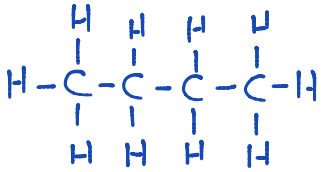
Answer Key

Chemistry 233
Chapter 1 Problem Set

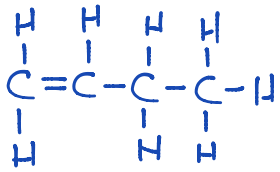
1) Draw a valid Lewis structure for each compound below.

Note: I have drawn one possible structure for each, but many have other valid structures.

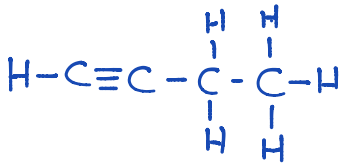
C_4H_{10}



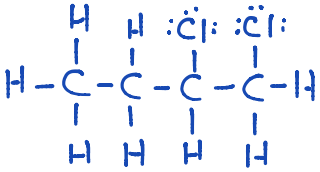
C_4H_8



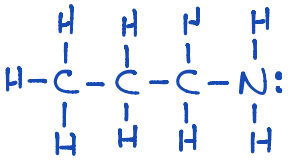
C_4H_6



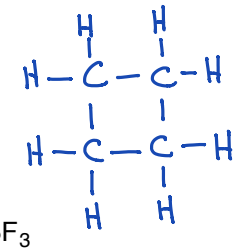
$C_4H_8Cl_2$



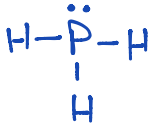
C_3H_9N



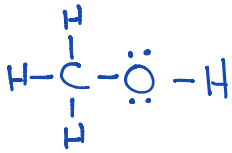
C_4H_8 (ring)



PH_3

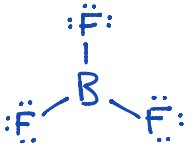


CH_3OH



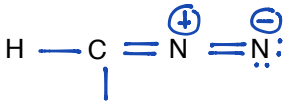
BF_3

Note: B will not have a full octet.

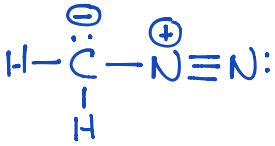


2) Draw a valid Lewis structure for each compound below. Assume the atoms are arranged as shown.

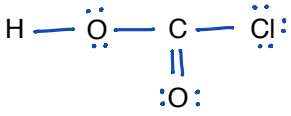
CH_2N_2



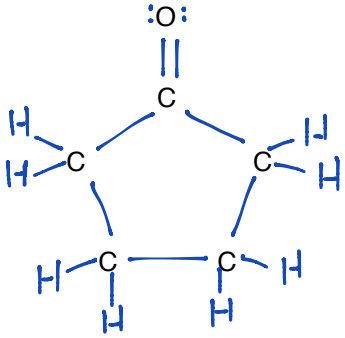
We will go over charges in Ch 2



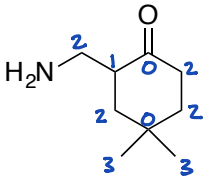
HCO_2Cl

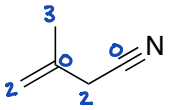


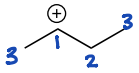
C_5H_8O

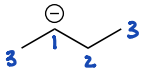


3) For each compound shown below, determine the number of hydrogen present on each carbon atom.









+ or - on carbon takes the place of one H

4) Determine the hybridization of each non-hydrogen atom in the compounds below.

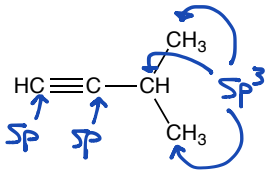
4 groups = sp^3

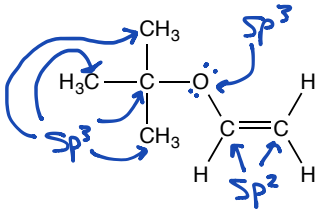
3 groups = sp^2

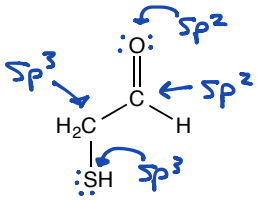
2 groups = sp

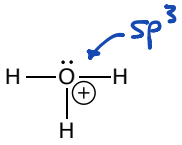
Single bond, double bond, triple bond, and lone pair each count as one group

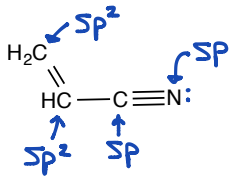
⊕ is not a group.

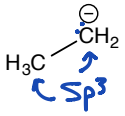


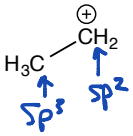


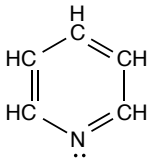




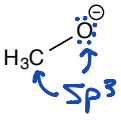




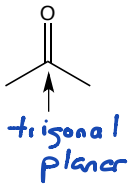


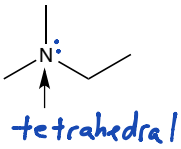


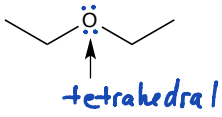
all C + N sp^2

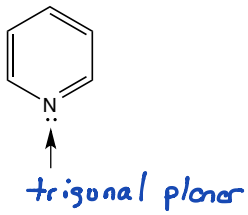


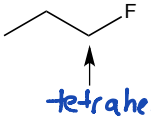
5) Predict the electron geometry around each indicated atom below.

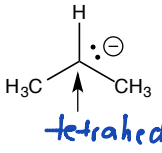


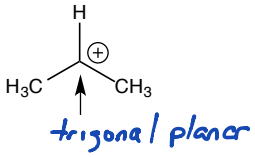


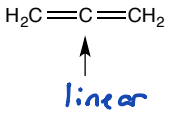


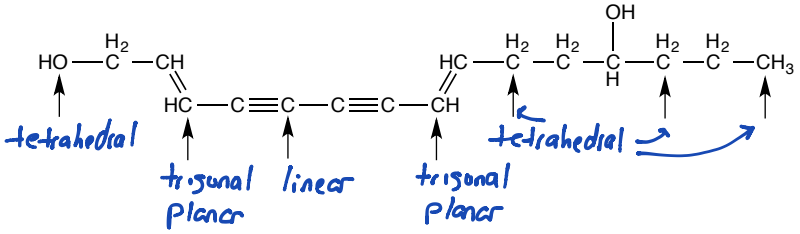






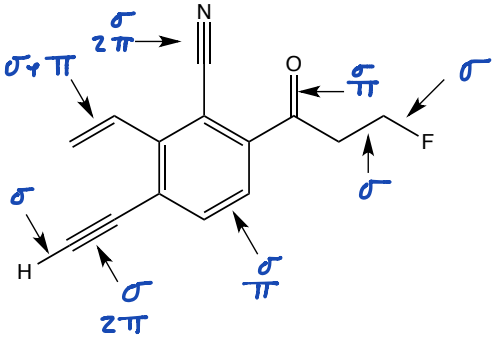




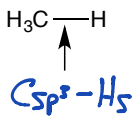


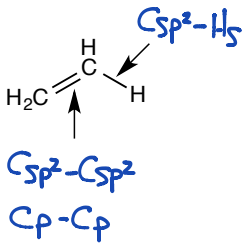
enanthotoxin:
a poison isolated from hemlock

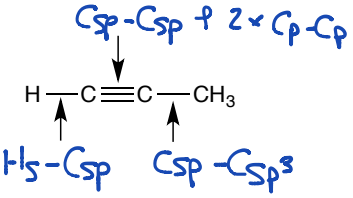
6) Classify each bond using σ and π. List the number of each bond type (i.e. 1 σ & 2 π bonds).

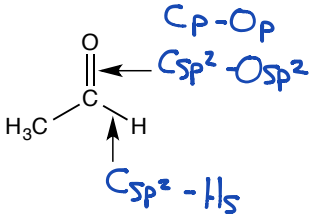


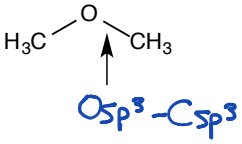
7) For each bond indicated in the structures below, determine the orbitals that make up that particular bond.

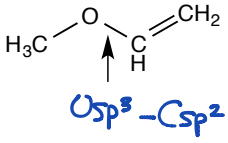


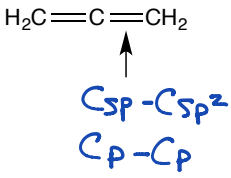


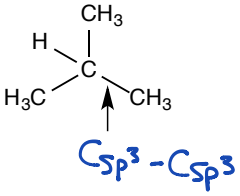




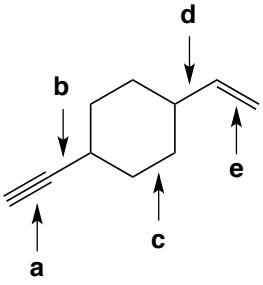








8) Consider the molecule shown below:



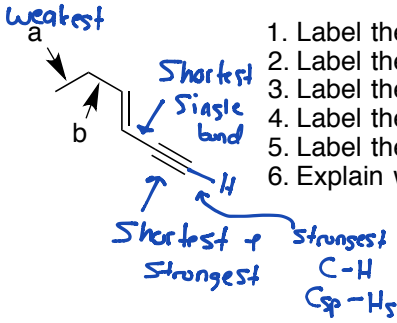
a. Rank the indicated bonds in order of increasing bond length.

a < e < b < d < c

b. Rank the indicated bonds in order of increasing bond strength.

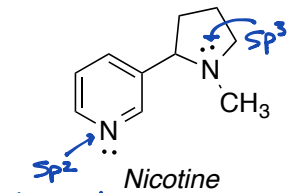
c < d < b < e < a

9) Answer the following questions about each molecule shown below.



1. Label the shortest bond.
2. Label the shortest C-C single bond.
3. Label the weakest C-C bond.
4. Label the strongest bond
5. Label the strongest C-H bond
6. Explain why bond **a** and bond **b** are different lenghts.

a = longer Csp3–Csp3
b = shorter Csp3–Csp2
more S-character



Nicotine

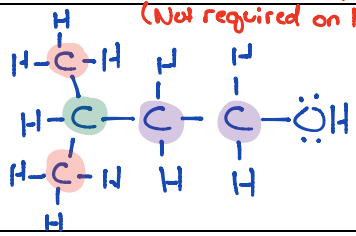
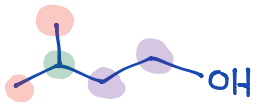
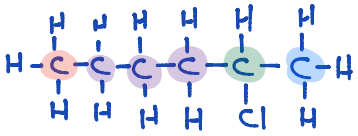
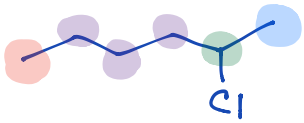
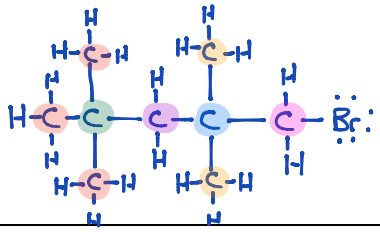
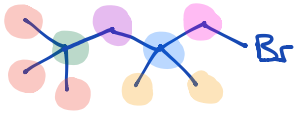
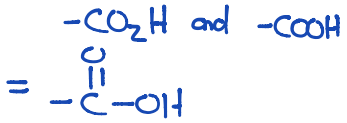
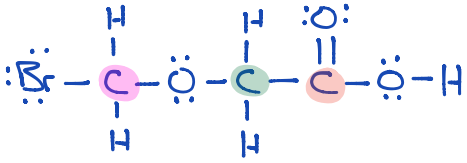
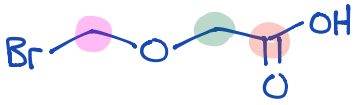
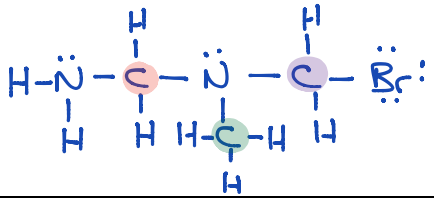
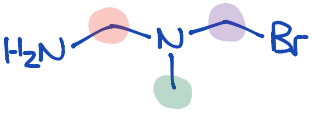
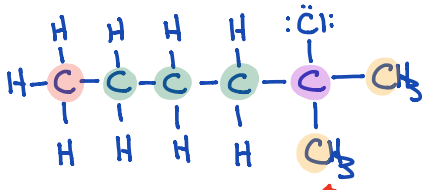
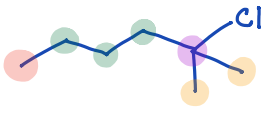
1. What is the hybridization of each N atom?
2. What is the geometry around each N atom?
3. In what type of orbital does the lone pair in each N reside?

since one of the 3 groups is a lone pair

in sp^3 orbital

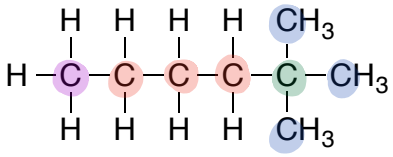
in sp^2 orbital

10)Convert each condensed structure below to a Kekule structure and a skeletal structure.

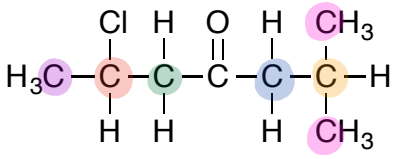
Condensed	**Kekule** - I included lone pairs. (Not required on Kekule)	**Skeletal**
$(CH_3)_2CH(CH_2)_2OH$		
$CH_3(CH_2)_3CH(Cl)CH_3$		
$(CH_3)_3CCH_2C(CH_3)_2CH_2Br$		
$BrCH_2OCH_2CO_2H$ 		
$H_2NCH_2N(CH_3)CH_2Br$		
$CH_3(CH_2)_3CCl(CH_3)_2$		

I partially condensed the CH_3 groups by not drawing out the C-H bonds.

11)Convert each structure below to a fully condensed structure.



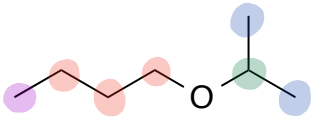
$CH_3(CH_2)_3C(CH_3)_3$



$CH_3CH(Cl)CH_2COCH_2CH(CH_3)_2$

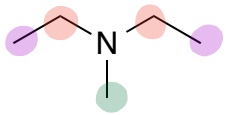
or $CH_3CHClCH_2COCH_2CH(CH_3)_2$

↑ single atom does not need to be put in ( )



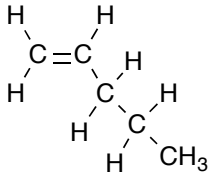
$CH_3(CH_2)_3OCH(CH_3)_2$

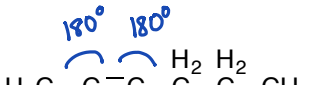
* a group of atoms (i.e. OH) would require parentheses.



$CH_3CH_2N(CH_3)CH_2CH_3$ or $(CH_3CH_2)_2NCH_3$

12)Draw each of the following as skeletal structures.





Shows 180° bond angles

better

okay