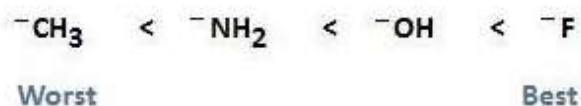


□ Nature of the leaving group

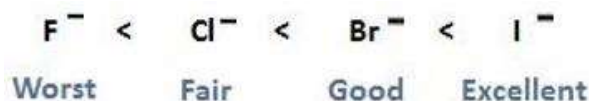
In S_N1 and S_N2 reactions, leaving group leaves as negatively charged species. The greater the stability of the leaving group, the more easily it will be lost and hence increases the rate of the reaction. Best leaving group are those which are least basic species thus will be less likely to share its electrons.

As Electronegativity Increases, Basicity Decreases – Leaving group tendency decreases from left to right of the periodic table.



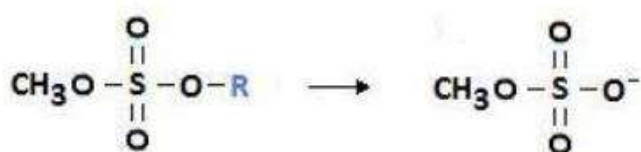
(This particular example is only use to understand the concept. In reality these are not good leaving group)

As Size Increases, Basicity Decreases – Leaving group tendency increases from top to bottom in the periodic table.

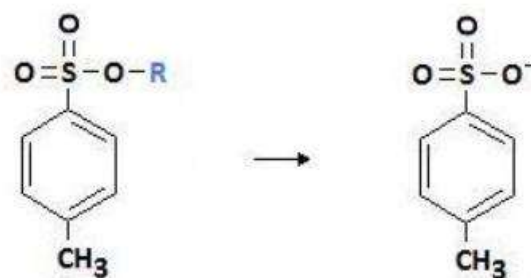


Resonance Increases the Ability of the Leaving Group to Leave

Basicity decreases with resonance. If the leaving groups after the removal can get themselves stabilized through resonance they are considered to be as the good leaving group.



Methyl Sulfate Ion



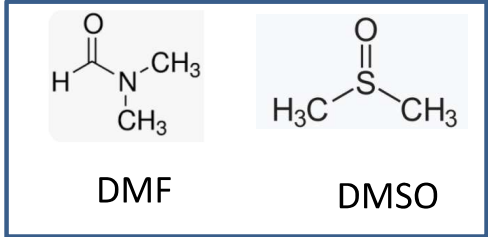
4-Methylbenzenesulfonate Ion (Tosylate)

Which is the best leaving group among the following?



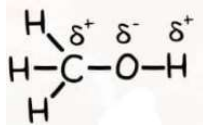
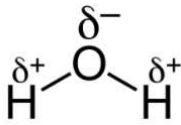
Effect of Solvent on the Reaction Rate

Type of solvents

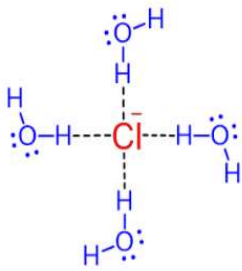
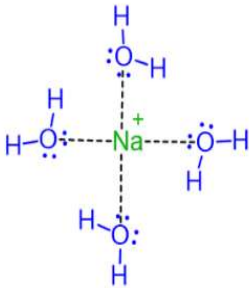


- ❖ **Polar Protic**- H₂O, CH₃OH, NH₃ etc
- ❖ **Polar Aprotic**- Dimethyl sulfoxide (DMSO) , Dimethylformamide (DMF), Acetone etc
- ❖ **Non Polar**- Benzene, Toluene etc.

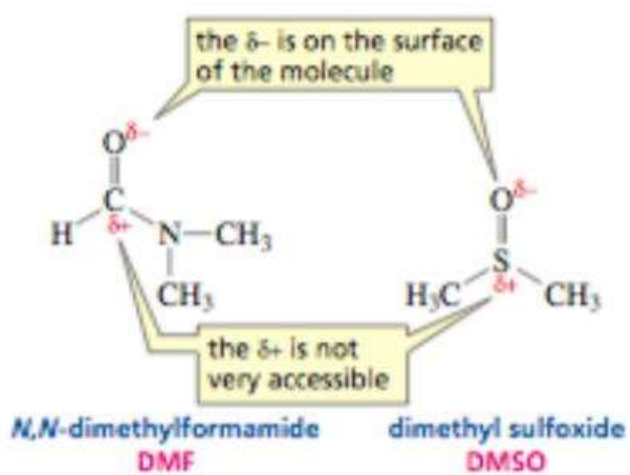
A **protic solvent** is a solvent that has a hydrogen atom bound to an O,N. It is a hydrogen bond donor



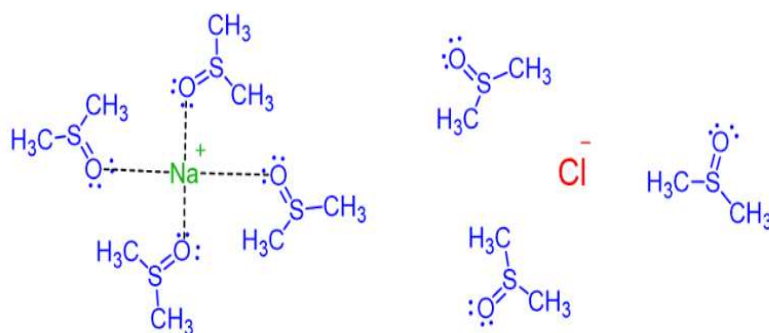
Polar protic solvents solvate both cations and anions



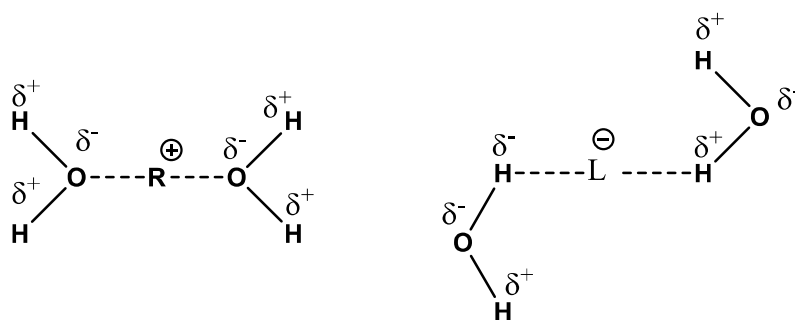
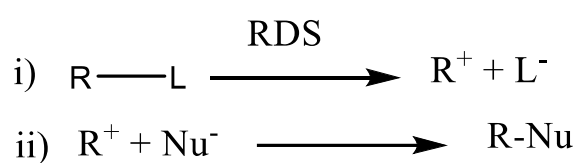
An **aprotic solvent** is a solvent that lacks a positively polarized hydrogen



Polar aprotic solvents solvate only cations leaving the anions naked



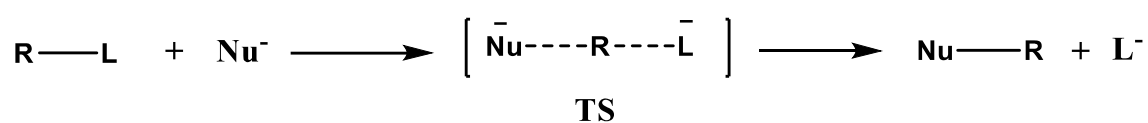
S_N1



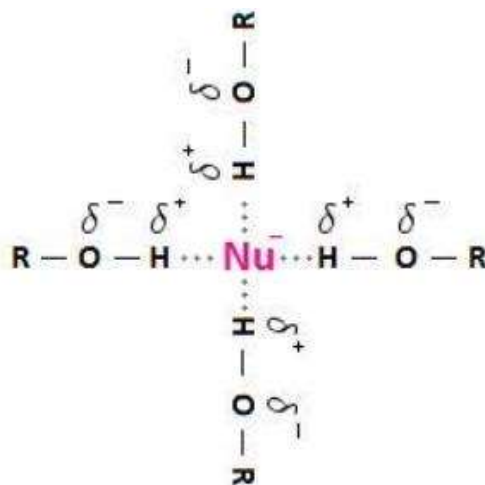
In S_N1 reaction, the rate determining step involves the formation of ions (Carbocation and halide ion). Polar protic solvent will solvate both cation and anion and stabilizes them. Due to solvation, energy is released which facilitates the ionization of alkyl halide further.

- ❖ The rate of S_N1 reaction increases with the increase in the polarity of the solvent

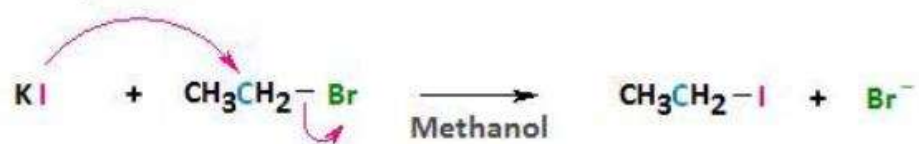
S_N2



In S_N2 the **protic solvent** puts the **nucleophile** in a cage, thus **making less available or weaker**, while the polar aprotic solvent solvates the cation leaving the nucleophile free. As a result, **in the polar aprotic solvent**, it becomes a **stronger nucleophile** since the counterion does not reduce its reactivity.



Example - Protic Solvent



Example - Aprotic Solvent

