Valence Bond model of bonding in H₂ shows the bond between two hydrogen atoms. It is the simplest model that explains electron pairing from two separate atoms to form a molecule. Valence Bond model of bonding H₂ is the base for understanding the behavior of valence electrons in bonding.

**Valence Bond Theory Overview**

Valence Bond Theory is a qualitative method for predicting the behavior of electrons in bonding. It focuses on the overlap of the outermost orbitals where the valence electrons reside. Electrons are thought to be concentrated along the interculear axis, causing a density of negatively charged electrons between both atoms. Attracted by the nuclei, these shared electrons pull together their respective atoms to which the electrons belong, and the result is formation of a covalent bond.

These hydrogens come together because of the electrostatic attraction between the nuclei and the electron density between them. Based on the principle of Valence Bond Theory, two electrons are required to make a single bond. Hydrogen has only one valence (outer) electron, so two hydrogen atoms are needed to make a bond. This allows accurate predictions about the shapes of simple molecules. In case of H₂, the shape is simply linear. Because Valence Bond Theory involves only valence electrons, Lewis dot structures are useful in representing a molecule. However, there are some drawbacks for certain bond predictions such as bond dissociation energy and magnetism.

Ultimately, a different atom which has more valence electrons can pair with other atoms to form a molecule with more than one bond. For instance, carbon has 4 valence electrons, so it can bond with 4 hydrogen atoms, resulting a CH₄ molecule.

Valence Bond Theory is, most of the time, used in conjunction with the idea of hybridization and VSEPR (Valence Shell Electron Pair Repulsion) in order to predict the shape and the bond angles of a molecule.

**Valence Bond Model of Hydrogen**

The formation of H₂ in Valence Bond Theory.
In this diagram, $H_A$ and $H_B$ both have one electron that can be accounted for. We know that the electron on $H_A$ belongs to $H_A$ and the electron on $H_B$ belongs to $H_B$. However, When these two hydrogen bond, it is impossible to know which electron belongs to $H_A$ or $H_B$. Also, since these two molecules are the same, they have equal attraction on the electrons they share. This is because their orbitals overlap and they now share the electrons. The electrons are allowed to spin in their respective orbitals.

**Draw backs of Valence Bond Theory**

Although Valence Bond Theory (together with hybridization and VSEPR) predicts simple structures relatively well, it becomes difficult to predict accurate energies of a bond. It also fails to predict aspects of magnetism that can be explained by Molecular Orbital Theory.

References


**Outside Links**

- [http://www.tutornext.com/molecular-o...lectrons/13915](http://www.tutornext.com/molecular-o...lectrons/13915)
- [http://www.ias.ac.in/initiat/sci_ed/...vb_article.pdf](http://www.ias.ac.in/initiat/sci_ed/...vb_article.pdf)
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**Problems**

1- Draw the lewis structure of $H_2$.

A: It is similar to the first diagram or H-H. There is only one bond because each hydrogen only has one valence electron. These two electrons pair to form the bond.
2- Explain why two hydrogens bond together.

A: Two hydrogens are able to bond together because they both have one valence electron. The electrons are inclined to come together to form a bond between the nuclei of two hydrogen atoms.

3- Why is dihydrogen fundamentally important to applying valence bond theory of other molecules?

A: Understanding the principles of valence bond theory applied to a hydrogen-hydrogen model lays a basis for understanding valence bond theory applied to other molecules.

Contributors