TDC Part III
Paper VI
Inorganic Chemistry

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TOPIC:- SYMBIOSIS
THEORETICAL BASIS OF HARDNESS AND SOFTNESS

SYMBIOSIS

In sense of biology, symbiosis may be defined as the dependency on each other i.e. when the two spices comes in the contact of each other then both are equally benefitted but in the sense of HSAB concept, symbiosis phenomena is different from the biological symbiosis. According to HSAB concept, attraction of the soft base toward the centre which is attached with the soft bases or attraction of the hard base toward the centre which is attached with the hard bases is known as symbiosis.

Explanation:

NH_3 exhibit the symbiosis phenomena with the BF_3 because the hard base NH_3 having the tendency to attach with B centre which is already attached with hard bases F^- ion.

$^+NH_3$ $\longrightarrow$ $BF_3 \longleftarrow$ NH_3

Hard base   Adduct
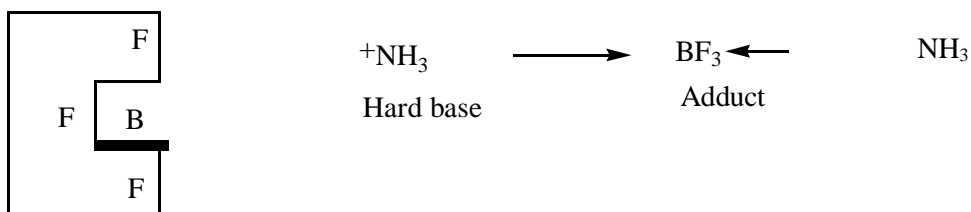
THEORETICAL BASIS OF HARDNESS AND SOFTNESS

There are some theories that can explain the interactions in between the hard acids and hard bases and vice versa. No single theoy can explain this kind of interaction.

Electronegativity concept for the HSAB theory

According to the electronegativity theory, the interaction between HA and HB is ionic or electrostatic in nature. As hard acid and hard bases are small in size (HB is highly electronegative and HA is highly electropositive), the internuclear distance between them will be smaller. As a result, interaction between HA and HB will be highly stable.

Covalent concept for the HSAB theory (σ-bonding)

Soft acids have high polarising power and soft bases like I- has high polarisability.
Therefore, the interaction between SA and SB is covalent in nature.

Covalent concept for the HSAB theory (л-bonding)

Soft acids have fully filled d orbitals (low oxidation state) and soft bases are   pi bonding ligands. Thus, SA has a good tendency to form π bonds with SB.