

I B.Sc.Chemistry (I SEMESTER)

BENZENE AND ITS REACTIVITY

- *Aromaticity*
- *Huckel's rule*
- *Benzenoid aromatic compounds*
- *Non -benzenoid aromatic compounds*

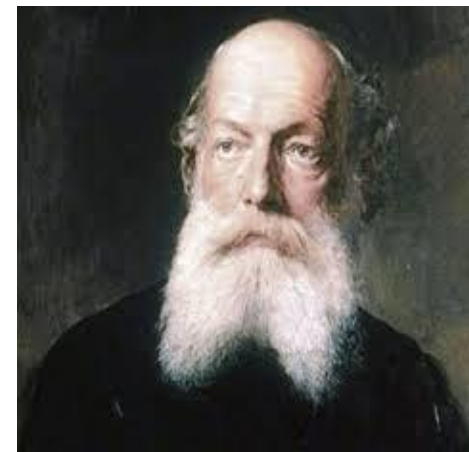
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Kekule

Aromaticity:- Aroma means sweet to smell. Compounds which resembles benzene in their chemical properties are called aromatic compounds and the nature is called aromaticity.

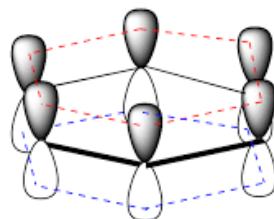
Characteristic properties of aromatic compounds:-

- 1.** These compounds similar to that of unsaturated compounds. But their behaviour resembles saturated compounds.

2. These undergo substitution reactions but not addition reactions. These undergo electrophilic substitution reactions like halogenation, nitration, sulphonation etc.,
3. These possess low heat of hydration and combustion.
4. These are cyclic compounds containing 5 or more membered rings.
5. These rings are planar in nature.
6. Cyclic compounds having conjugated double bonds with high resonance energy are stable such compounds are aromatic in nature. The resonance energy of benzene is 36 K.Cal/mole.

HUCKEL RULE:-Huckel proposed a rule to know whether to give compounds is an aromatic or not this is based on Molecular Orbital Theory.

- The aromatic compound should contain delocalized cyclic π electron cloud, above and below the plane of the molecule.



π electrons delocalized around the ring, above and below the plane

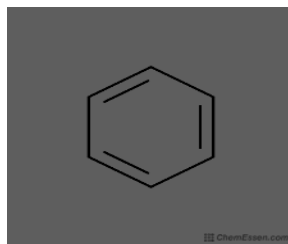
- π electron cloud must contain a total no. of $(4n+2)$ π electrons where n is no. of rings it means no. Of π electrons may be 6,10,14....

APPLICATION OF HUCKLE RULE:-

- 1. Benzenoid compounds:-** Most of the aromatic compounds contain benzene rings which are called benzenoid aromatic compounds.

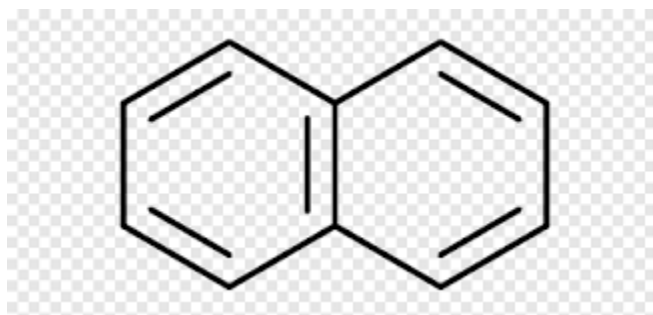
a) BENZENE:-

- It is having conjugated double bonds.
- It is planar cyclic molecule.
- It is having sp^2 hybridization.
- It is having 6 π electrons according to Huckel rule. These are delocalized π electrons.
- Hence benzene is aromatic in nature.



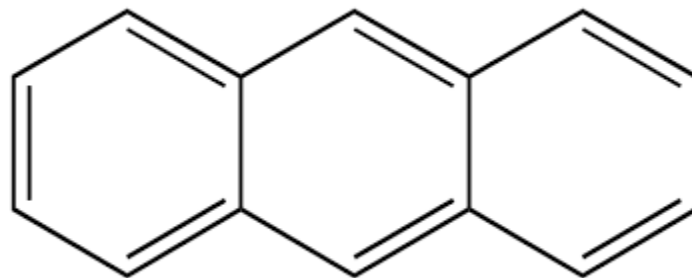
b) NAPHTHALENE:-

- It is having conjugated double bonds.
- It is planar cyclic molecule.
- It is having sp^2 hybridization.
- It is having 10π electrons according to Huckel rule. These are delocalized π electrons.
- Hence naphthalene is aromatic in nature.



c)ANTHARACENE:- It is having conjugated double bonds.

- It is planar cyclic molecule.
- It is having sp^2 hybridization.
- It is having 14π electrons according to Huckel rule. These are delocalized π electrons.
- Hence anthracene is aromatic in nature.

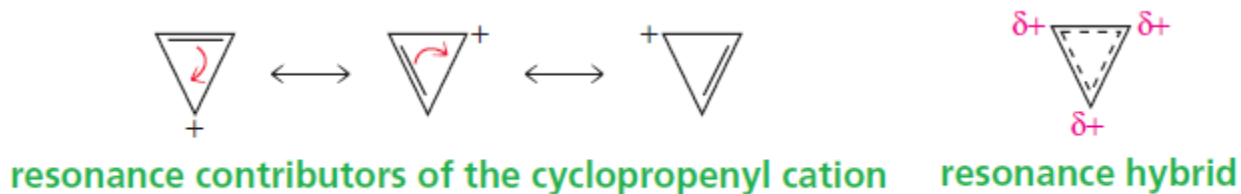


2. Non-benzenoid compounds:-

Compounds which do not have benzene rings, but behaves like benzene are called non-benzenoid aromatic compounds.

a) **Cyclo Propenyl Cation**:- It is a planar ion.

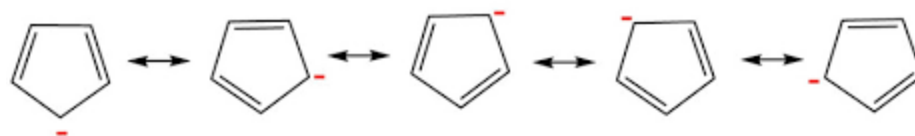
- It is having sp^2 hybridization.
- It contains two π electrons according to Huckel rule.
 $(4n+2)\pi = (4*0+2)\pi = 2\pi$ electrons.
- It is aromatic in nature.
- It shows resonance structures.



- **CYCLOPENTADIENYL ANION:-**

- It is a planar ion.
- It is having sp^2 hybridization.
- According to Huckel rule, it should have 6π electrons to have aromatic in nature. Actually it has 4π electrons in the 2π bonds and a lone pair which is involved in delocalization. Hence it has a closed group of 6π electrons and exhibits aromaticity.
- Resonance structures.

Resonance structures of cyclopentadienyl ion



c) Tropilium Cation (Cyclo heptatrienyl cation):-

- It is a planar.
- It is having Sp² hybridization.
- According to Huckel rule, it should have 6 π electrons to have aromatic in nature.
- Resonance structures.

