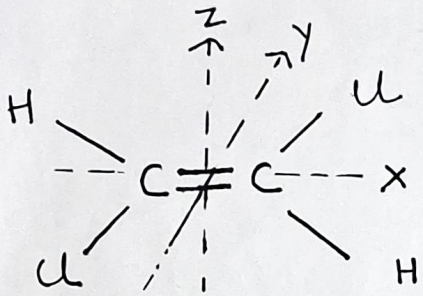
Prof. Kumud Kumar

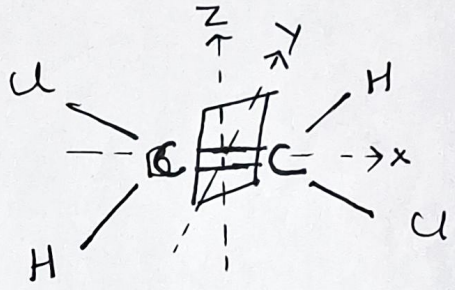
Symmetry in chemistry (contd.)

4. The Rotation-Reflection axis or Improper rotations(S_n):

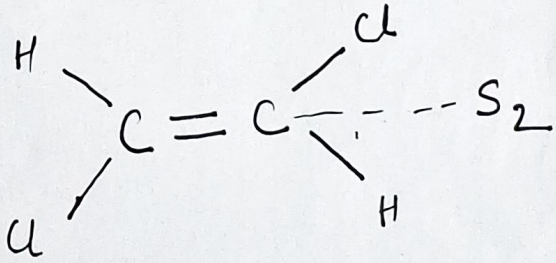
This operation involves rotation about an axis followed by reflection through a mirror plane which is perpendicular to the rotation axis or vice versa. The result of two operations produce an equivalent structure. This operation is known as improper rotation and the rotation reflection axis is known as alternating axis. The symbol S is used to indicate this symmetry element. For example in molecule transdichloroethylene. The molecule is rotated by 180^0 followed by reflection . The improper axis are S_2 which is equivalent to i. If a molecule is rotated around an axis



(a)



(b)



Rotation reflection axis of symmetry S_2

and the resulting orientation is reflected in a plane perpendicular to this axis and if the resulting orientation is superimposible on the original, the molecule have a rotation reflection axis.

5. Identity(E):

An identity operation results in the production of a orientation which is identical to the original orientations. All molecules when rotated by C_1 operation 360^0 results in the same molecule. The concept of identity operation involves no change in the molecule and is thus a pseudo operation. Every element has a symmetry element E. Several operations which produce configurations which are identical to the original are equivalent to the identity. For example, the rotation about the three fold rotation axis of BCl_3 gives the original configuration so C_3^3 operation which are equivalent to E.