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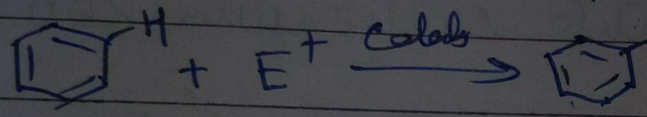
Electrophilic Substitution Rk:

When substitution reaction involve the attack by an electrophile. The reaction is referred to electrophilic substitution rk. The benzene ring with its delocalised π e is an electron rich system attacked by electrophile gives substitution product The reaction is represented as:-

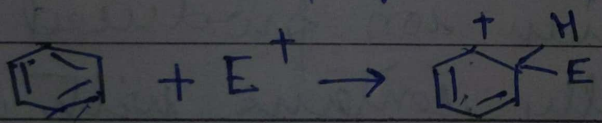


Mechanism :-

Step 1 - Formation of electrophile.

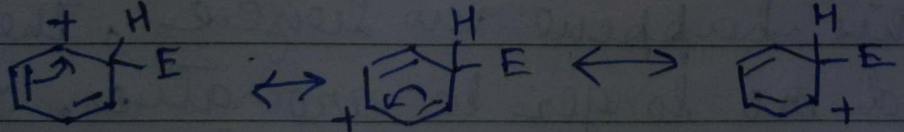
$$E-Nu + catalyst \longrightarrow E^+ + :Nu-[catalyst]$$

Step II - The electrophile attacks the aromatic ring to form carbonium ion.

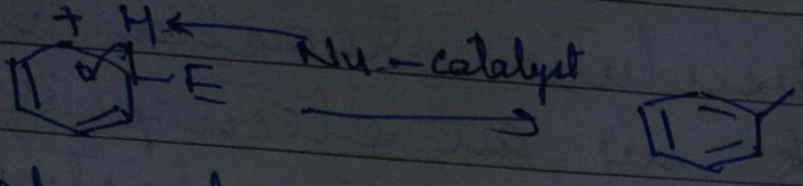


Carbonium ion

The intermediate ion is resonance - stabilized. It is a hybrid of the following three structure.

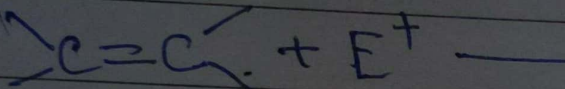


Step III. Loss of proton gives the substitution product.

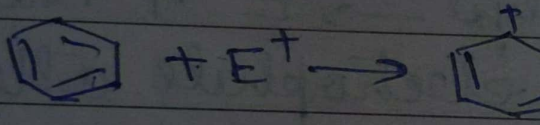


Why benzene undergoes electrophilic substitution reaction whereas alkenes undergoes addition reaction :-

Both benzene and alkenes are electrophilic attack because of their ~~each~~ exp ~~bod~~ π $\bar{e}$. Both reacts with electrophiles to form stable carbonium ion.

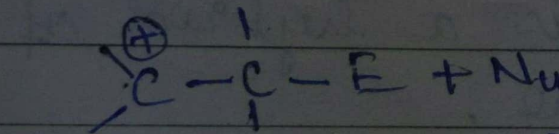


Electrophilic addition to an alkene



Electrophilic addition to benzene.

The carbonium ion produced from the alkene usually contains with a electrophil to give the overall addition product.



If this happens in benzene, the product would no longer be aromatic. The R.E.

of benzene would be lost. If the nucleophile removes a proton from the carbonium ion intermediate, the loss of proton allows the electrons from the C-H bond to go back into the ring and regenerate the aromatic π system. Net change is the replacement of a hydrogen atom by an electrophile.