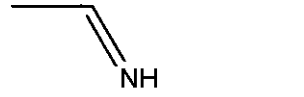
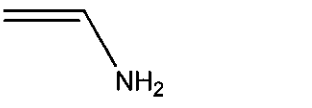
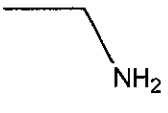
Practice Exam Answers

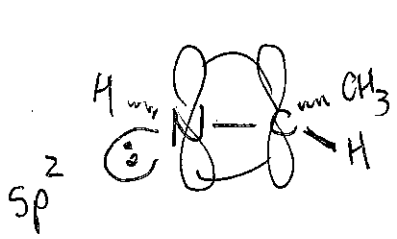
1. Draw orbital overlap pictures for these three molecules:

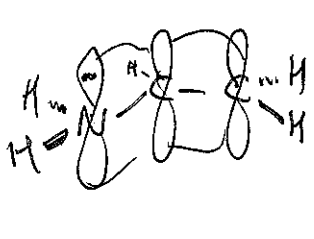
A B C

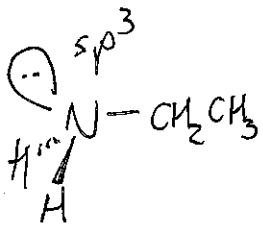












Rank the stability of the lone pairs of these three molecules from most stable to leas stable.

B most stable C least stable

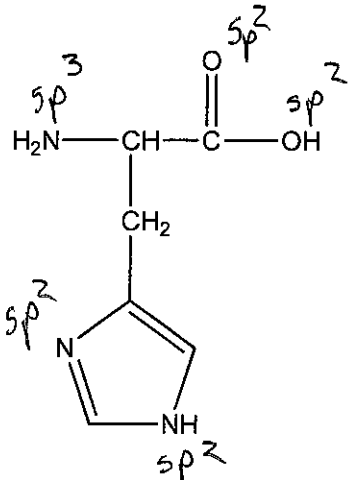
Referring to your orbital overlap pictures, explain how you chose the most stable lone pair.

It is in a p orbital that is in conjugation (overlap) with the π bond.

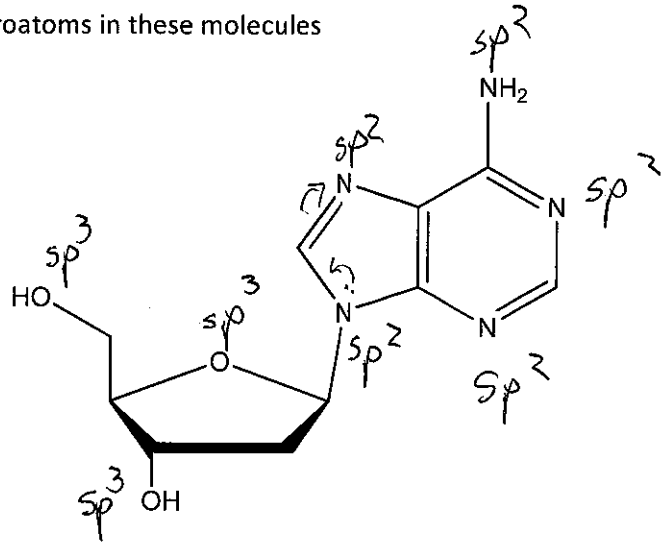
Referring to your orbital overlap pictures, explain how you chose the least stable lone pair.

The least stable lone pair is in an sp^3 orbital, which has more p-orbital character (75%) making it least stable.

2. Label the hybridization of all the heteroatoms in these molecules



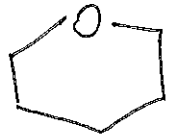
Histidine (amino acid)



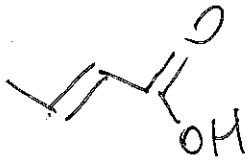
Adenine (building block of ATP)

3. Draw bond line formula for these compounds:

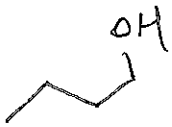
cyclic ether with five carbons

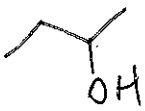


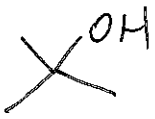
molceule with alkene and carboxylic acid in conjugation



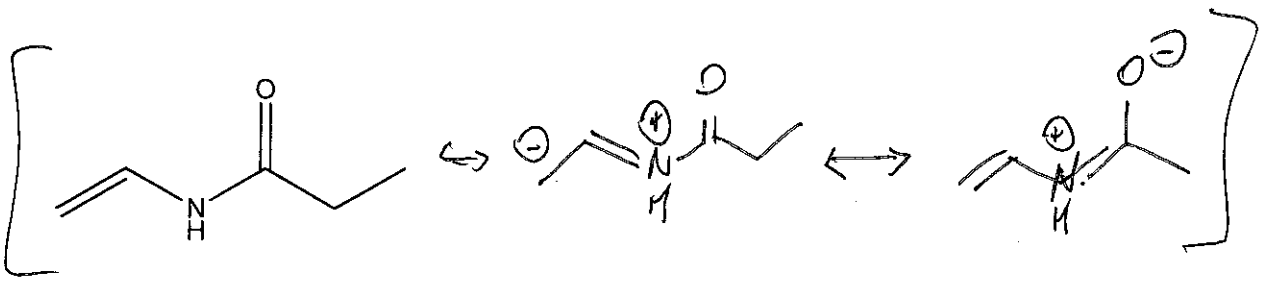
three alcohols that are constitutional isomers of $C_4H_{10}O$



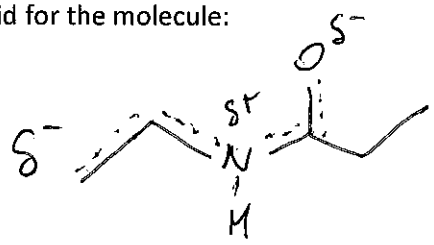




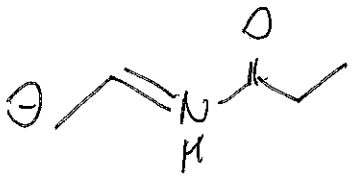
4. Draw ~~three~~ two significant resonance structures for this compound:



Draw a resonance hybrid for the molecule:



Which of the resonance structures could be used to explain why there is an exceptionally reactive carbon in this molecule?



shows an e⁻ rich carbon

Is the lone pair on nitrogen more or less stable than a lone pair on a typical amine? Explain.

More stable - in extended conjugation