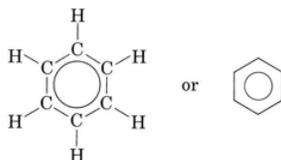


8.9: Aromatic Hydrocarbons

Aromatic hydrocarbons are one of the three classes of compounds found in petroleum. They are less abundant than the [alkanes](#) and [cycloalkanes](#), amounting to only a few percent of the total, but they are quite important commercially. Most aromatic hydrocarbons contain a **benzene ring**. You will recall from the discussion on [resonance](#) that benzene, C_6H_6 contains a flat ring of six carbon atoms joined by bonds which are intermediate in character between single and double bonds. The benzene ring is usually indicated by



First structure shows six "C" arranged in a hexagonal structure. Each "C" is connected to one "H" branching outwards from the hexagon. In the center of the hexagon is a circle. The second structure shows a hexagonal shape and circle in the middle without any element symbols.

In the latter structure the lines represent C—C bonds, but carbon and hydrogen atoms, as well as C—H bonds, have been omitted. The benzene ring is very stable, surviving unchanged in most chemical reactions. It is very different in reactivity and shape from the puckered six-membered rings found in cycloalkanes. Below are 3D Jmol models of both cyclohexane and benzene.

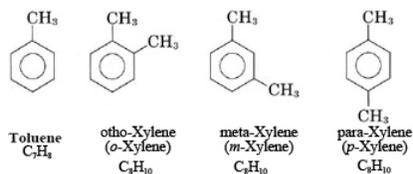
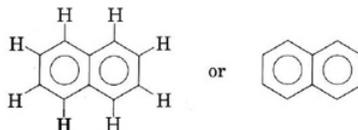


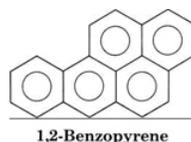
Figure 8.9.1: Examples of aromatic hydrocarbons found in crude oil

Note that the three xylenes are also isomers. Compounds containing two benzene rings joined together, such as naphthalene, are also found in crude oil, though they are much rarer than benzene-related compounds.



Aromatic hydrocarbons are much more common in coal than in petroleum, though in the United States they are mostly manufactured from the latter. In addition to their use in motor fuel, they may be made into dyes, plastics, explosives, detergents, insecticides, medicines, and many other products. In 2000, a total of 6.74×10^{12} liters of benzene were produced in the US, after compensation for exportation and importation.

Some aromatic compounds, benzene among them, are toxic. The compound 1,2-benzopyrene was the cause of the first demonstrated case of occupational disease.



During the eighteenth century chimney sweeps in London were found to have extremely high rates of skin cancer relative to the average person. This was eventually traced to the carcinogenic (cancer-causing) properties of 1,2-benzopyrene in the soot which coated the insides of the chimneys they cleaned. Small quantities of the compound were produced by inefficient combustion of coal in the fireplaces used to heat London houses.

References

1. Price, C. "Summary of available production volumes in millions of gallons per year for selected volatile organic compounds(VOCs) studied by the National Water Quality Assessment(NAWQA) Program." USGS. March 07, 2005. water.usgs.gov/nawqa/vocs/national_assessment/aboutvocs/prod_data.xls

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