

## 24- Benzene and its compounds

Q-1) Delocalisation in benzene. ( $C_6H_6$ )

> Overlap of the p orbitals in the  $3\pi$  bonds in benzene causes produces a ring of delocalised electrons above and below the plane of benzene.

These delocalised electrons are very attractive for the electrophiles to attack  $\therefore$  they undergo electrophilic substitution rather than addition.

The substitution reactions involve a temporary breaking of the delocalisation  $\therefore$  the activation energy is high, and the reactions tend to be relatively slow.

Q-2) Reactivity ~~the~~ difference between benzene and chlorobenzene.

> Chlorobenzene reacts more slowly than benzene.

- Chlorine is said to be the deactivating group.

- Chlorine is more electronegative than carbon, so it draws electrons in the ring towards itself.

- This decreases the electron density around the ring so its less attractive for ~~nucleophiles~~ <sup>electrophiles</sup>  $\therefore$  the reaction is slower than benzene.

Q-3) Acidic character of phenol, alcohol and water.

PHENOL > WATER > ALCOHOL

most acidic

least acidic

Phenol is weakly acidic



- > The phenoxide ion has its negative charge spread over the whole ion as one of the lone pairs on oxygen atom, overlaps with the delocalised  $\pi$  bonds.

This reduces its charge density  $\therefore$   $\text{H}^+$  ions are not strongly attracted.

Also, phenol ionises to form a stable negative ion  $\therefore$  the equilibrium lies to the right.

- > In the alcohols, the electron donating alkyl groups <sup>attached to oxygen atom</sup> concentrate the negative charge on the oxygen atom, which more readily accepts  $\text{H}^+$   $\therefore$  the equilibrium lies to the left.



Q-4) Benzene structure:

- All C-C bonds are of same length.
- Bond angles are  $120^\circ$
- $\sigma$  bonds between C-C and C-H
- Carbon's are  $sp^2$  hybridised
- delocalised  $e^-$  form rings of charge above and below plane of carbon.