

Answer on Question #54089 – Chemistry – Organic Chemistry

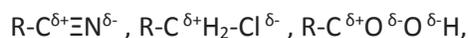
Question:

explain +I and -I effect?

and how we came to know that which group show which effect.

Answer:

The inductive effect is the polarization of a bond between two atoms which is conditioned by the difference in their electronegativities. This inducts the partial non-zero charges (shown as $\delta+$ or $\delta-$) on atoms, for instance:

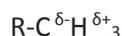


It is so because O, N, Cl have higher electronegativities than C. Since the carbon atom in these groups has positive charge, it tends to pull electrons from R group towards itself. This effect is called $-I$ inductive one, and substituents are termed electron-withdrawing groups.

Decreasing order of $-I$ effect of various groups can be shown:



The carbon atom has small negative charge, when its electronegativity is higher than bound atom (hydrogen atom). It means that the atom can push electrons to R. This is called $+I$ inductive effect, and substituents are termed electron-donating groups. For instance, methyl group is considered as $+I$ group:



Increasing number of carbon atoms with negative charge makes $+I$ effect stronger:



However, in the case when group includes O, N, S atoms with negative charge, they also donate electrons to R. The $+I$ effect occurs when the heteroatom is bound with R. For instance:

