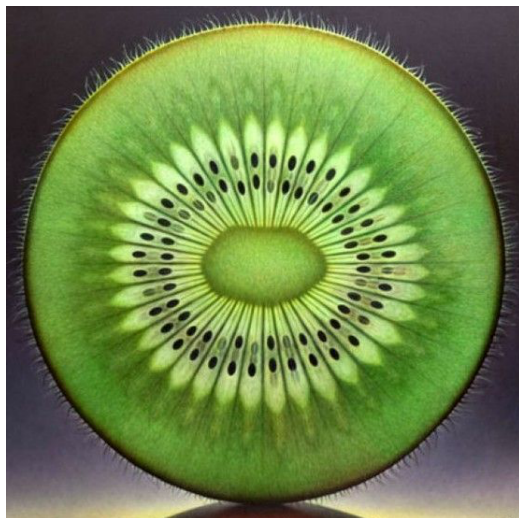


CH 431: SYMMETRY

MFT Chapter 4



Symmetry all around us



Why care about symmetry?

- The symmetry of a molecule tells us about the structure of a molecule
- Structure is important for defining the properties and functions of molecules
- In inorganic chemistry, and specifically transition metal chemistry, the geometry and symmetry of a molecule help define the electronic and magnetic properties, and the reactivity → FUNCTION



Why care about symmetry?

- We can use symmetry to solve problems:

1) Interpret spectroscopic data

- NMR and IR spectra

2) Describe bonding

- Molecular orbitals

3) Determine chirality of a molecule



Terminology for this unit

- Symmetry operation
- Symmetry element
- Point group
- Character Table
- Reducible and irreducible representations



Helpful symmetry websites/tools

<http://symmetry.otterbein.edu/index.html>

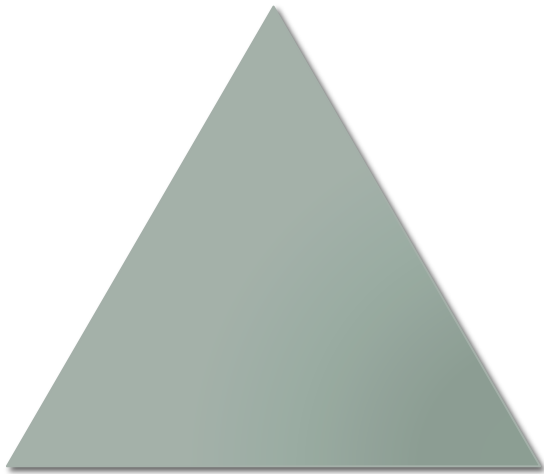
https://sites.cns.utexas.edu/jones_ch431

3D visualization can be hard!

Molecular model sets, or toothpicks and marshmallows (or the equivalent!) can be very helpful to help you visualize



Which shape is more symmetric?

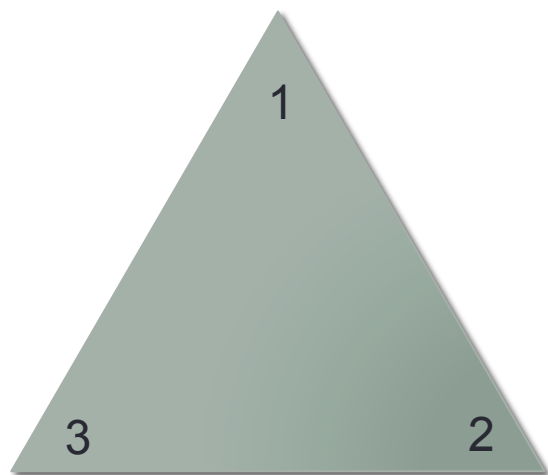


A

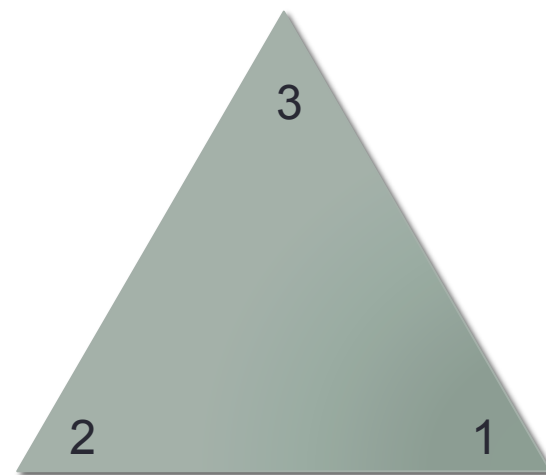


B



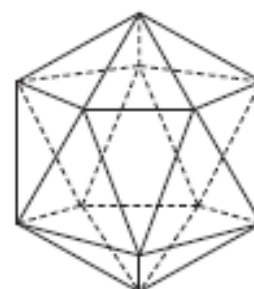
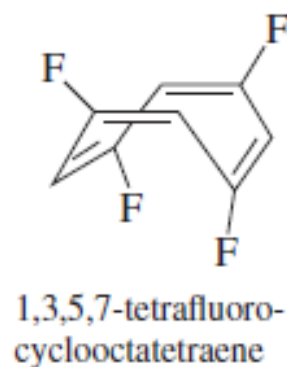
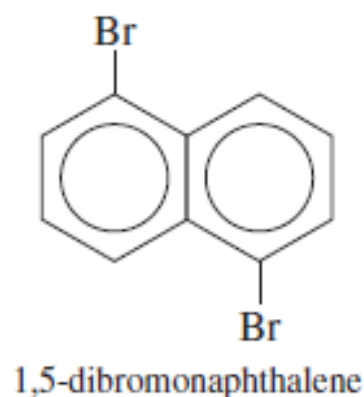
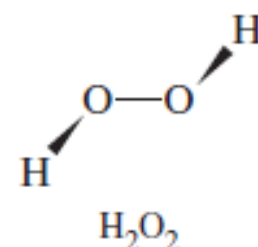
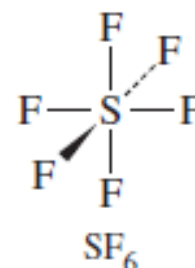
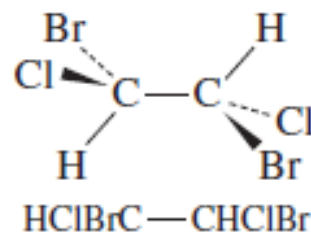
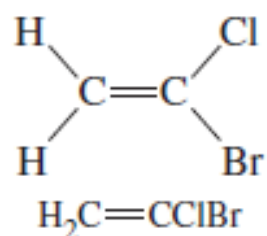
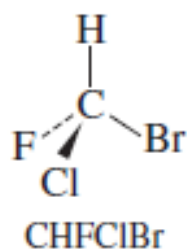
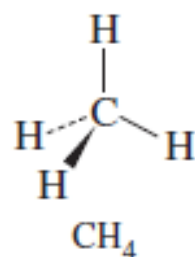
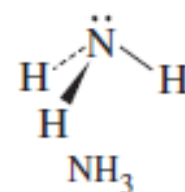
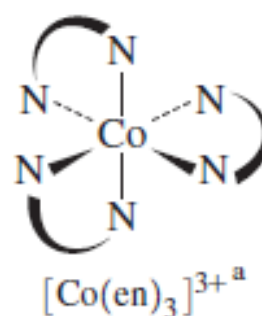
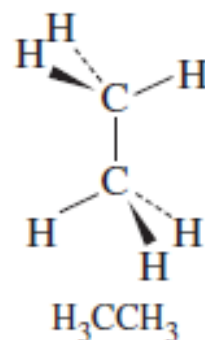
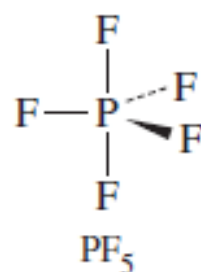
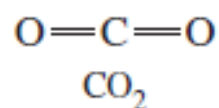
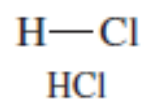


Rotate clockwise



This rotation represents a *symmetry operation*. The triangle looks the same before and after the rotation is performed, however the points are in different places.





dodecahydro-*closo*-dodecaborate
(2-) ion, B₁₂H₁₂²⁻ (each corner has
a BH unit)