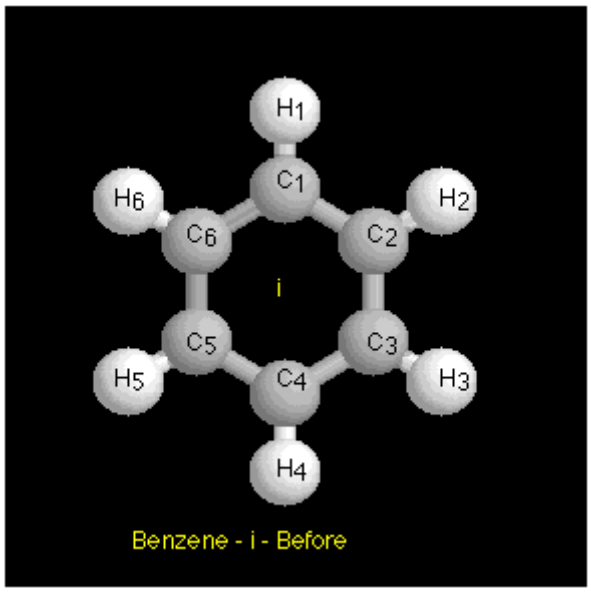
Answer on Question #46468 – Chemistry – Organic Chemistry

Question:

List the symmetries of the C_6H_6 molecule.

Answer:

Benzene has a center of symmetry, (i).



It also has a rotational axis passing through the center and perpendicular to the molecular plane. This axis in fact combines a C_6, a C_3, and a C_2 axis. The molecule has two sets of C_2 axes in the molecular plane:

(a) $3C_2'$ axes passing through the center and containing two C-H bonds.

(b) $3C_2''$ axes passing through the center and through the center of pairs of bonds on opposite sides of the hexagon.

Benzene has a plane corresponding to the molecular plane which is perpendicular to the C_6 principal axis of rotation i.e. a sh plane.

It also has 3sv planes associated with the three C_2' axes and containing the principal axis (C_6) and the center (i).

In addition there are 3sd planes associated with the three C_2'' and containing the principal axis (C_6) and the center (i).

Finally, because there is a C_6, C_3, and a C_2 axis perpendicular to the molecular plane, there also exists an S_6, S_3, and an S axis but the latter is redundant since it is equivalent to the already defined center of inversion, I.