

D. B. College (Jaynagar) Leaf - 4

Akhilesh Kumar Singh

Chemistry department BSC(Hons) Part-II  
Mob! - 8750390927

## (1) A GENERAL MECHANISM FOR ELECTROPHILIC AROMATIC SUBSTITUTION:

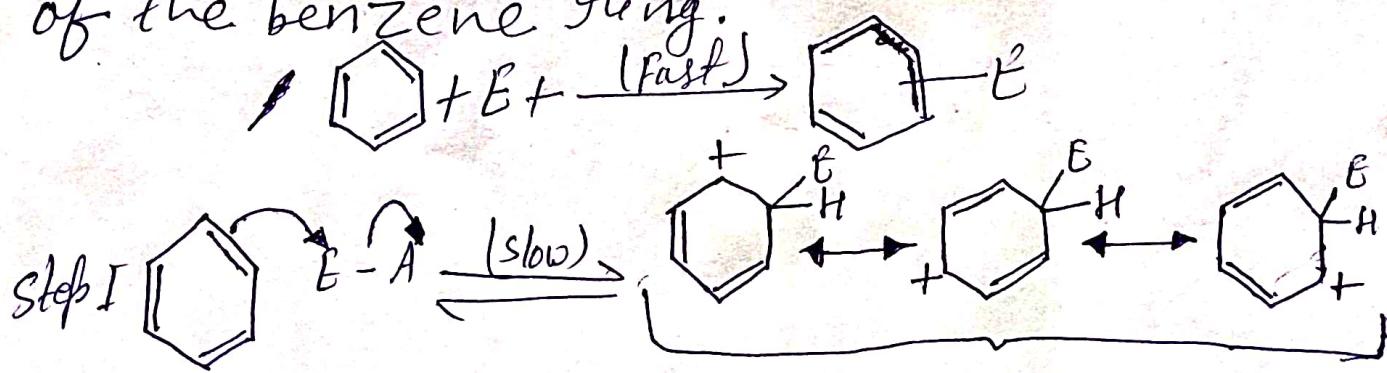
Benzene is susceptible to electrophilic attack. Primarily because of its exposed  $\pi$ -electrons. In this respect benzene resembles an alkene, for in the reaction of an alkene with an electrophilic the site of attack is the exposed  $\pi$  bond.

We saw however, that benzene differs from an alkene in a very significant way.

Benzene's closed shell of six  $\pi$  electrons gives it a special stability. so although benzene is susceptible to electrophilic attack, it undergoes substitution reactions rather than addition reactions. Substitution reactions allow the aromatic sextet of  $\pi$  electrons to be regenerated after

attack by the electrophile was occurred. We can see how this happens if we examine a general mechanism for electrophilic aromatic substitution.

Once the electrophilic,  $E^+$  is generated in the reaction, it enters into some kind of a weak interaction with the  $\pi$  cloud of benzene ring leading to the formation of a  $\pi$ -Complex. This  $\pi$ -Complex is a of a Complex, benzene being the donor and electrophile, the acceptor. These adducts are known as charge transfer complexes. In the complex that benzene forms with bromine, it has been shown that the halogen molecule is located centrally and at right angles to the plane of the benzene ring.



In Step 1 the electrophile takes two electrons of the six-electron  $\pi$  system to form a  $\sigma$  bond to one carbon atom of the benzene ring. Formation of this bond to the electrophile becomes  $sp^3$  hybridized and therefore, no longer has an ~~available~~ available p-orbital. Now only five carbon atoms of the ring are still  $sp^2$  hybridized and still have p-orbitals. A calculated electrostatic potential map for the arenium ion formed by electrophilic addition of bromine to benzene indicates that positive charge is distributed in the arenium ion ring (figure) just as was shown in the contributing resonance structures.