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Valence bond Theory

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Dr. Sanjay Kumar Yadav वैशाख शुक्ल, मंगलवार, संप्र २०१३

Lecture Notes Series 1-11Valence bond Theory

This theory was advanced by Heitler and London (1927) and later extended by Pauling and Slater (1931). It is based upon the pairing and neutralization of opposed electron spin. This theory is also known as Heitler-London theory. According to this theory. These are following fundamental idea about summarized below-

- (a) The combining atom must have one or more unpaired electrons to form bond
- (b) A bond is formed by pairing of electrons. for a stable bond formation, the two electrons must have opposite spin (1L).
- (c) After the bond formation, there is no distinction between the combining atoms i.e we can not say which electrons belongs to which atom.
- (d) Each atom in a molecule forms a closed shell of electrons.
- (e) The pair of electrons is localised between the two bonded atoms.

For Example:-

Heitler and London started with H_2 molecule. They calculated the Energy curve

In prayer it is better to have a heart without words than words without a heart.

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which is shown by figure and explained them as follows.

When two H-atoms having parallel spins

(1L) of their electrons are brought near to one another, the Potential Energy of the System Increases as Shown in Curve - I.

This is due to the strong repulsive force between

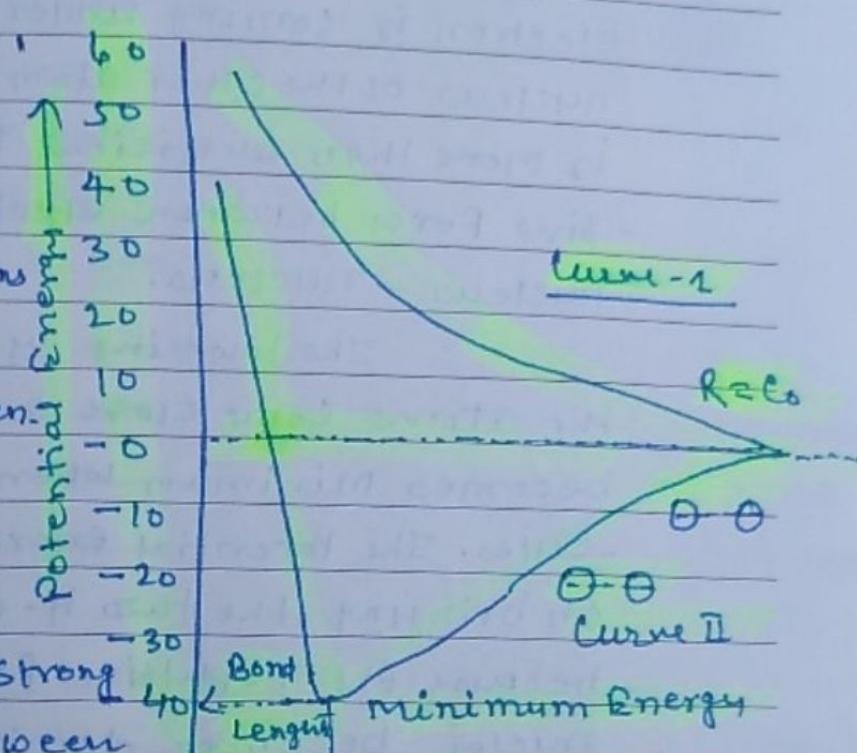
the electrons. This force increases when the atoms

reach near and

[Change in Potential Energy in the formation of H_2 Molecules.]

nearer thus, The H_2 Molecules so formed will be less stable than the individual H-atoms.

when two H-atoms having opposite spins (1L) of their electrons are brought near to one another, The change in Potential Energy of the system is Curve (II). When the two H-atoms far apart, the Potential Energy of each atom is independent of each other and arbitrarily taken as zero. As the two atoms come closer, there is an attraction between them and the Potential energy decreases.



[Distance between Hydrogen Nuclei \rightarrow]

[Change in Potential Energy in the formation of H_2 Molecules.]

$M\ T\ W\ T\ F\ S\ S\ M\ T\ W\ T\ F\ S\ S\ M\ T\ W\ T\ F\ S$

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H_2 energy occurs because each electron is coming under the influence of the nucleus of the other atom. This attractive force is more than sufficient to compensate the repul.

- Since force between electron-electron and nucleus-nucleus.

The lowering of Energy continues as the atoms come close and closer. This energy becomes minimum when the atoms form a molecule. The Potential energy increases rapidly on bringing the two H-atoms still closer because the repulsive force between the two nuclei becomes dominant causing an increase in the Potential Energy. Therefore the formation of the Covalent bond between the two H-atoms having opposite spins takes place at the point which corresponds to the minimum in curve. The distance corresponding to this point is the bond length.

Objections

- This theory fails to explain the formation of co-ordinate bond.
- This theory fails to explain the structure of odd-electron molecules and ions.
- This theory fails to explain the structure of perbromates.
- It fails to account for the directional characteristics of covalent bond.

What do I think of Western civilization? I think it would be a very good idea.

[Rest Part Next Pg]