

Group F: Organic Functional Groups

It may be easier to construct the models for C_2H_2 , C_2H_4 , and C_2H_6 if you consider them to have the structural formulas $CHCH$, CH_2CH_2 , and CH_3CH_3 , respectively.

In stable compounds carbon always forms four bonds and these may be distributed as four single bonds, a double bond and two single bonds, two double bonds, or one triple and one single bond. Accordingly, compounds of carbon are classified by the bonds formed between carbon atoms: compounds that contain only carbon-carbon single bonds are called *alkanes*, compounds with carbon-carbon double bonds are *alkenes* and compounds with carbon-carbon triple bonds are called *alkynes*. These groupings of atoms, which can occur individually or together in a molecule, are examples of *functional groups*.

You should also note that even when several carbon atoms are strung together, each carbon atom retains a distinct geometry that is dictated by its bonding, and the same is true when other atoms replace the hydrogen in the parent molecules.

There is an alternate way of writing structural formulas that may help you build some of these models. In this method if more than one oxygen atom appears next to a carbon, parentheses are placed around the oxygen or around both the oxygen and carbon when the carbon and the oxygen are attached to each other. So we can write $HCOOH$ as $HC(O)OH$, or as $H(CO)OH$, and $HCOH$ as $H(CO)H$ to emphasize the connectivity. These compounds contain functional groups that involve oxygen: $-OH$ (*alcohol* or *hydroxyl*), $C-O-C$ (*ether*), $C-(CO)-H$ (*aldehyde*), $C-(CO)-C$ (*ketone*), and $C-(CO)-OH$ (*carboxylic acid*). Again we see that carbon only forms four bonds, no matter what else is attached to it. Note the similarity of the alcohol and ether functional groups to H_2O . There are two other functional groups found in the table $C-N$ (*amine*) and $C-(CO)-N$ (*amide*). Note the similarity of the amine functional group to NH_3 .

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
C_2H_2				
C_2H_4				
C_2H_6				
$CH_3CH_2CH_3$				
CH_3Cl				
CH_2Cl_2				

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
CHCl ₃				
CH ₃ OH				
CH ₃ NH ₂				
H ₂ CO				
HCOCH ₃				
HCOOH				

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
CH_3OCH_3				
HCONH_2				
C_6H_6				