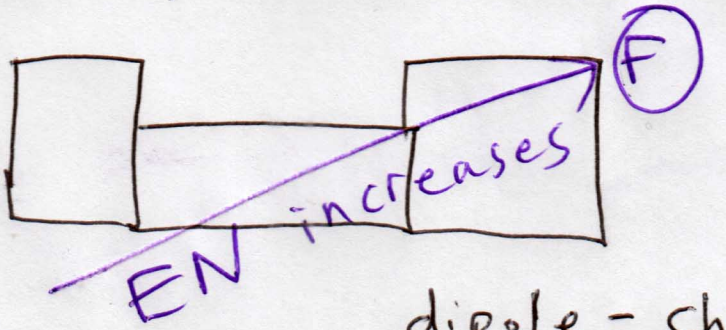
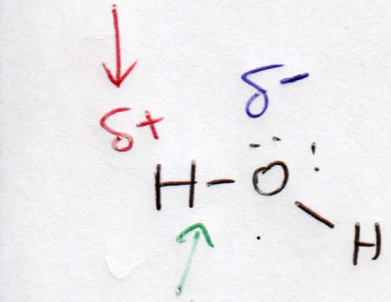
H_2O water MM = 18 g/mol

$CH_3 - CH_3$ ethane MM = 30 g/mol

Electronegativity – The tendency for an atom to draw electron density towards itself when part of a bond.



delta- "a little bit"



dipole - charge separation across space (two ends, positive + negative)

→ a vector quantity

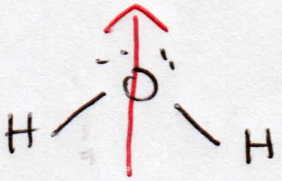
polar - has a dipolar bond dipole - caused by a difference in electronegativity of the atoms in a bond

VSEPR - valence shell electron pair repulsion

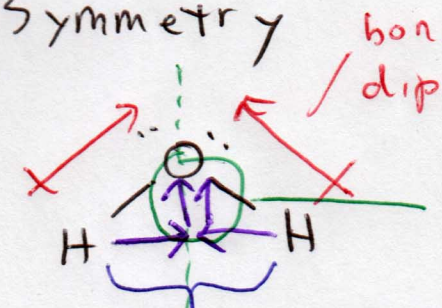
valence shell: contains the most energetic electrons that are involved in bonding

electron pair: orbitals hold pairs of electrons

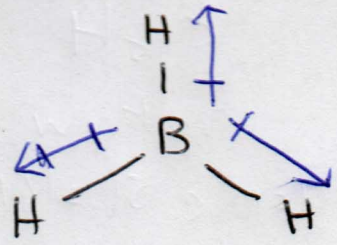
repulsion: like charges repel

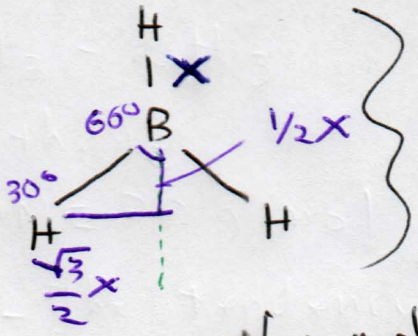


Symmetry



borane





The dipoles in boron exactly balance each other, meaning the vector sum is zero, meaning the molecule is non-polar

- Due to its asymmetric shape and its strong bond dipoles, water is a very polar molecule.
- Due to its symmetric shape and its weak bond dipoles, ethane is a non-polar molecule,

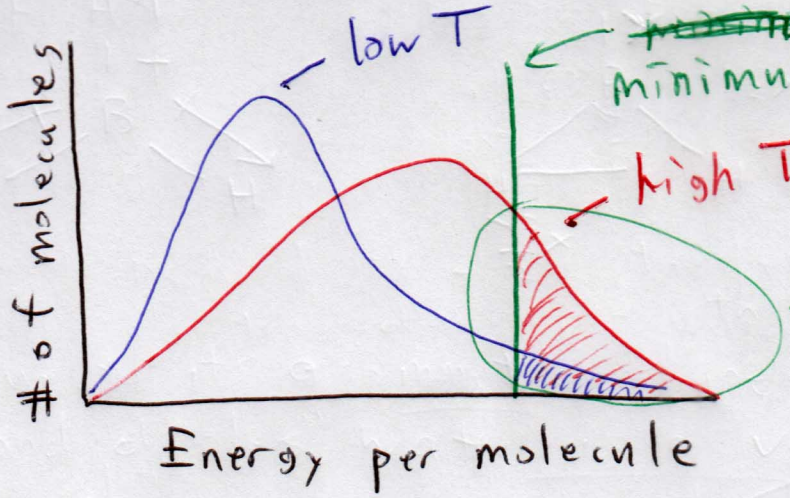
IMF - inter-molecular forces - attractions between molecules due to the interaction of full charges (ions) or partial charges (permanent or induced dipoles) → electostatic forces

Water has strong IMF due to its polarity, while ethane has very weak IMF due to its non-polarity.

heat (thermal energy) - sum of the translational, vibrational, or rotational motion of the atoms and/or molecules in a system ↗ room temperature

Water is able to be a liquid at RT because its IMF are able to resist the effects of heat. Ethane is unable to be a liquid at RT because thermal energy overcomes ethane's weak IMF.

Molecular energy distribution diagram



Water is able to evaporate at room temperature, even though it is not near its (normal) boiling point, because a small fraction of molecules will have the energy necessary to evaporate.