

Organic chemistry

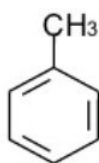
Arenes and their derivatives

Lecture -4-

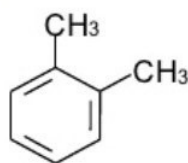
- **Arenes** are aromatic hydrocarbons containing 1 or more benzene rings.

- Their general formula is C_nH_{2n-6m} Where n is the number of carbon atoms and m is the number of rings.

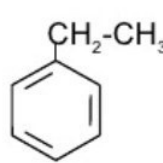
Monocyclic arenes



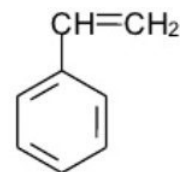
toluene



o-xylene

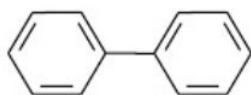


ethylbenzene

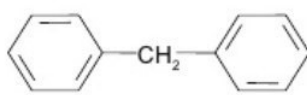


styrene

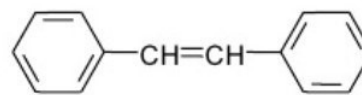
Polycyclic aromatic hydrocarbons



biphenyl

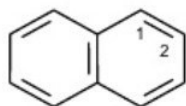


difenylmethane

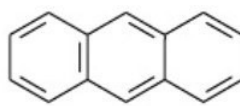


stilbene
(1,2-diphenylethene)

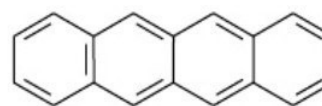
Linear fusion of aromatic rings:



naphthalene



anthracene



naphthacene

23

- Isomerism in Arenes:

When two hydrogen atoms of benzene ring are replaced by two same or different substituents, three isomers are possible which differ in the position of substituent. Thus, substitution products of benzene show position isomerism. These three isomers are called ortho, meta and para according as the relative position of the two substituents are 1,2; 1,3 and 1,4.

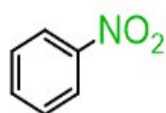
PHYSICAL PROPERTIES OF ARENES

In general, arenes resemble other hydrocarbons in their physical properties. They are nonpolar, insoluble in water, and less dense than water. In the absence of polar substituents, intermolecular forces are weak and limited to van der Waals attractions of the induced-dipole/induced-dipole type. At one time, benzene was widely used as a solvent. This use virtually disappeared when statistical studies revealed an increased incidence of leukemia among workers exposed to atmospheric levels of benzene as low as 1 ppm. Toluene has replaced benzene as an inexpensive organic solvent, because it has similar solvent properties but has not been determined to be carcinogenic in the cell systems and at the dose levels that benzene is.

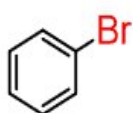
Naming Arenes Compounds

Monosubstituted Derivatives of arenes

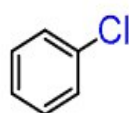
Benzene is the “first and simplest” aromatic compound and many monosubstituted derivatives of benzene are named systematically by adding the name of the substituent to “benzene” which is the parent: For examples



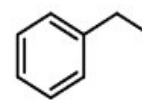
nitrobenzene



bromobenzene

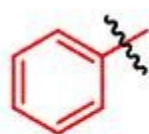


chlorobenzene

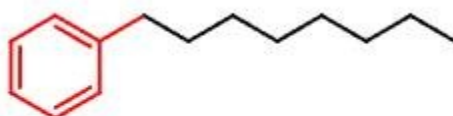


ethylbenzene

If the substituent is an alkyl chain with more carbon atoms than benzene, then benzene can be treated as a substituent. The ring, in this case, is called a phenyl group just like the methyl, ethyl, etc. The phenyl group is often abbreviated as “Ph”.



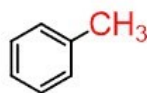
Phenyl



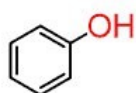
1-Phenyloctane

There are also monosubstituted benzene rings that have common names. And when naming an aromatic compound with one of these rings, you need to use the common name as the parent and not the “benzene”. Below is the list of these common names

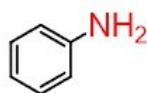
Common IUPAC names of monosubstituted aromatic compounds



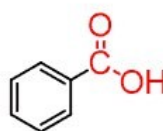
Toluene



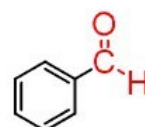
Phenol



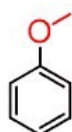
Aniline



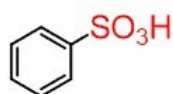
Benzoic acid



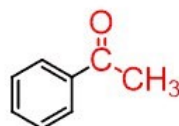
Benzaldehyde



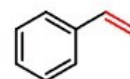
Anisole



Benzenesulfonic acid



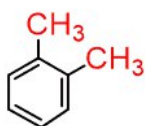
Acetophenone



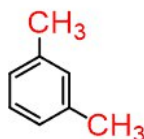
Styrene

Disubstituted Derivatives of Benzene

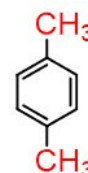
Some disubstituted benzene rings also have common names. For example, the toluene with another methyl group is called "xylene". Depending on the positions of the methyl groups, we have ortho, meta, and para-Xylenes:



ortho-Xylene
(1,2-dimethylbenzene)

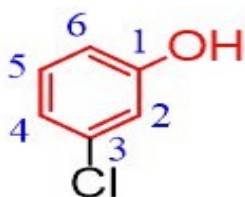


meta-Xylene
(1,3-dimethylbenzene)

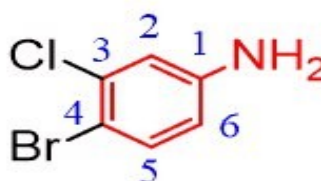


para-Xylene
(1,4-dimethylbenzene)

For the other rings with common names, start numbering the ring from the substituent that is part of the common ring such that the other groups get the smallest possible locants :

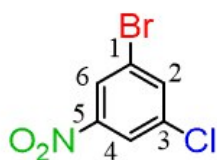


3-chlorophenol



4-bromo-3-chloroaniline

-If there are more than two groups, and numbering doesn't make a difference, start from the alphabetical priority and number the ring toward the next alphabetical priority :



1-bromo-3-chloro-5-nitrobenzene



NOT

1-bromo-3-nitro-5-chlorobenzene