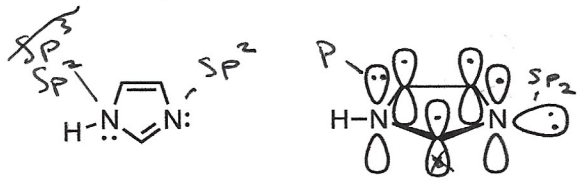
Name: Josh Whitehead ID: v1069343



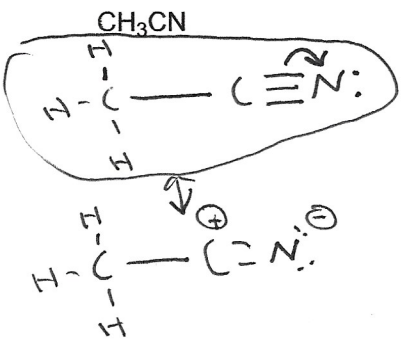
1. The compound shown below is a common base called imidazole. A) What is the hybridization of each nitrogen atom? B) Determine and label which orbital each lone pair resides in. C) Draw all lone pairs and π electrons on the structure provided below.




2. A) Draw the Lewis structure for each of the following molecules and be sure to include any formal charges. B) Provide at least 1 resonance structure and use curved arrows to show the movement of electrons. C) Circle the major resonance contributor.

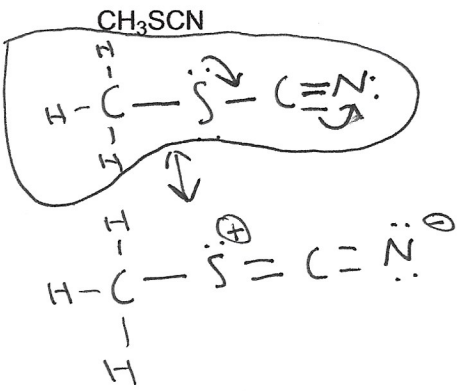
4+2+3+5 = 16 e⁻

CH₃CN



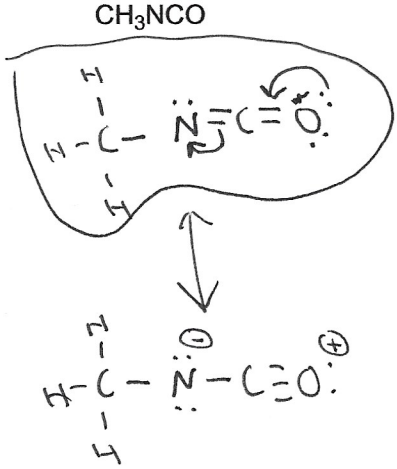
4+3+6+4+5 = 22 e⁻

CH₃SCN



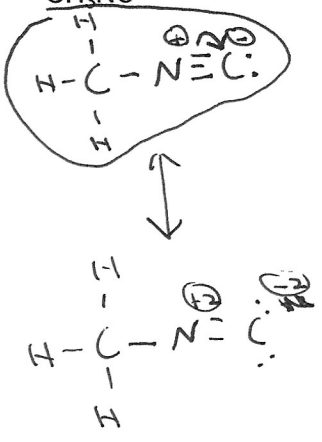
4+3+5+4+6 = 22 e⁻ −12

CH₃NCO

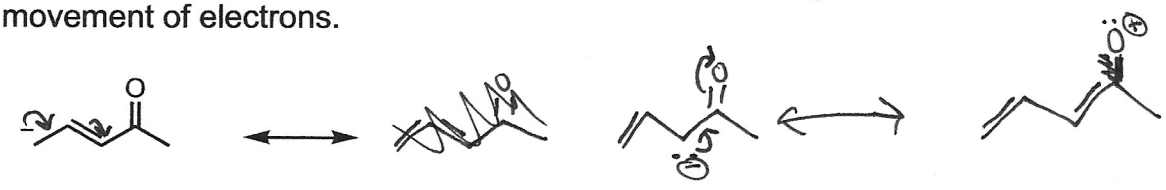


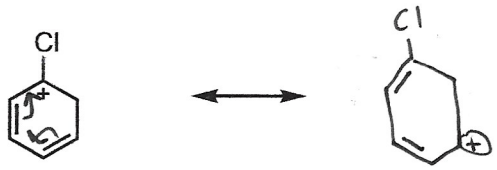
4+3+5+4 = 16 e⁻ −10

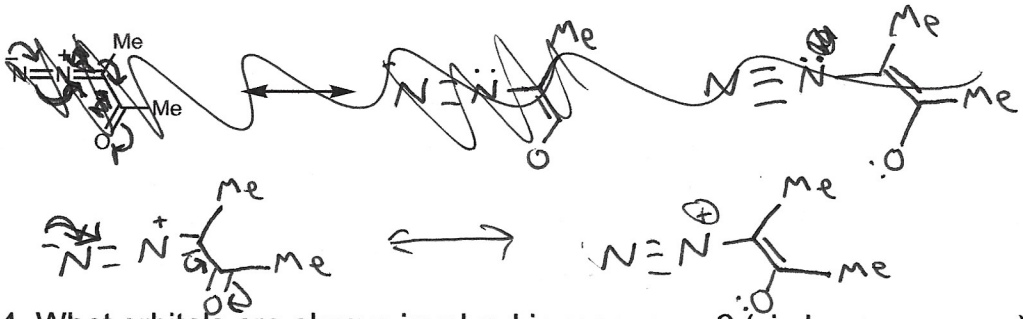
CH₃NC



3. Provide all reasonable resonance structures using curved arrows to show the movement of electrons.



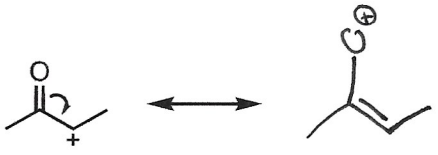




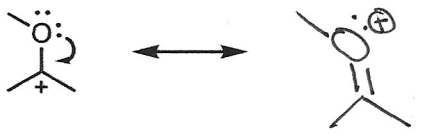
4. What orbitals are always involved in resonance? (circle your answer)

s (p) sp $sp^2$ $sp^3$

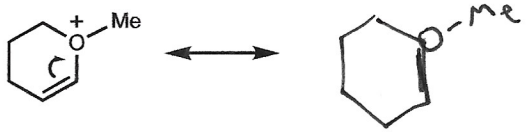
5. Are the following resonance arrows allowed? Briefly explain your answer.



~~Yes, but it's not likely because O is more electronegative than C~~
(NO,) O has less than 8 e⁻

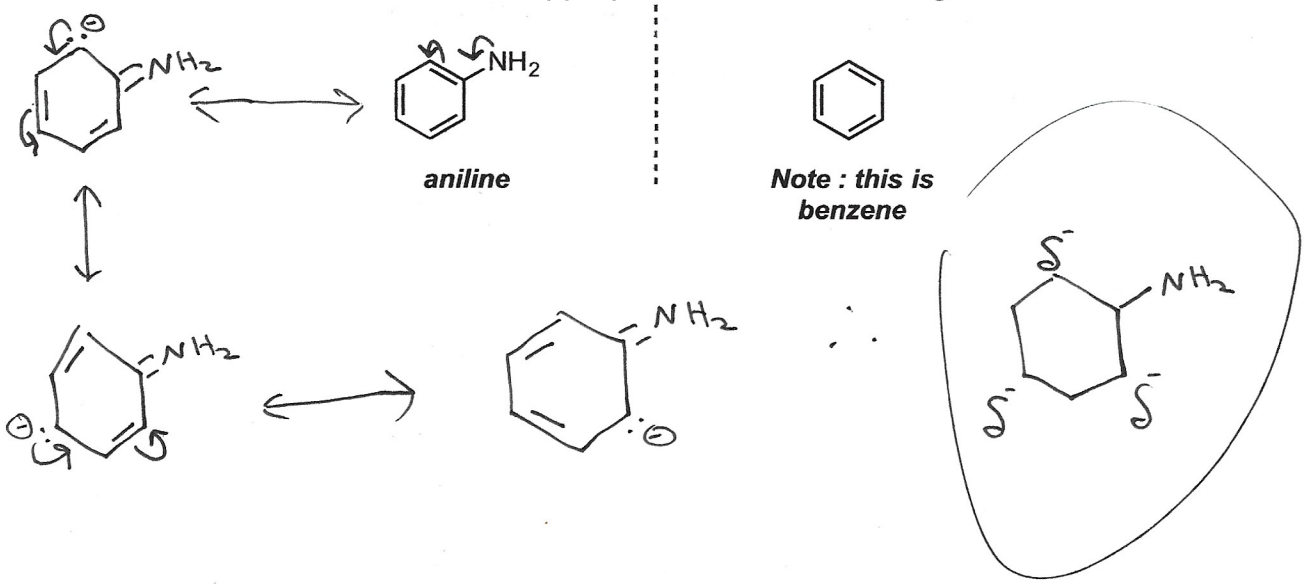


Yes, O has 8 e⁻ but no more, sigma bonds aren't broken and octet rule isn't broken

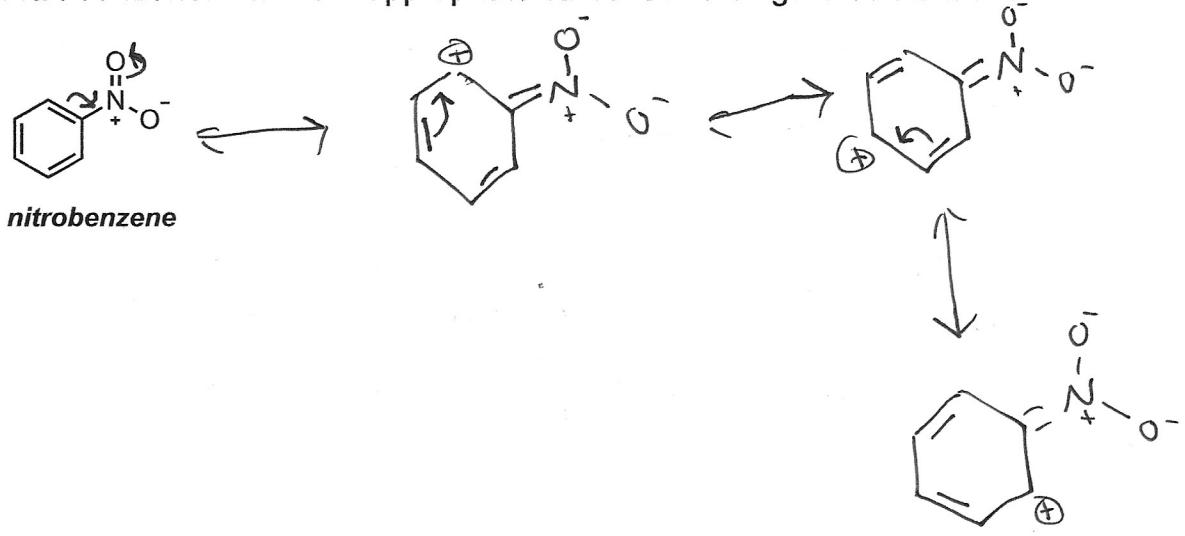


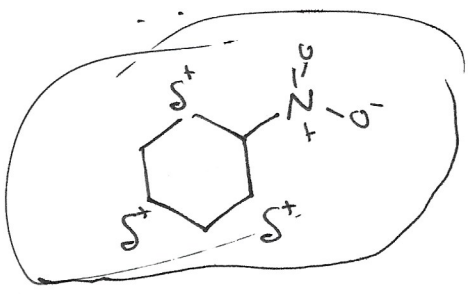
(NO,) Oxygen would have too many e⁻

6. Aniline and nitrobenzene are two substituted benzene compounds that contain nitrogen atoms. A) Use resonance structures to identify all carbon atoms that are electron rich on **aniline**. Mark the appropriate carbons in the figure below with a $\delta^-$.

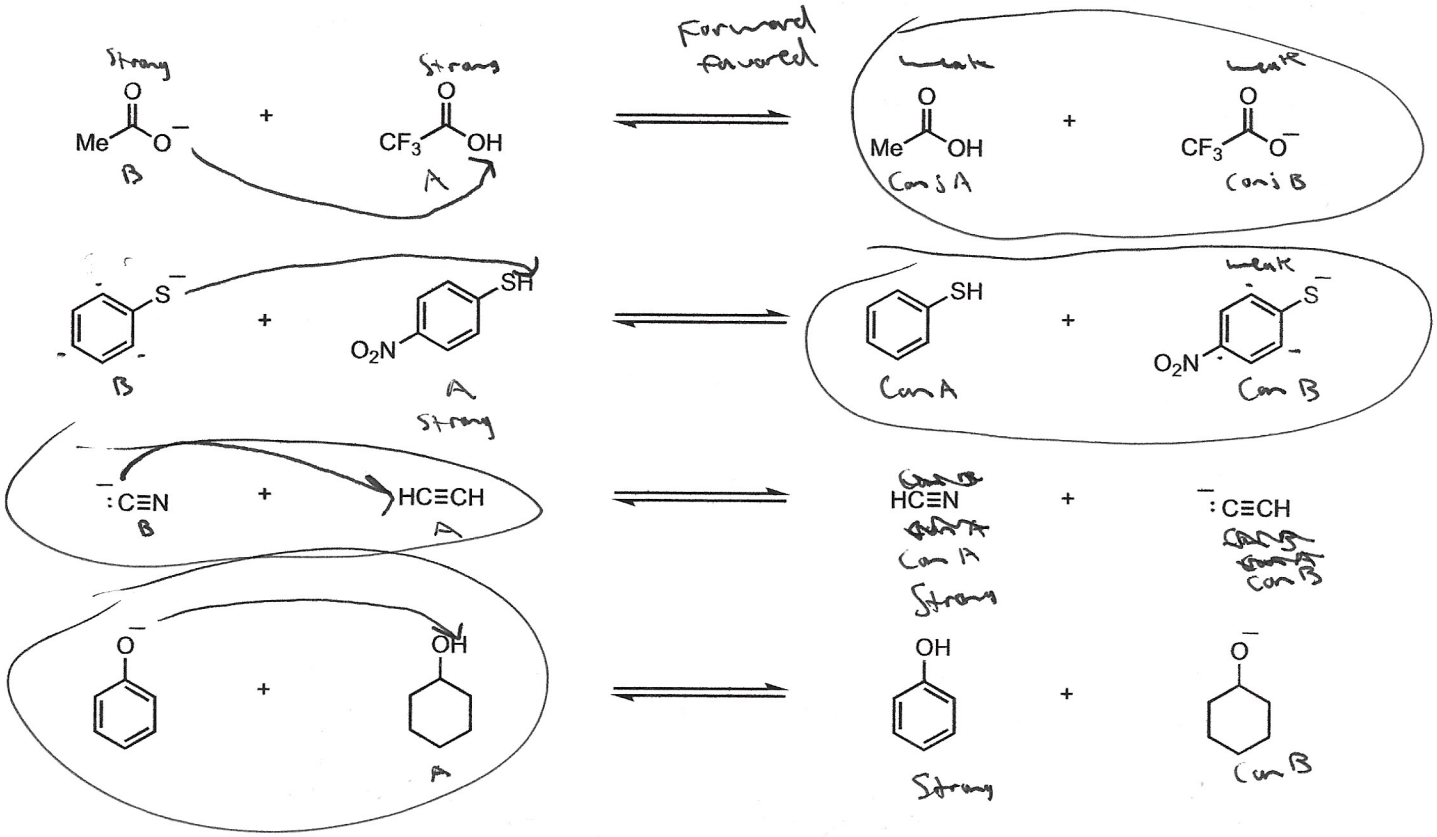



B) Use resonance structures to identify all carbon atoms that are electron deficient on **nitrobenzene**. Mark the appropriate carbons in the figure below with a $\delta^+$.

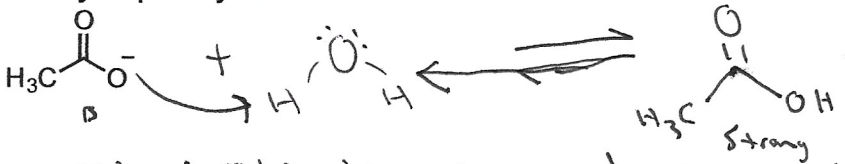


7. For the following equilibria, circle which side is favored. Hint: identify the weaker acid and the weaker base.

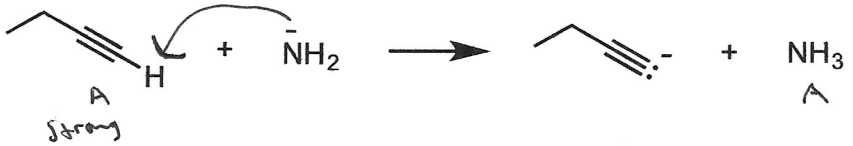



8. A) Would water be a suitable proton source to protonate the following compound? Briefly explain your answer.



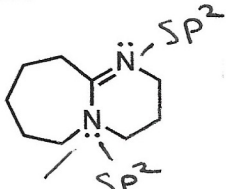

NO, water is not a good proton donor because $OH^-$ is not stable compared to $H_3C$ (resonance)

B) Would ethanol ($CH_3CH_2OH$) be a suitable solvent in which to perform the following proton transfer? Briefly explain your answer.



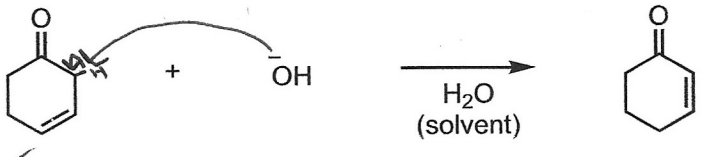

Yes, $CH_3CH_2O^-$ is more stable than $\bar{N}H_2$ because O is more electronegative than N. $\therefore$ $CH_3CH_2OH$ would be the stronger acid

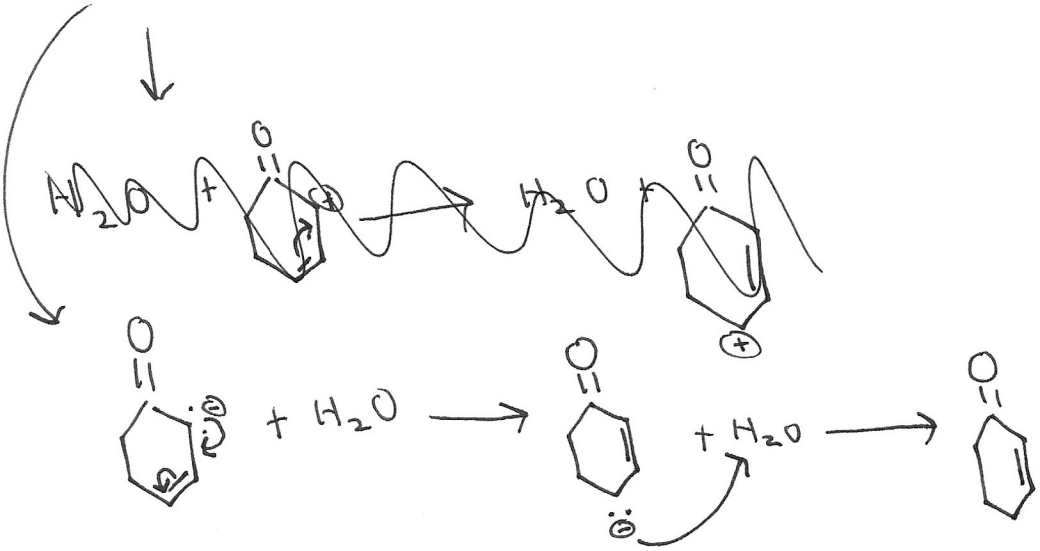
9. The compound shown below is called DBU, a common base you will encounter in this course. A) Label the hybridization of each nitrogen atom. B) Which nitrogen atom is more basic? Briefly explain your answer.




more Basic — lone Pair in a P orbital so it's more easily given up

10. **Mechanism**: Provide a detailed, stepwise mechanism for the following transformation using proton transfer reactions. Use curved arrows to show the movement of electrons. *HINT: Identify the most acidic proton.*




Resonance