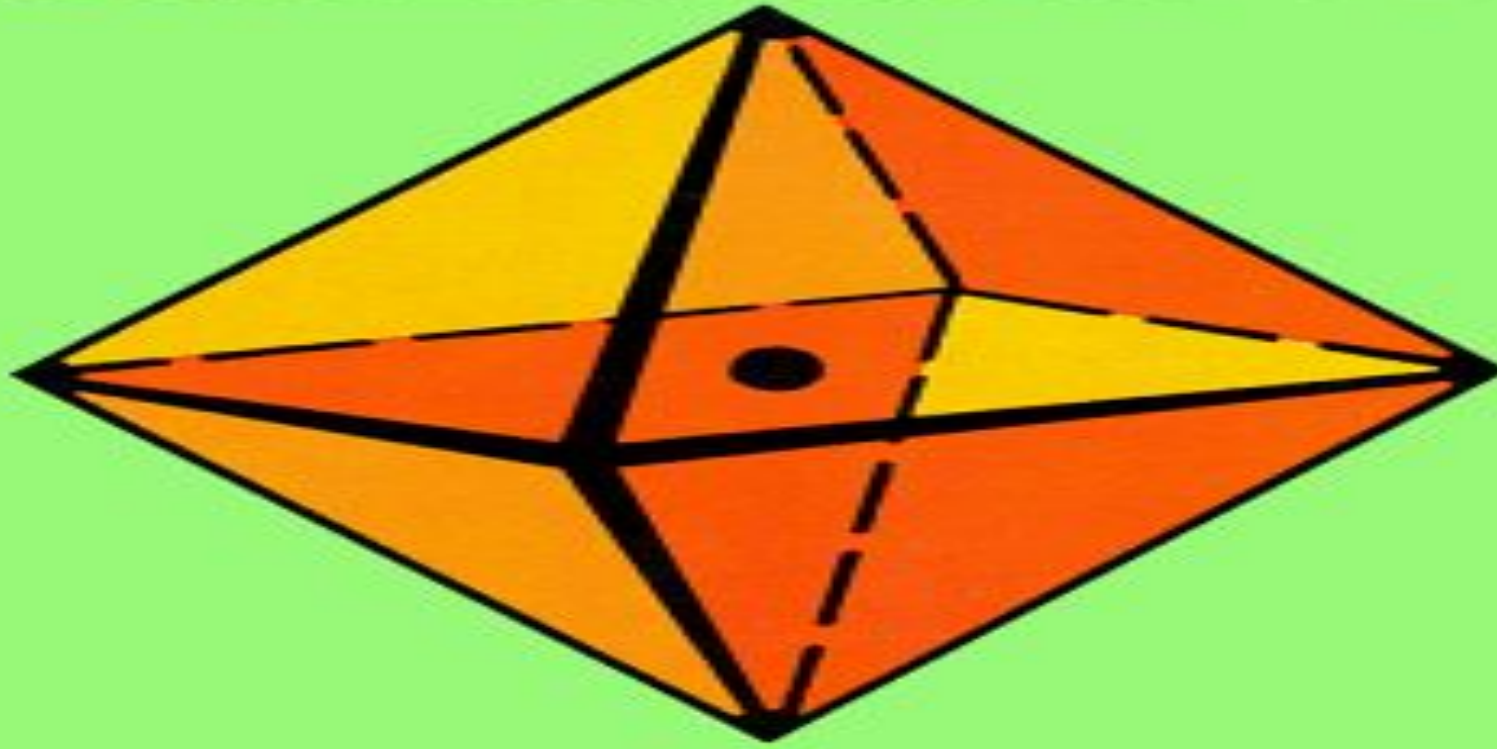
THE MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL WOMEN TEACHER TRAINING UNIVERSITY

GROUP THEORY

PERFORMED BY
ZHAKYP aIGERIM

GROUP THEORY AND CHEMISTRY



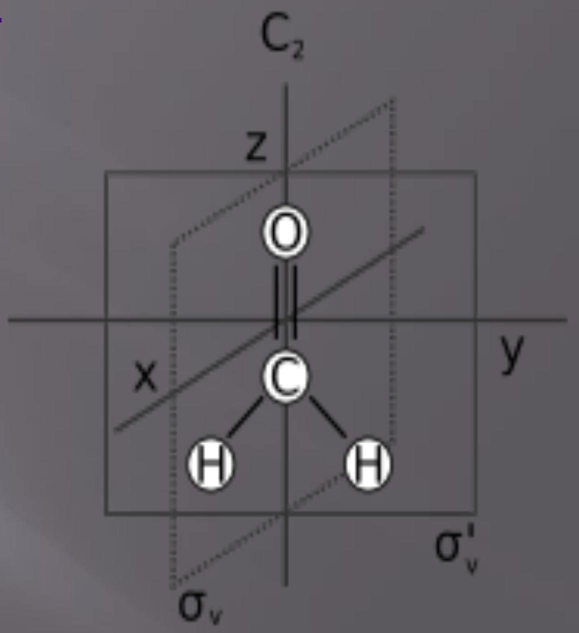
Symmetry in Coordination Chemistry

- Symmetry in Coordination Chemistry provides a comprehensive discussion of molecular symmetry. It attempts to bridge the gap between the elementary ideas of bonding and structure learned by freshmen, and those more sophisticated concepts used by the practicing chemist. The book emphasizes the use of symmetry in describing the bonding and structure of transition metal coordination compounds. The book begins with a review of basic concepts such as molecular symmetry, coordination numbers, symmetry classification, and point group symmetry. This is followed by separate chapters on the electronic, atomic, and magnetic properties of d-block transition elements; the representation of orbital symmetries in a manner consistent with the point group of a molecule. Also included are discussions of vibrational symmetry; crystal field theory, ligand field theory, and molecular orbital theory; and the chemistry of a select few d-block transition elements and their compounds. This book is meant to supplement the traditional course work of junior-senior inorganic students. It is for them that the problems and examples have been chosen.

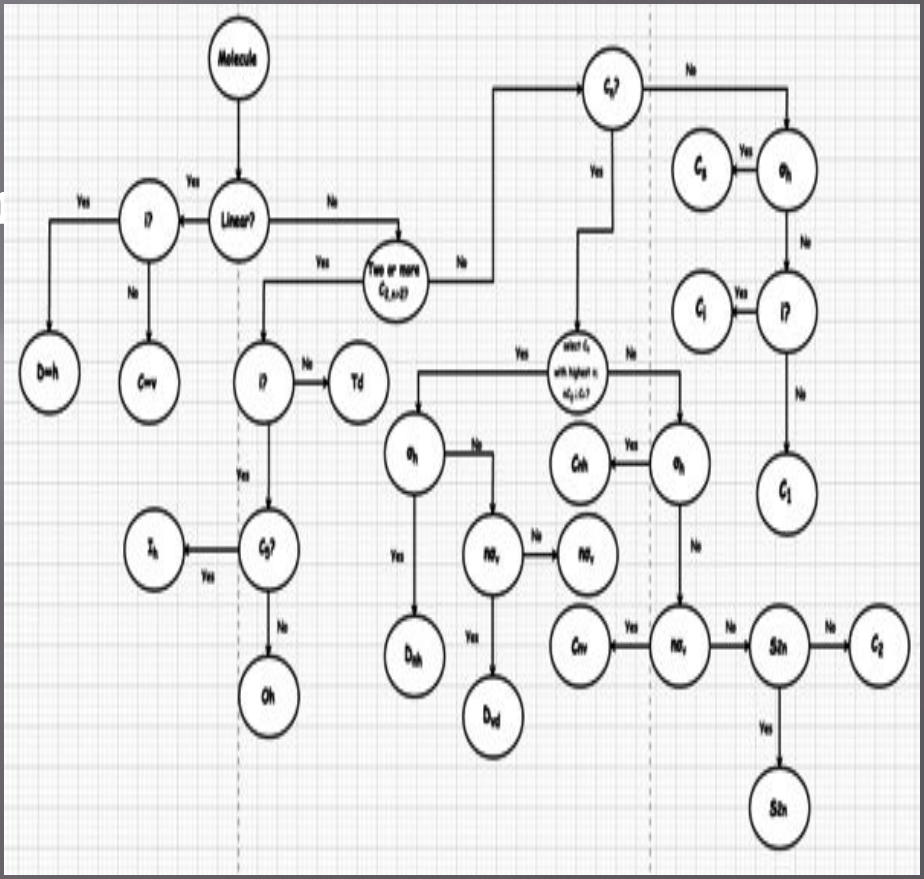
- Symmetry is important to chemistry because it undergirds essentially all *specific* interactions between molecules in nature (i.e., via the interaction of natural and human-made chiral molecules with inherently chiral biological systems). The control of the symmetry of molecules produced in modern chemical synthesis contributes to the ability of scientists to offer therapeutic interventions with minimal side effects. A rigorous understanding of symmetry explains fundamental observations in quantum chemistry, and in the applied areas of spectroscopy and crystallography. The theory and application of symmetry to these areas of physical science draws heavily on the mathematical area of group theory

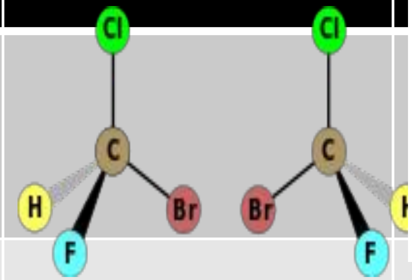
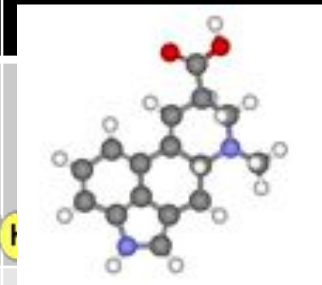
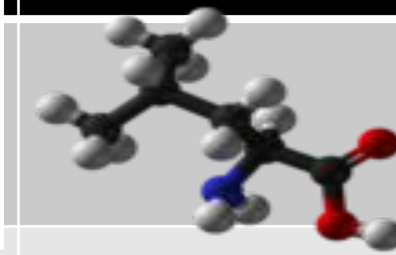
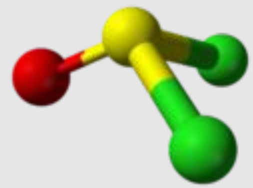
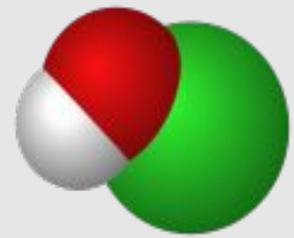
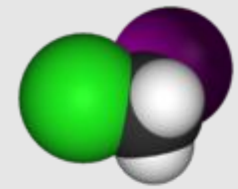
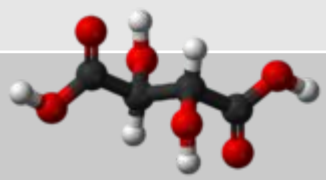
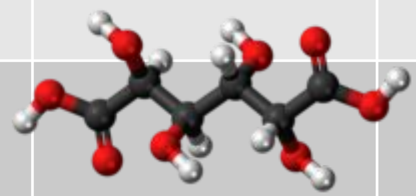
Molecular symmetry

- **Molecular symmetry** in chemistry describes the symmetry present in molecules and the classification of molecules according to their symmetry. Molecular symmetry is a fundamental concept in chemistry, as it can be used to predict or explain many of a molecule's chemical properties, such as its dipole moment and its allowed spectroscopic transitions. Many university level textbooks on physical chemistry, quantum chemistry, and inorganic chemistry devote a chapter to symmetry.
- The predominant framework for the study of molecular symmetry is group theory. Symmetry is useful in the study of molecular orbitals, with applications such as the Hückel method, ligand field theory, and the Woodward-Hoffmann rules. Another framework on a larger scale is the use of crystal systems to describe crystallographic symmetry in bulk materials.
- Many techniques for the practical assessment of molecular symmetry exist, including X-ray crystallography and various forms of spectroscopy. Spectroscopic notation is based on symmetry considerations.



- This group is called the point group of that molecule, because the set of symmetry operations leave at least one point fixed (though for some symmetries an entire axis or an entire plane remains fixed). In other words, a point group is a group that summarizes all symmetry operations that all molecules in that category have. The symmetry of a crystal, by contrast, is described by a space group of symmetry operations, which includes translations in space.



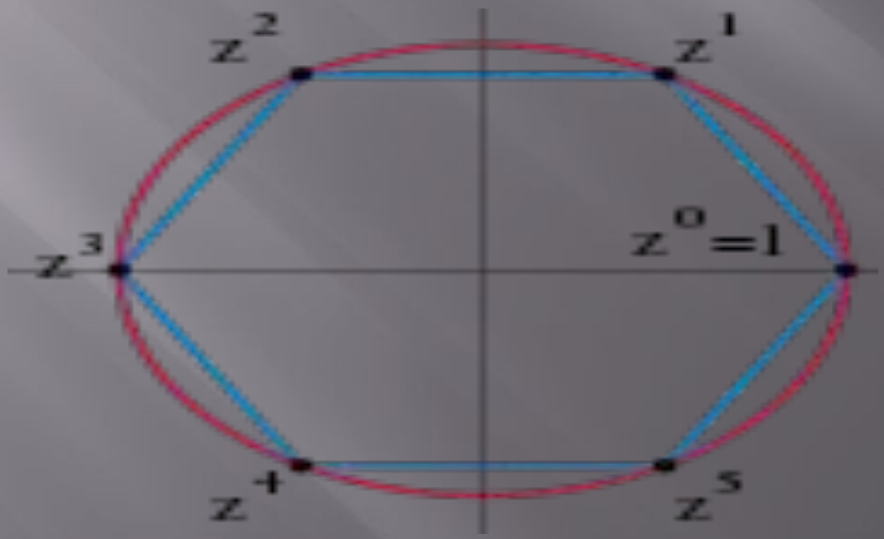
Point group	Symmetry operations	Simple description of typical geometry	Example 1	Example 2	Example 3
C_1	E	no symmetry, chiral			
C_s	$E\ \sigma_h$	mirror plane, no other symmetry			
C_i	$E\ i$	inversion center			

This article covers advanced notions. For basic topics, see Group (mathematics).

For group theory in social scienspaces, can all be seen as groups endowed with additionalces, see social group.

- In mathematics and abstract algebra, **group theory** studies the algebraic structures known as groups. The concept of a group is central to abstract algebra: other well-known algebraic structures, such as rings, fields, and vector operations and axioms. Groups recur throughout mathematics, and the methods of group theory have influenced many parts of algebra. Linear algebraic groups and Lie groups are two branches of group theory that have experienced advances and have become subject areas in their own right.
- Various physical systems, such as crystals and the hydrogen atom, may be modelled by symmetry groups. Thus group theory and the closely related representation theory have many important applications in physics, chemistry, and materials science. Group theory is also central to public key cryptography.

- One of the most important mathematical achievements of the 20th century[1] was the collaborative effort, taking up more than 10,000 journal pages and mostly published between 1960 and 1980, that culminated in a complete classification of finite simple groups.



Main classes of groups

Main article: Group (mathematics)

The range of groups being considered has gradually expanded from finite permutation groups and special examples of matrix groups to abstract groups that may be specified through a presentation by generators and relations.