1. Draw acceptable Lewis structures of the following compounds by adding all necessary nonbonding electrons and multiple bonds.

S: 3 3
S = C = S

Br: C: N

\[ \begin{align*}
\text{Br} & \quad - \quad \text{C} \quad - \quad \text{N} \\
\end{align*} \]

2. Indicate the overall charge on the following compounds. Hint: you should calculate formal charges on each atom and then sum these up for overall charge.

\[ \text{CH}_3 \text{N} \text{N} \text{CH}_3 \]

\[ \text{CH}_2 \text{-C} \text{=C} \text{O} \text{.O} \]

\[ -1 \quad \text{overall} \]

\[ \text{CH}_2 \text{-C} \text{=C} \text{O} \text{.O} \]

\[ -2 \quad \text{overall} \]

3. Both BH$_3$ and NH$_3$ contain a central atom bonded to three hydrogen atoms. One of these molecules is polar; the other one is not. Explain fully in terms of hybridization and geometry considerations.

\[ \text{NH}_3 \quad \text{planar} \quad \text{sp}^3 \quad \text{pyramidal} \]

\[ \text{BH}_3 \quad \text{trigonal} \quad \text{sp}^2 \quad \text{hedral} \]

4. Use arrow formalism to draw other resonance structure of the following and indicate which one is the major contributor. (Note lone pairs are not shown).

\[ \text{CH}_3 \text{-C} \text{=O} \quad \text{L} \quad \text{C}_{6} \text{H}_{5} - \text{C} \text{=O} \]

\[ \text{CH}_3 \text{-C} \text{=O} \quad \text{L} \quad \text{C}_{6} \text{H}_{5} - \text{C} \text{=O} \]

\[ \text{CH}_3 \text{-C} \text{=O} \quad \text{L} \quad \text{C}_{6} \text{H}_{5} - \text{C} \text{=O} \]
5. Determine if the following pairs represent resonance forms or different structures.

\[ \text{H}_2\text{N} = \text{N} \quad \text{and} \quad \text{H}_2\text{C} - \text{N} = \text{N} \]

resonance

6. Over years, students have written the following resonance structures for ozone.

\[ \text{A} \quad \text{B} \quad \text{C} \]

a. Calculate the formal charges for the oxygen atoms above.

b. Which of the above structures are legitimate? A, B

c. Which one(s) are major contributor(s)? A, B

7. Indicate the hybridization of the underlined atoms in the following compounds.

\[ \text{CH}_2=\text{C}=\text{O} \quad \text{CH}_2\text{CH}=\text{NH} \quad \text{CH}_2\text{C}=\text{OH} \]

8. Complete the following acid-base equations.

\[ \text{CH}_3\text{CO}_2\text{H} + \text{CH}_3\text{OH} \rightarrow \text{CH}_3\text{CO}_2\text{CH}_3 + \text{H}^+ \]
8. \[ \text{PhOH} + \text{NH}_3 \rightarrow \text{Ph} + \text{NH}_4^+ \]

9. a. What is the conjugate base of CH₂CH₂OH?
   - \( \text{CH₃CH₂O⁻} \)

b. What is the conjugate acid of iodide ion?
   - \( \text{HIO} \)

10. In what direction will the equilibrium lie for the following acid-base reaction. pKₐ are given below the compounds.

   \[ \text{CH₃CH₂COO⁻} + \text{H₂O} \rightleftharpoons \text{CH₃CH₂COOH} + \text{OH⁻} \]

11. Indicate which one in the following pairs is more acidic?
   - H⁺ or HCl
   - \( \text{H}^+ \) or \( \text{NH}_3 \)

12. Indicate which one in the following pairs is the more basic?
   - \( \text{Br}^- \) (bromide ion) or F⁻ (fluoride ion).
   - \( \text{HS}^- \) or \( \text{HCl}^- \)

13. Write systematic (IUPAC) names for the following compounds:

   - 6-t-Butyl-2-chloro-4,7-dimethyloctane
   - 2-Methyl-4-pentyl-2-pentene
Model above. 

1. Identify and name the functional groups in the following molecule.

15. Draw Newman projections of the staggered and eclipsed conformations of 2-}

5:1°-endo/anti

14. Draw the structure for the following compounds.
17. Consider the following molecule.

a. Identify a) tertiary hydrogen/s carbons  
   b. quaternary carbon/s  
   c. secondary

b. Is the molecule a cis or trans isomer?

18. Give the relationship between the following pairs of structures. The possible relationships are: same compound, cis-trans isomers, constitutional (structural) isomers, not isomers (different molecular formulas).

   cis - trans

   3,4-dimethyl - 3-ethyl
   3,4-dimethyl - 3-
   2-ethyl