

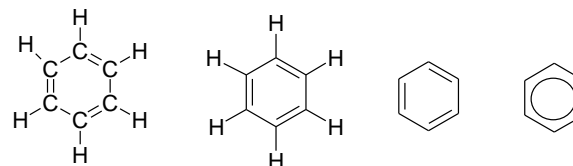
Aromatic compounds

- An **aromatic hydrocarbon** (abbreviated as ArH) or **arene** is a hydrocarbon, of which the molecular structure incorporates one or more planar sets of six carbon atoms that are connected by delocalised electrons numbering the same as if they consisted of alternating single and double covalent bonds.
- The term 'aromatic' was assigned was derived from the fact that many of the compounds containing a ring with alternating single and double covalent bonds have a sweet scent.

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Benzene – an aromatic compound

- The configuration of six carbon atoms in aromatic compounds is known as a benzene ring, after the simplest possible such hydrocarbon, benzene.



Different representations of benzene

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Properties of Benzene

- First isolated in 1825 by Michael Faraday by pyrolysis of whale oil; was characterized as a "CH" empirical formula compound.
- Later shown that benzene has a molecular formula of C_6H_6 (1834), a mp of $5.5\text{ }^\circ\text{C}$, a bp of $80.1\text{ }^\circ\text{C}$, and at room temperature is a colorless liquid.
- It is chemically inert under many reaction conditions; in fact, it is so inert that benzene has been widely used as an industrial and laboratory-scale organic solvent.

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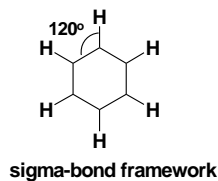
More Properties of Benzene...

- Colorless Liquid
- Boiling Point: $80.08\text{ }^\circ\text{C}$
- Melting Point: $5.48\text{ }^\circ\text{C}$
- Density: 0.880 g/cm^3
- Insoluble in Water
- Soluble in Oils & Fats
- Explosive Vapors
- Flammable Liquid

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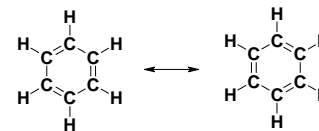
Structure and Stability of Benzene

- All carbon-carbon bonds are 139 pm (1×10^{-9} m) in length, i.e. intermediate between typical C-C single bond (154 pm) and typical double bond (134 pm)
- Benzene is planar i.e. flat
- All C-C-C bond angles are 120°

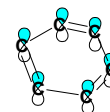


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- All six electrons are delocalized about the six carbon atoms of the ring.



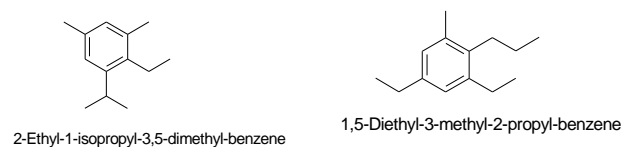
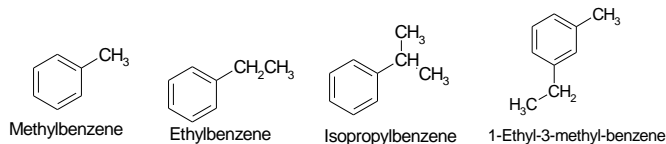
- All six carbon atoms have p orbitals perpendicular to the plane of the ring



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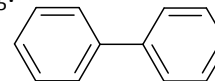
Nomenclature of Benzene Compounds

- Benzene is considered as the parent and comes last in the name

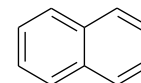


Adding extra benzene rings

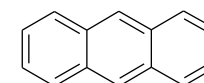
- Linking two benzene rings gives biphenyl, $C_6H_5-C_6H_5$.



- Further loss of hydrogen gives "fused" aromatic hydrocarbons, such as naphthalene and anthracene



Naphthalene

Anthracene ⁸

Uses of benzene

- Benzene is mainly used as an intermediate to make other chemicals.
- Its most widely-produced derivatives include styrene, which is used to make polymers and plastics, phenol for resins and adhesives (via cumene), and cyclohexane, which is used in the manufacture of Nylon.
- Smaller amounts of benzene are used to make some types of rubbers, lubricants, dyes, detergents, drugs, explosives, and pesticides

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Health Hazards of Benzene

- Carcinogen -- Causes Leukemia
- Does not Dissolve in Water, but does in Oils and Fats
 - Accumulates in the Food Web
- Mimics Hormones
 - Disrupts Normal Functions and Growth

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