SUBJECT - CHEMISTRY
CLASS (SUB/HEN) PART-I
GROUP - B
TOPIC - Defects of VBT

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Defects of VBT : (i) It fails to explain the paramagnetic property of O_2 and some other molecules.

(ii) It fails to explain the bonding in B_2H_6, H_2^+, He_2^+, etc.

(iii) It gives no satisfactory explanation for the formation of a co-ordinate bond in which one of the bonded atoms donates both the electrons. Since according to this theory, the bonded pair of electrons of a covalent bond must come equally from the bonded atoms.

(iv) It totally fails to explain colour, kinetic thermodynamic and structural properties of compounds.

(v) It does not take into account the presence of other nuclei in a molecule and their effects on the distribution of electrons of constituent atoms.

(vi) The theory has to introduce hypothetical concepts of resonance and hybridisation to explain formation and structures of several compounds.

Q. Explain valence bond theory of chemical bondings.

Ans. When two atoms A and B having wave functions ψ_A & ψ_B respectively and having one electron each are infinitely far apart, the joint wave function is given by

$$\psi = \psi_A \cdot \psi_B$$

According to wave mechanics, the position of electron can only be expressed in terms of probability. Hence -

$$\psi_I = \psi_A^{(1)} \psi_B^{(2)} \quad , \quad \psi_{II} = \psi_A^{(2)} \psi_B^{(1)}$$

Assumption is made that neither of the atoms distrub each other as they are far apart and the joint wave function remains the same even if they approach each other. In ψ_I & ψ_{II}, one electron is one each atom and they represent ψ_{cov}.

$$\psi_{cov} = \psi_A^{(1)} \psi_B^{(2)} + \psi_A^{2} \psi_B^{(1)}$$

Both electrons may reside on the same atoms even for a while and this will represent ionic nature.

$$\psi_{ionic} = \psi_A^{(1)} \psi_A^{(1)} + \psi_B^{(2)} \psi_B^{(2)}$$

$$\therefore \psi_{V.B} = \psi_{cov} + \lambda \psi_{ionic}$$

where λ is the coefficient of mixing ψ_{cov} with ψ_{ionic}