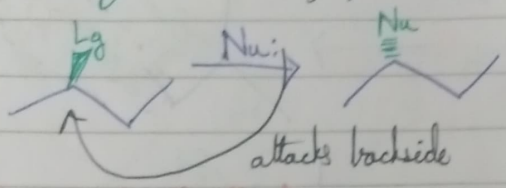
2) SN^2 → Bimolecular Nucleophilic Substitution

Here, Nucleophile = ₹ve seeking
attacks partially positive molecule

Bimolecular = reaction takes place 2 molecules at a time or it is a 2nd Order reaction

Mechanism:- Let Lg → leaving group, Nu: → nucleophile

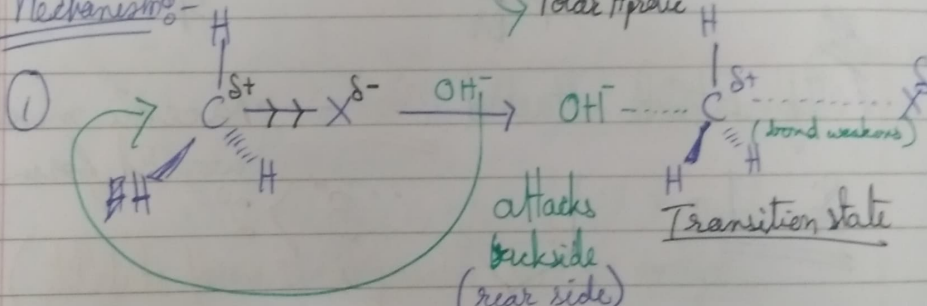


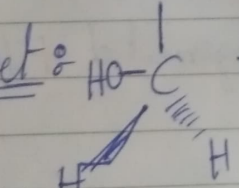
This backside attack causes inversion of chirality

Eg:- $CH_3\overset{\oplus}{-}X^{\ominus} + K^{\oplus}OH^{\ominus} \xrightarrow[\text{Acetone } (CH_3COCH_3)]{} CH_3-OH + X^{\ominus}$

↳ Polar Aprotic

Mechanism:-



∴ We get:- 

∴ In SN^2, we have no carbocation formation

∴ Only Inversion of Configuration takes place

∴ SN^2 is a 1-step reaction [There is no Step ①]
Here, no Intermediate forms [No Carbocation formed]

Transition state → Inversion [If nucleophile attacks chiral carbon]

Rate: Step (1) is the rate determining state

It depends on Transition State

Speed of reaction is faster :- • strong nucleophile
• good leaving group

Speed of reaction is slower : • weak nucleophile
• steric hinderance

In terms of Kinetics,

Rate is dependent on the substrate & nucleophile concentration

$\therefore$ Rate $= k[Nu^{\ominus}][R-X]$

where $[Nu^{\ominus}] \rightarrow$ nucleophile conc.
$k \rightarrow$ rate constant
$[R-X] \rightarrow$ substrate conc.

(*) Nucleophile influences the rate of the reaction

This is because it takes part in Step (1) [rate determing step]

Stability: Transition State cannot be isolated from reaction

$\therefore$ No Carbocation formation in SN^2 reaction

$\therefore$ Stability depends on stability of Transition State

It also depends on :- • Leaving group
• Nucleophile strength
• Solvent
(Polar Aprotic $\rightarrow SN^2 \uparrow$)