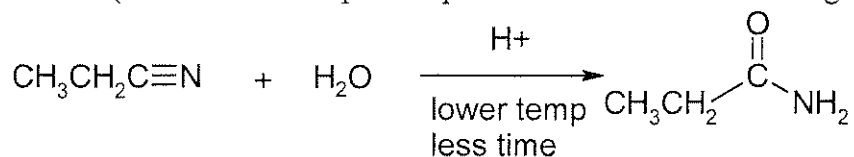


- b) Explain why an amide is more resistant to nucleophilic attack (and is consequently more stable) than an ester.

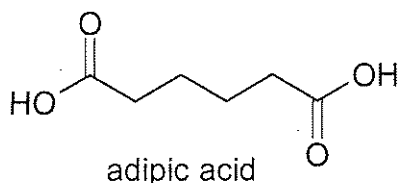
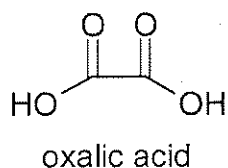
3. (5 pts) A chemist carried out an oxidation reaction of heptanol and produced heptanoic acid. Unfortunately, the reaction didn't go as well expected. There was a fair amount of the starting material that was left unreacted. (Both the product and starting material were dissolved in the organic solvent that was used for the reaction). The chemist wanted to separate the product carboxylic acid from the alcohol starting material. Briefly explain how this separation could be accomplished.

4. (4 pts) What is the isoelectric point of an amino acid?

5. (9 pts) Write a complete mechanism for the **acid-catalyzed** hydrolysis of propanenitrile to propanamide. (Note: the first step is the protonation of the nitrile nitrogen)

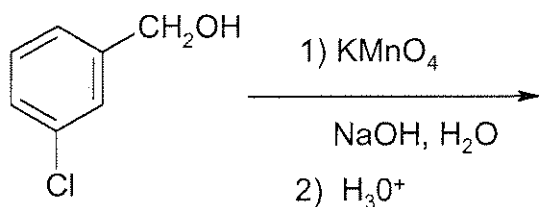


6. (5 pts) Oxalic acid has 2 acidic protons with pKa's of 1.27 and 4.27. Adipic acid also has 2 acidic protons with pKa values of 4.43 and 5.41. (See structures below). Briefly explain why the 1st pKa value for oxalic acid (pKa = 1.27) is so much lower than the 1st pKa value for adipic acid (pKa = 4.43).

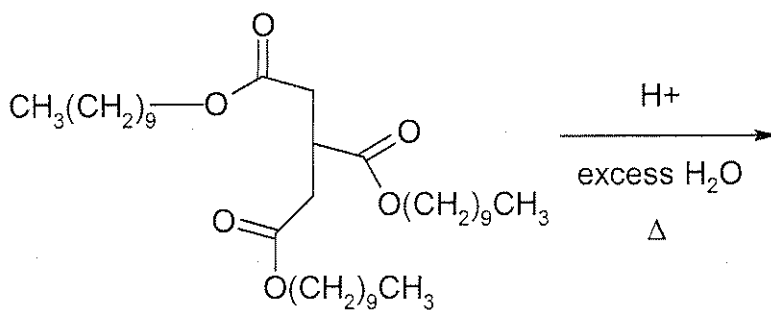


7. (32 pts, 4 each) Give the structures for the **major product** or the **reagents needed** for the following transformations. If no reaction occurs, write **NO RXN**.

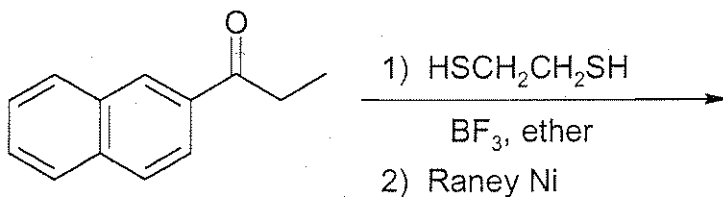
a)



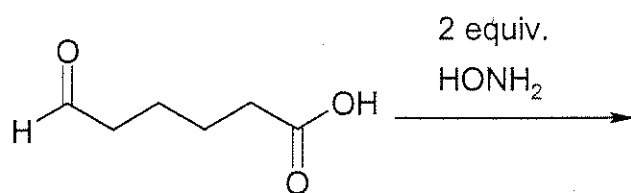
b)



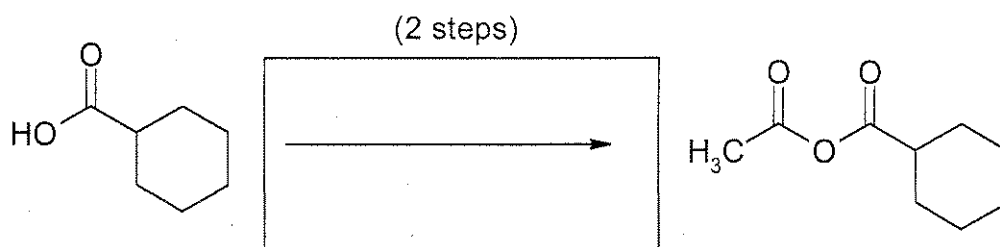
c)



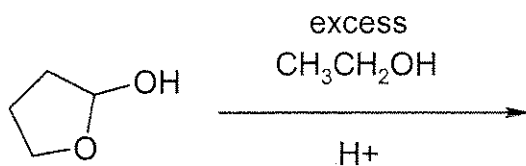
d)



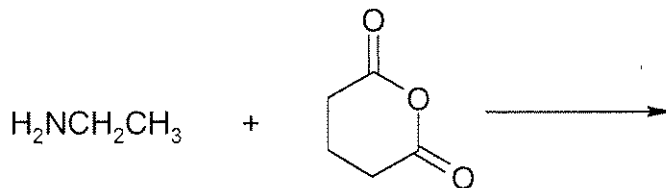
e)



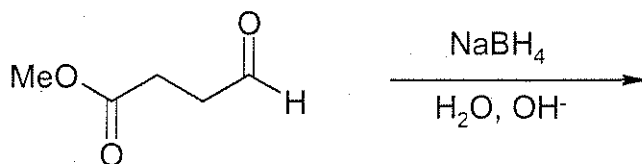
f)



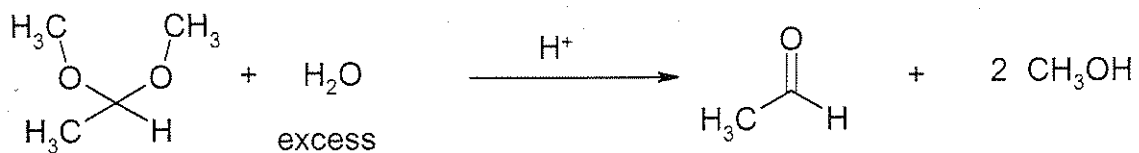
g)



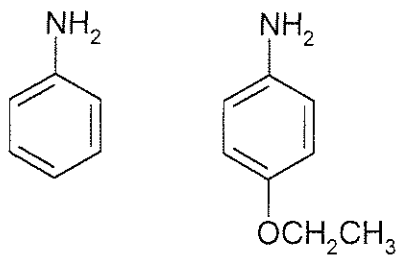
h)



8. (11 pts) Give the complete mechanism for the following acid-catalyzed hydrolysis of an acetal.



9. (7 pts) You have two aromatic amines - aniline and 4-ethoxyaniline. Circle the compound which is **least basic** of the two, and briefly explain why you chose your answer. (Be sure to include a discussion of resonance effects in your explanation).



10. (8 pts) **Multistep synthesis.** Give the **reagents needed** as well as the structures of the **intermediate products** on the pathway to synthesize the following product from the given starting material.

