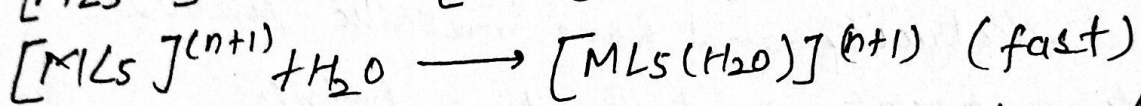
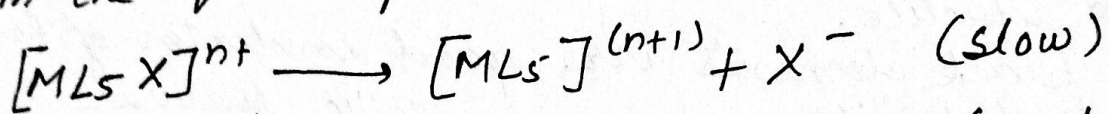


Acid Hydrolysis

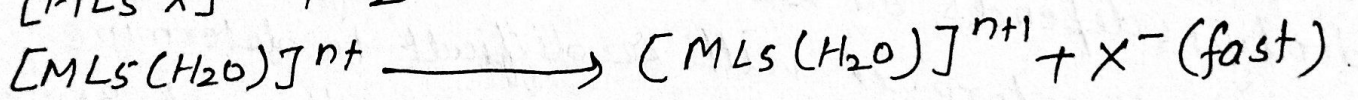
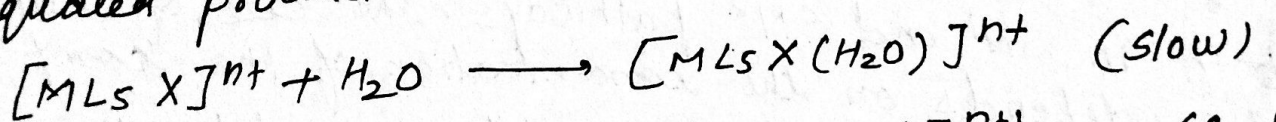
A. Mechanism of Acid Hydrolysis When no inert ligand in the complex is a π donor or π -acceptor

- In S_N1 (dissociative) mechanism of acid hydrolysis, the rate determining step is the one in which the bond $M-X$ dissociates to produce a 5-coordinate intermediate complex which then immediately reacts with water to form the aquated product as below.



Rate of acid hydrolysis = k_1 (concentration of $[ML_5X]^{n+}$)

- In S_N2 (associative) mechanism of acid hydrolysis, the rate determining step is the one in which a seven coordinate intermediate complex is formed which then releases the leaving group X^- to yield the aquated product as below.



Rate of acid hydrolysis = k_2 (concentration of $[ML_5X]^{n+}$ and H_2O)

Since H_2O is present in large amount in all reactions. Its concentration can be taken as constant

hence Rate of acid hydrolysis = k_2 (concentration of $[ML_5X]^{n+}$ $\times$ constant)

Rate of acid hydrolysis = k_2 (concentration of $[ML_5X]^{n+}$)

So, As we find that in first case

rate of acid hydrolysis (for S_N1) = k_1 (concentration of $[ML_5X]^{n+}$)

and rate of acid hydrolysis (for S_N2) = k_2 (concentration of $[ML_5X]^{n+}$)

since both in SN^1 and SN^2 pathways, the rate of acid hydrolysis depends on the concentration of the complex $[ML_5X]^{n+}$, therefore it will be difficult to determine whether acid hydrolysis takes place through SN^1 or SN^2 pathway.

• Therefore following factors would be used to determine the pathway of acid hydrolysis.

- 1) Charge on substrate
- 2) Strength of $M-X$ bond
- 3) Inductive effect of inert ligand
- 4) Solvation effect