1. The molecule presented above is called nicotine.

a. What is the hybridization of each N atom in nicotine?
b. What is the geometry around each N atom?
c. In what type of orbital does the lone pair on each N atom reside?
d. Draw a constitutional isomer of nicotine.
e. Draw a resonance structure of nicotine.

2. With reference to species B, label each species below as an isomer, a resonance structure, or neither.
3. Rank the following compounds in order of increasing acidity.

a. NH$_3$, H$_2$O, HF  
b. HBr, HCl, HF  
c. H$_2$O, H$_3$O$^+$, HO$^-$  
d. NH$_3$, H$_2$O, H$_2$S  
e. CH$_3$OH, CH$_3$NH$_2$, CH$_3$CH$_3$  
f. HCl, H$_2$O, H$_2$S  
g. CH$_3$CH$_2$CH$_3$, CICH$_2$CH$_2$OH, CH$_3$CH$_2$OH

4. Rank the following ions in order of increasing basicity.

a. CH$_3^-$, HO$^-$, Br$^-$

5. Draw curved arrows to show the movement of electrons in this step of the reaction mechanism.

\[
\begin{align*}
\text{H} & \quad \text{H} - \text{Cl}^- & \quad \text{H} & \quad \text{H} - \text{Cl}^- \\
\text{H} & \quad \text{H} - \text{Cl}^- & \quad \text{H} & \quad \text{H} - \text{Cl}^- \\
\end{align*}
\]
6. Identify which compound is more acidic if the pKₐ of propiolic acid (HC≡CCO₂H) is 1.8 and the pKₐ of propanoic acid (CH₃CH₂CO₂H) is 4.9. Draw the conjugate base for each to explain.