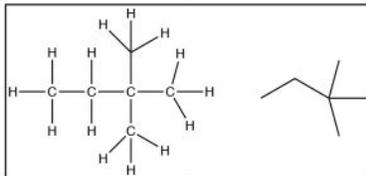
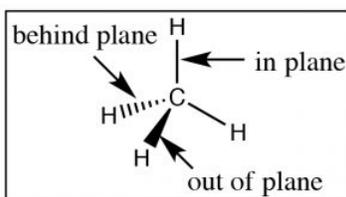


### 3: Conformations and Configurations - the consequences of the three-dimensional nature of carbon compounds



Now it is time to turn our attention to the ways in which the three-dimensional structure of organic molecules affects their stability, reactivity, and the ways in which they interact with one another and with solvent molecules. To begin with, we will consider compounds that are composed of  $sp^3$  hybridized (i.e. tetrahedral) carbons which are inherently three-dimensional since each of the four bonds points toward the vertex of a tetrahedron (a three-dimensional as opposed to a planar or two-dimensional organization). It is important to remember and understand this aspect of organic chemistry, since we tend to represent organic compounds in ever more simplified (and abstract) two-dimensional diagrams. The Lewis structure of a molecule is a 2-D (that is, flat) cartoon that contains a great deal of information (if you know how to look for it). As we move to even more abstracted representations of molecular structures it is easy to forget about the wealth of information encoded within a structural diagram. This includes both how many carbons and hydrogens are present and the three-dimensional relationships between the parts of the molecule. While there are ways to show the three-dimensional nature of  $sp^3$  hybridized carbon (such as through the use of wedge-dash structures), they can be quite cumbersome when it comes time represent complex molecules and we don't often use them unless we want to specifically address the three-dimensional arrangement of atoms within the molecule. The other idea that gets lost in a static two-dimensional representation is that the bonds between  $sp^3$  hybridized carbon atoms are sigma ( $\sigma$ ) bonds; the two parts of the molecule linked by a  $\sigma$  bond can rotate relative to each other, without disrupting the overlap between the bonding orbitals.<sup>[1]</sup> At room temperatures the carbons in most  $\sigma$  bonds are rotating freely and rapidly with respect to each other, although we have to portray them in a fixed orientation when we draw them.



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