# 3.091 Solid State Chemistry: Week 5

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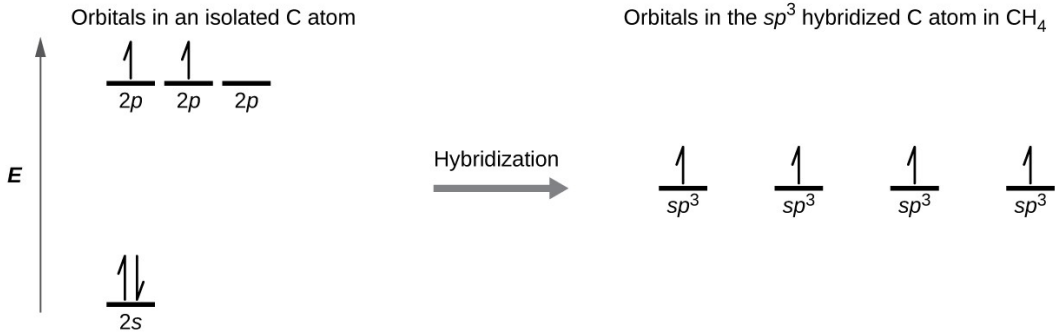
# Progress Update

Over the past week I have been introduced to:

1. Orbital Hybridization.
2. VSEPR.
3. Van der Waals force, London dispersion, and hydrogen bonding (Intermolecular forces).
4. Reaction rates & activation energy.

# Orbital Hybridization

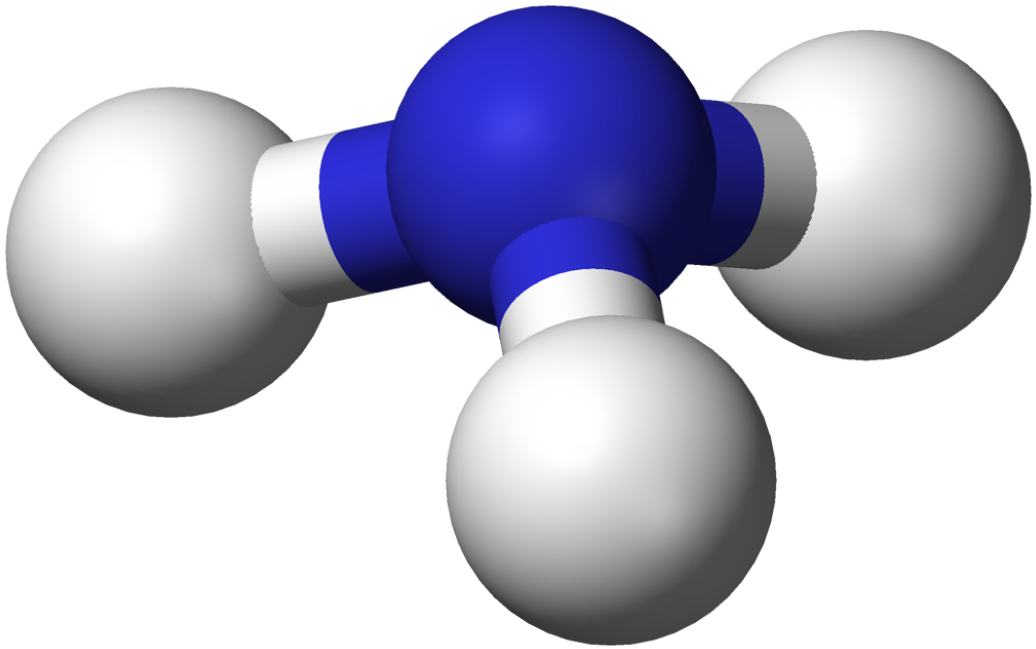
Orbital hybridization is one means of reducing potential energy in a bond. Consider the following scenario: Water, $CH_4$ has 4 hydrogens (Valence $1s^1$) and 1 carbon (Valence $2s^2 2p^2$). We can maximize the energy gained from bonding by spending some energy to "mix" the orbitals.




The $2s$ and $2p$ orbitals of the carbon mix, and we now have 4 orbitals wanting a second electron (that can be received from a hydrogen).

# VSEPR

Valence shell electron pair repulsion; a topic not mentioned my name in my Splash talk but certainly why it existed. VSEPR is a method used to predict the shape of molecules, with by the method of assuming that atoms maximize separation from eachother, then introducing electron pairs to "warp" the shape. Consider ammonia:



# Intermolecular forces

There exist a few intermolecular forces, all of which are a subset of (1):

1. Van der Waals - all intermolecular forces; causes perfectly clean sheets of glass to stick to themselves, as well as silicon to silicon or chalk to chalkboard.
2. London Dispersion - A moving electron location generates electric fields that interact with electrons of other atoms, pushing those others away.
3. Hydrogen bonding - The attraction between hydrogen atoms when each hydrogen is attached to another atom, due to minute dipoles.

# Reaction rates

Reaction rates are, as they are named, the speed/rate that a reaction of interest occurs at. It may be measured in how much of product $C$ is generated per second, how much of reactant $A$ is consumed per second, or some other normalized $R$ describing how many times the reaction as a whole occurs.

# Activation energy

The activation energy, just like the reaction rate, is incredibly self explanatory. The system containing a reaction must reach a certain level of potential energy before said reaction can occur.