1. Draw Lewis structures for the following. Identify any formal charges.
   a. CO$_3^{2-}$  
   b. N$_2$O  
   c. CH$_3$CN  
   d. CH$_3^+$  
   e. CH$_3^-$

2. Give the hybridization and bond angles for the above molecules.

3. How many sigma and pi bonds are in each structure in #1?

4. How many of the atoms in #1c are in the same plane?

5. Consider the structure of cocaine, shown below:
   a. What is the formula of the compound?
   b. How many atoms are sp$^2$ hybridized?
   c. What type of amine is present in cocaine?

6. a. Draw the Kekule and skeletal structures for the following: CH$_3$CH(CH$_3$)CH$_2$N(CH$_3$)CH$_2$CH$_3$
   b. Name the above compound.

7. Predict the products in the following acid-base reaction. Also state on which side the equilibrium lies.

   $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{NH}_3 \rightleftharpoons \text{CH}_3\text{CH}_2\text{CH}_2\text{ONH}_3^+$

8. Circle the stronger acid:
   a. HI  or  HF
   b. CH$_3$NH$_3^+$  or  CH$_3$OH$_2^+$
   c. CH$_2$CH$_2$  or  CHCH

9. Order the following from weakest to strongest acid:
   a.
   b. $\text{CH}_2=\text{CH}_2$  or  $\text{CHCH}_2\text{OH}$  or  $\text{CH}_{2}\text{NH}_2$
10. Pick the stronger base:
   a. HS⁻ or HO⁻
   b. CH₃COO⁻ or CH₂ClCOO⁻

11. Given the pKa values on the amino acid below, draw the predominant structure of the compound at the following pH values: 0, 3, 7 and 12.

![Amino Acid Structure]

12. The pKa of CH₃COOH is 4.76. What is the ratio of acetic acid to acetate ion at a pH of 6.76?

13. Identify the Lewis acid and Lewis base in the following. Draw the electron arrow mechanism.

   \[
   \text{NH}_3 \quad \text{BF}_3 \quad \rightarrow \quad \text{H}_3\text{N}^+\text{BF}_3
   \]

14. Consider 2,3-dimethylpentane. Draw the Newman projections for the most and least stable conformers around the C2-C3 bond.

15. Draw the most stable conformation of cis-1-tert-butyl-4-methylcyclohexane.

16. Which of the following is the most stable? Draw the most stable chair conformation of it.

   ![Conformations]

17. Which of the following is a trans isomer?

   ![Isomers]

18. What are the systematic and common names for:

   a. 
   b. 
   c. 

   ![Chemical Structures]
19. Give the systematic name for:

a. 

b. 

c. OH