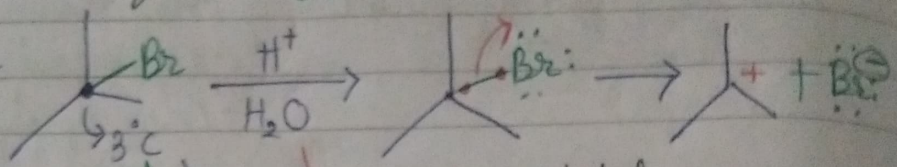
Reactions:- In SN^1 reactions, H^+ acts as catalyst by protonating the leaving group to facilitate its departure

Carbocation formation is not favoured in SN^1 reactions But H^+ promotes carbocation formation by facilitating departure of leaving group from the molecule.

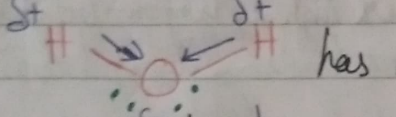
Mechanism:- Eg:-



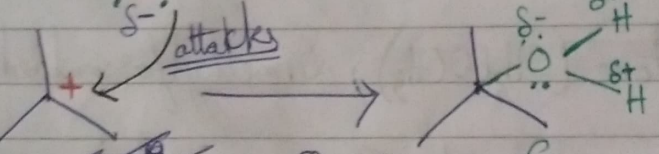
H^+ → catalyst
H_2O → polar protic solvent

Here, H^+ facilitates/helps Br^- to leave the molecule

H_2O is polar protic and can also act as nucleophile

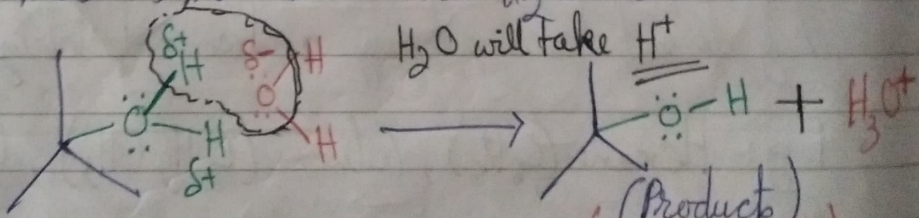


has e^- it can donate to carbocation

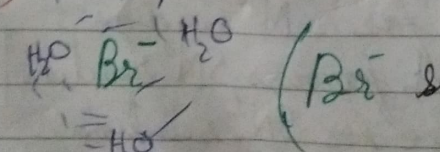


Here, ~~Oxygen~~ Oxygen is δ−
Hydrogen is δ+

But there is more than one H_2O molecule :-



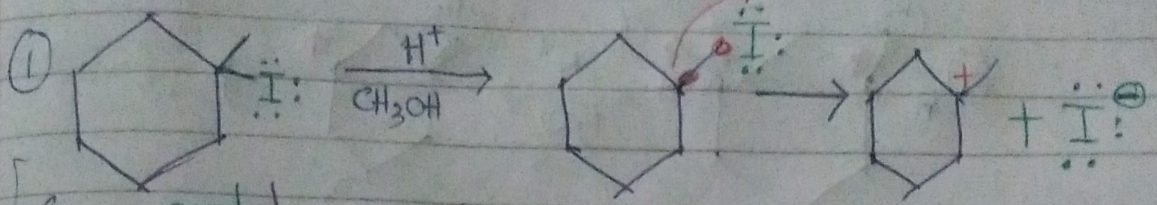
H_3O^+ can protonate the leaving group (similar to H^+)



(Br^- surrounded by polar protic solvent)

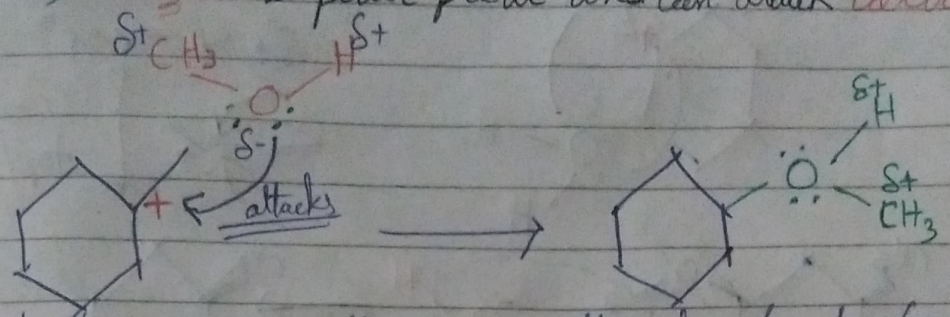
$\rightarrow [H_2O - Br^-]$ Solvation means solvent molecules surround Br^- ion

Benzene

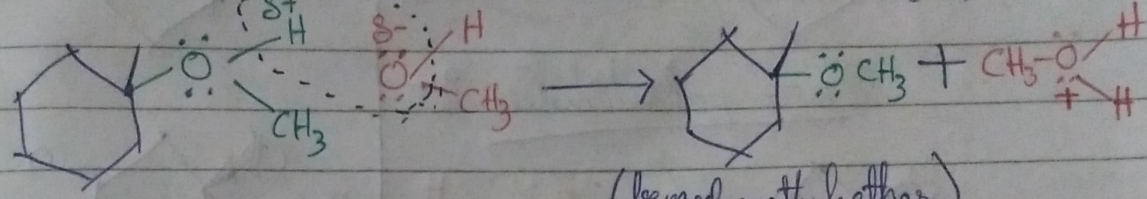


(I → good leaving group)

Here, CH_3OH is polar protic and can attack carbocation

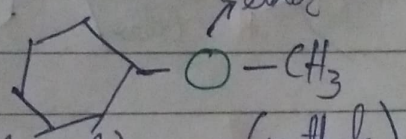


But there is more than one methanol molecule (CH_3OH)

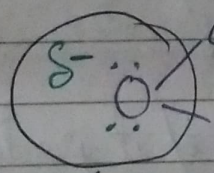


(benzyl methyl ether)

Here,



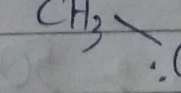
[Naming :- alkyl alkyl ether
left → right]

(*) Why 

take away H^+ and not CH_3^+ ?

H^+ is proton itself as it has ~~zero~~ zero e⁻ & 1 proton

(H+) { no e⁻ 1 proton

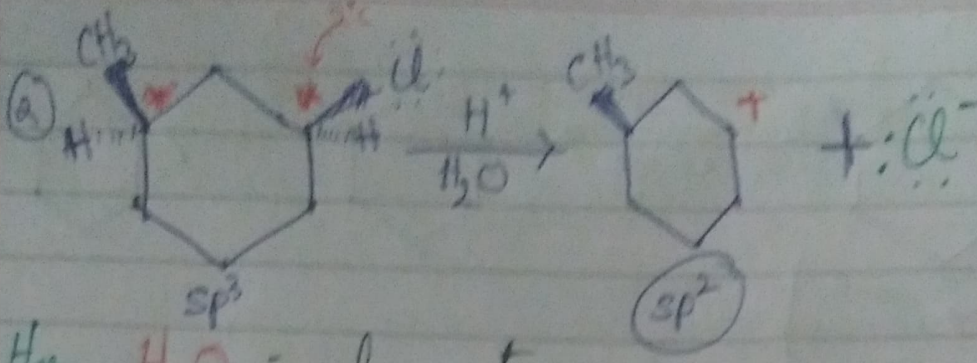


Oxygen of methanol is a nucleophile

∴ It is proton loving, hence attacks/takes away H^+

CH_3^+ is highly unstable, ∴ Oxygen of methanol takes away H^+

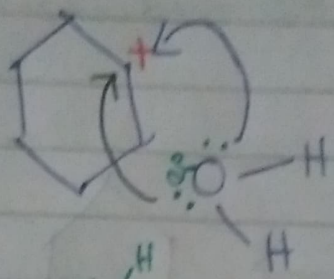
∴ CH_3 is unstable, it will lead to unstable carbocation formation which is not favoured in SN^1 reaction

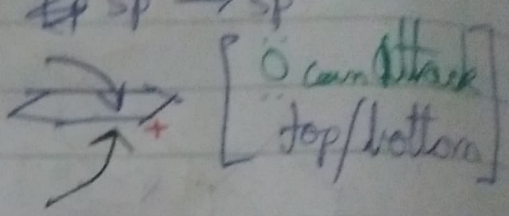


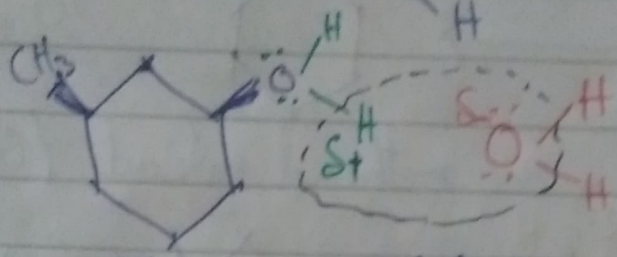
Here, H_2O is polar protic

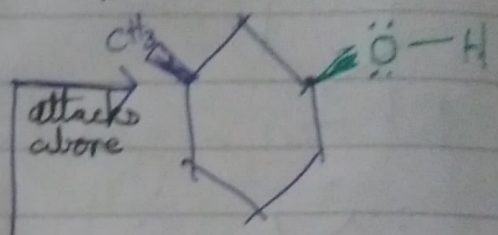
∴ Hybridization changed

$sp^3 \rightarrow sp^2$

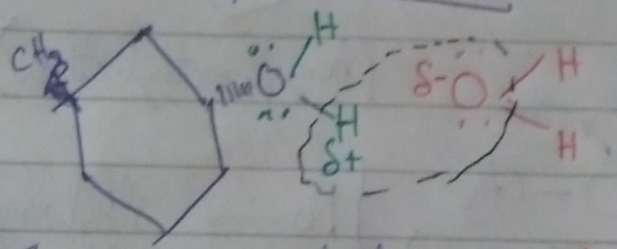


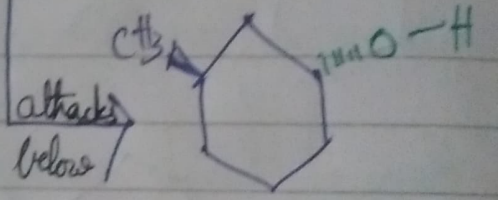






Two possibilities :-





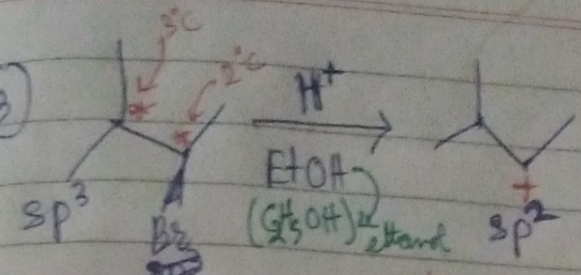
These two products are Racemic mixtures because the chirality is lost in the sp^2 intermediate

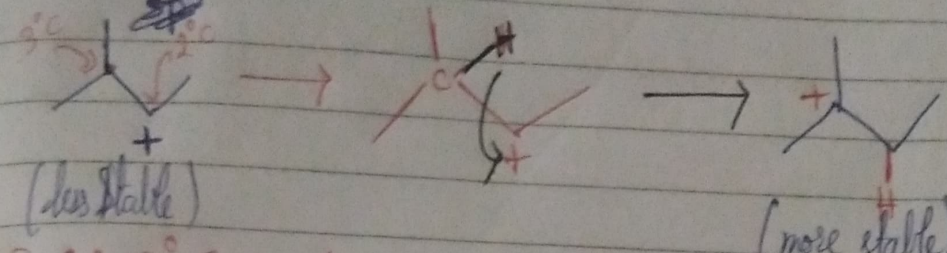
↳ Molecule is chiral if it produces non-superimposable mirror image

Racemic mixture :- 50:50 ratio of R & S configuration

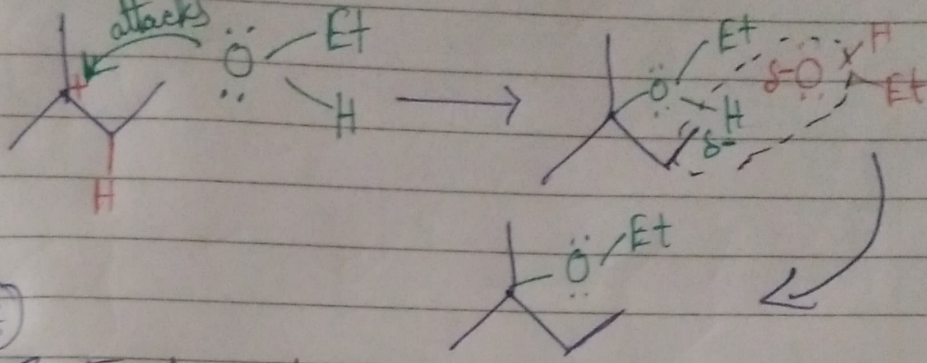
That means when reaction produces two enantiomers in equal amounts

③



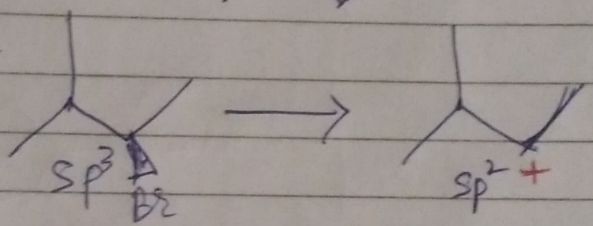


[∵ 3° Carbocation is more stable than 2° Carbocation]



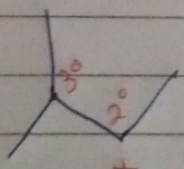
(*)

First :-



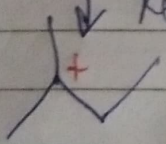
If EtOH attacked 2°C → Racemic mixture would form

Second :-



∵ 3° > 2° (in terms of stability)

↓ Rearrangement of + took place



Now, EtOH attacks 3°C which is more stable

∴ This was only possible since 3°C was near 2°C
As rearrangement was possible, we get more stable molecule
If there was no 3°C, we would have got Racemic mixture