# STERIC EFFECTS IN A COVALENT BOND

## Steric effects

These effects are very significant in organic chemistry and biology. Most books would deal with this effect in a very sketchy way, but it is important to understand the basis of this effect. The word steric is derived from ‘stereos’ meaning space. So this effect is manifested when two or more groups or atoms come in close proximity to each other (precisely within each other’s van der Waals radii (definition of van der Waals radii can be found in any standard textbook)) and result in a mutual repulsion. This makes the molecule unstable. The situation can be compared to a crowded bus or train where each passenger stands touching the other one and there is collision, one steps on the other’s feet, hits one another with elbows and so on and so forth. It’s clearly not a very pleasant scenario! It is the same things with molecules. So sheer bulk of the atoms or groups and their proximity can have serious implications. The usual physical clash between groups, almost always is accompanied by an electronic component as well. This is called stereoelectronic effect, which is not the same as the electronic effects discussed above and does not carry have an effect on some other part of the molecule like inductive and resonance effects. When the two atoms get to close, into each other’s van der Waal’s radii, the electron cloud surrounding each atom repel each other leading to a lot of destabilization. Steric effect affects different properties of molecules, like acidity, basicity and general reactivity. In biological systems where everything occurs in the level of angstroms and in a very precise manner, steric effects even due to tiny H atoms can result in the improper folding of proteins, leading to serious diseases like Alzheimer’s Disease.[1] Steric clashes can lead to

improper DNA replication resulting is destruction of genetic information and hence to a plethora of genetic diseases including cancer.[2]

**[stextbox id="info" caption="An illustration"]**

A substitution reaction on a halide by a hydroxide does not work in this case because of steric hindrance. The second figure represents the same reaction, with spheres replacing the alkyl groups to show the spatial perspective.

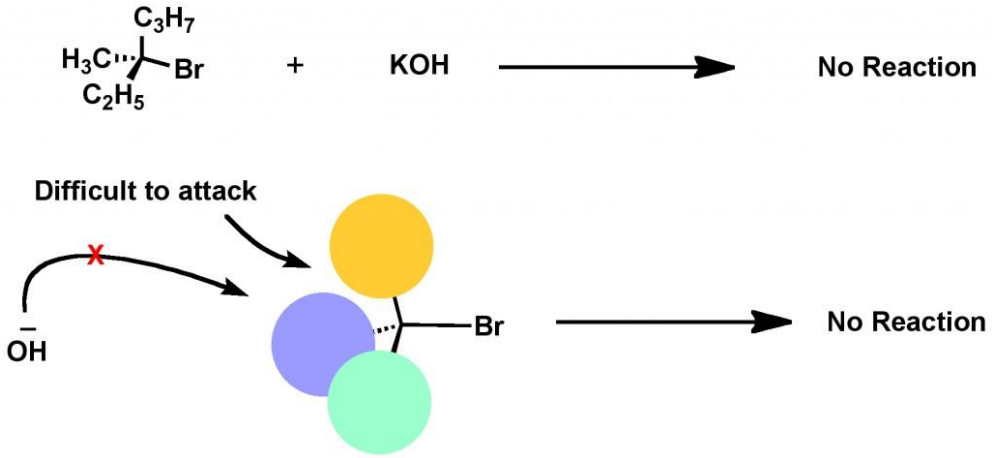


Figure 8. An illustration of steric effects

So sterics can help us rule out certain reaction mechanism and help us predict the reactivity of certain molecules in certain reactions.

Source : http://padakshep.org/otp/subjects/chemistry/organic-chemistry/steric-electronic-effects/