1. Calculate the formal charge on the designated atom or atoms.

![Molecule A](image1)

2. Draw the important resonance structure for the following.

![Molecule B](image2)

3. Predict the product of the following acid-base reaction.

![Reaction](image3)

4. Indicate the stronger acid: $H_2S$ or $H_2O$

5. Indicate the stronger base: $PH_2^-$ or $NH_2^-$
6. Which whether the following pairs of structures are actually different compounds or simply resonanace structures of the same compound.

a. CH₃-NH-C=NH₂ and CH₃-NH=C-NH₂

b. CH₃CH-CH and b. CH₃CH=CH

7. Write structural formulas for the following.

a. ethyl isopropyl ether

b. sec-butyl alcohol

c. 1-chloro-3-isobutylcyclopentane

8. Identify the functional groups in the following molecule.
9. Name the following compounds by the IUPAC system.

(Hint, OH is hydroxy radical, and don't forget to include cis or trans in front of the name)
10. Write the two chair conformations for trans 1-t-butyl-4-isopropylcyclohexane. Basic structure is shown below.

- Show clearly the axial and/or equatorial position occupied by both substituents in each conformer.

- Calculate the energy differences between the two conformers written above given that each 1,3-diaxial interaction between t-butyl and hydrogen and between isopropyl and hydrogen is 2.7 and 1.7, respectively.

- Circle the more stable conformation.

11. Write the Newman projection, about the C3-C4 axis in 3,4-dibromohexane, for the most stable and least stable conformer. Basic structure is shown for the most stable, you must draw the one for the least stable. Assume that a methyl group is larger than a bromine atom.
12. Determine the hybridization of the designated atom/s and give the shape of the molecule. Lone pairs not shown.

\[\text{CH}_3\text{CH}=\text{NH} \quad \uparrow \quad \uparrow \quad \text{BF}_3 \quad \uparrow \quad \text{NH}_2\text{NH}_2 \quad \uparrow\]

13. Which one in the following pair of molecules has the greater dipole moment.

\[\text{CHF}_3 \quad \text{or} \quad \text{CF}_4 \quad \quad \quad \quad \quad \text{NH}_3 \quad \text{of NF}_3 \quad \quad \quad \quad \quad \text{Cl}_2\text{C}=\text{C}=\text{CCl}_2 \quad \text{or} \quad \text{Cl}_2\text{C}=\text{CCl}_2\]

\[\text{This is a bonus question worth 3 pts.}\]

\[\text{SO}_2 \quad \text{or} \quad \text{CO}_2\]

14. What is the direction of equilibrium for the the following acid-base reaction?

\[\text{CH}_3\text{CO}_2\text{Me} + \text{NH}_2^- \quad \overset{\text{light}}{\underset{\rightarrow}{\longrightarrow}} \quad :\text{CH}_2\text{CO}_2\text{Me} + \text{NH}_3\]

\[\text{pKa} = 24 \quad \quad \quad \quad \quad \text{pka} = 35\]

15. Give the two chain propagation steps for the mono chlorination of ethane.

\[\text{CH}_3\text{CH}_3 + \text{Cl} \quad \overset{\text{light}}{\rightarrow} \quad \text{CH}_3\text{CH}_2\text{Cl} + \text{HCl}\]

step 1

step 2
16. Name the following bicyclic compounds

17. Indicate if the following pairs are same compound, geometric isomers, or structural isomers.

a.  

b.  

18. Draw the most stable chair conformation for the following