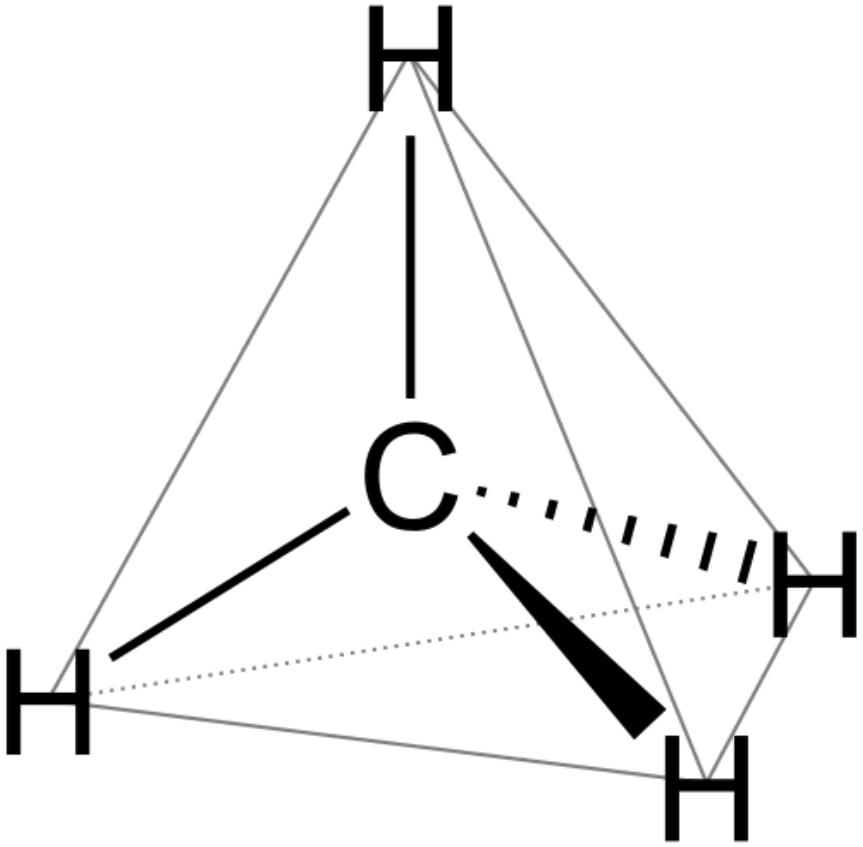
3.1.1

Hydrocarbons

TEXT HERE

When carbon forms bonds with just hydrogen we call the structure a hydrocarbon. The simplest hydrocarbon is composed of four single bonded hydrogen atoms surrounding a center carbon and is called methane (CH_4). Since covalent bonds store lots of energy, hydrocarbons are often used as fuel, an example being the propane in your barbeque grill. In addition, to maximize structural stability, the electron orbitals cause methane to exist in a three-dimensional shape called a tetrahedron with bonds spaced as far apart as possible, in this case exactly 109.5˚ apart, and four triangular faces. The three-dimensional shapes of various hydrocarbons dictate how they function within the macromolecule. Shapes are typically straight chains or rings or combinations of both.



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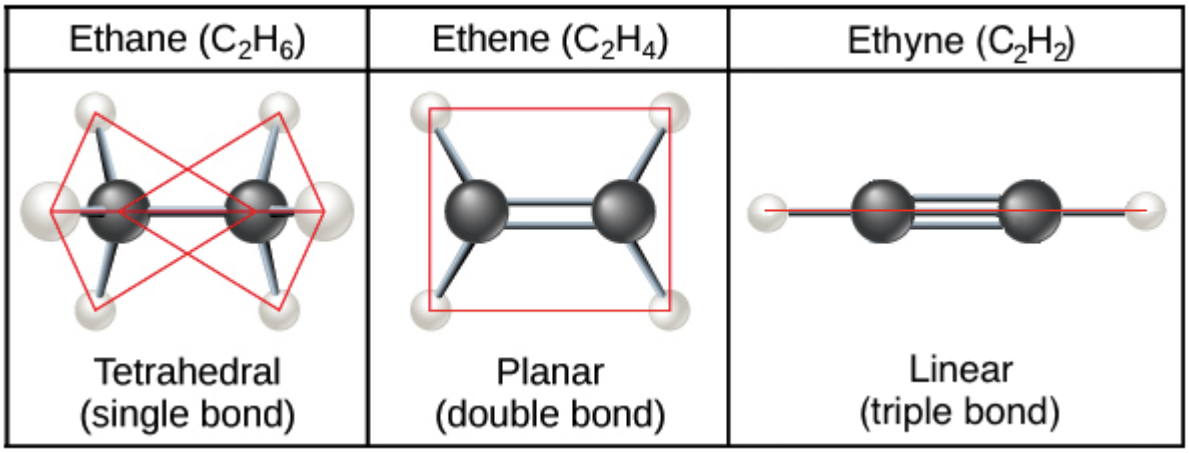
Hydrocarbon Chains and Rings

As already stated, some hydrocarbons exist as linear chains also called **aliphatic** . The geometry of the chain is affected by the number of single, double, or triple covalent bonds which in turn effects the overall shape of the molecule they are

incorporated in. Single bonds allow carbons to rotate around the axis of the bond, double bonds force planar structures and triple bonds linear structures. For example, consider the three hydrocarbons ethane, ethene, and ethyne. Note the prefix “eth-“ which always signifies a two carbon hydrocarbon. The suffixes of “-ane,” “-ene,” and “-yne” indicate a single bond, double, or triple bond respectively, between the two carbons. Thus, like methane, ethane will have a tetrahedral shape because there is a single bond between the two carbons (allows for rotation) and each are surrounded by three hydrogens. The hydrogen will try and space out as far as possible creating a tetrahedral three-dimensional shape. Ethene has a double bond between the carbons and only two hydrogen atoms connected to each carbon. Thus, the shape becomes flat or planar because the two carbon atoms are locked in place (can’t rotate). Finally, Ethyne has three bonds and each carbon only one hydrogen making the structure linear. The same model follows for the prefix of three carbon hydrocarbons “prop-“(propane, propene, propyne) and the prefix of four carbon hydrocarbons “but-“ (butane, butene, butyne).



Hydrocarbons that are not linear but instead form benzene rings are called **aromatic**. Benzene rings are closed rings of carbon atoms that may or may not contain double bonds. Rings can be formed with five or six carbon atoms. Rings are incorporated in many of the macromolecule structures.