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Hard and Soft Acids and Bases

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In a recent publication[1] the rate data for the generalized nucleophilic displacement reaction were reviewed and analyzed.

$$N + S\text{–}X \longrightarrow N\text{–}S + X \qquad (1)$$

In this paper the equilibrium constants of eq. 1 will be considered, instead of the rates.

$$N\ (\text{base}) + S\text{–}X\ (\text{acid–base complex}) \rightleftharpoons N\text{–}S\ (\text{acid–base complex}) + X\ (\text{base}) \qquad (2)$$

Table I
Classification of Lewis Acids

Class (a) or hard	Class (b) or soft
H^+, Li^+, Na^+, K^+	Cu^+, Ag^+, Au^+, Tl^+, Hg^+, Cs^+
Be^{2+}, Mg^{2+}, Ca^{2+}, Sr^{2+}, Sn^{2+}	Pd^{2+}, Cd^{2+}, Pt^{2+}, Hg^{2+}, CH_3Hg^+
Al^{3+}, Sc^{3+}, Ga^{3+}, In^{3+}, La^{3+}	Tl^{3+}, $Tl(CH_3)_3$, BH_3
Cr^{3+}, Co^{3+}, Fe^{3+}, As^{3+}, Ir^{3+}	RS^+, RSe^+, RTe^+
Si^{4+}, Ti^{4+}, Zr^{4+}, Th^{4+}, Pu^{4+}, VO^{2+}	I^+, Br^+, HO^+, RO^+
UO_2^{2+}, $(CH_3)_2Sn^{2+}$	I_2, Br_2, ICN, etc.
$BeMe_2$, BF_3, BCl_3, $B(OR)_3$	Trinitrobenzene, etc.
$Al(CH_3)_3$, $Ga(CH_3)_3$, $In(CH_3)_3$	Chloranil, quinones, etc.
RPO_2^+, $ROPO_2^+$	Tetracyanoethylene, etc.
RSO_2^+, $ROSO_2^+$, SO_3	O, Cl, Br, I, R_3C(?)
I^{7+}, I^{5+}, Cl^{7+}	M^0 (metal atoms)
R_3C^+, RCO^+, CO_2, NC^+	Bulk metals
HX (hydrogen bonding molecules)	

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