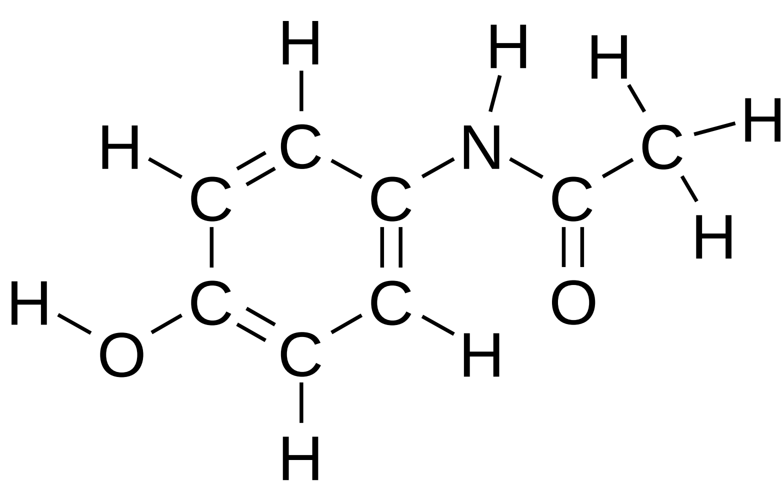
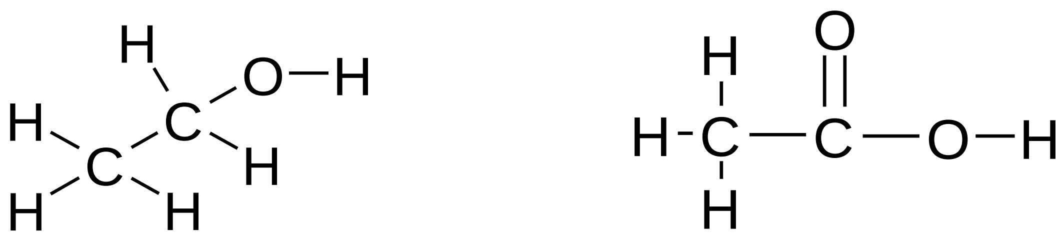
CHM 2210 - Ch 1 Homework

1. The formamide molecule (H_2NCHO) is similar to urea (page 1 of chapter notes).
   Its carbon atom is bonded to nitrogen, oxygen (double), and hydrogen.
   The two remaining hydrogen atoms are bonded to the nitrogen atom.
   Review Example 1-3 in McMurry, then show the complete Lewis dot structure for formamide.
   Review Figures 1.12, 1.13 and 1.14 in McMurry also, then indicate all σ and Π bonds,
   as well as all lone (nonbonding) pairs, for formamide. (2 pts)

2. Review hybrid orbitals and multiple bonding in the class notes, as well as sections 1.6,
   1.7, and 1.8 in McMurry. Acetaminophen (below) is commonly known as Tylenol.
   Determine the hybridization of each carbon, nitrogen, and oxygen atom in acetaminophen.
   Then, indicate the location of all Π bonds and lone (nonbonding) pairs. (2 pts)



3. Determine the hybridization and molecular geometry for all of the carbon and oxygen atoms in both ethanol and acetic acid (below). Then, determine their approximate bond angles as a function of their geometries, as the actual angles are not pictured below. Use that information to redraw the molecules with the correct angles and 3D details. Include the lone pairs. (2 pts)



4. Review hybrid orbitals and multiple bonding in the class notes, as well as sections 1.8 and 1.9 in McMurry. The acetonitrile molecule (H_3CCN) has three bonds between the nitrogen atom and its neighboring carbon atom. Draw the complete dot structure. Provide both diagrams and complete sentences that describe the shape (overall appearance?) and location (where are the e^{-1}'s?) for the one σ bond and two Π bonds that comprise the triple bond between the C and N atoms. (2 pts)

5. A stable carbocation such as $(CH_3)_3C^{+1}$ can be created in the laboratory from its related alkene.
Review Section 2-3, Table 2-2, and Figure 6.3 in McMurry.
Determine the number (≤ 4) of valence electrons "owned" by the positive (central) carbon atom.
The empty p orbital on the positive carbon atom cannot hybridize.
Review hybrid orbitals, and then determine the type of its hybridized orbitals.
Then, determine how many hybridized orbitals this carbon has.
Finally, determine the molecular geometry (shape) at the positive carbon atom,
and draw the molecule with the correct bond angles at this carbon.
(2 pts)