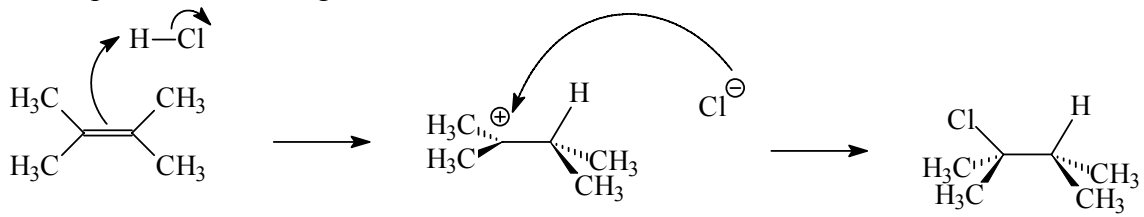


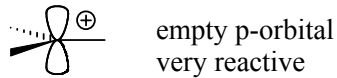
Electrophilic addition: e.g. addition of HCl



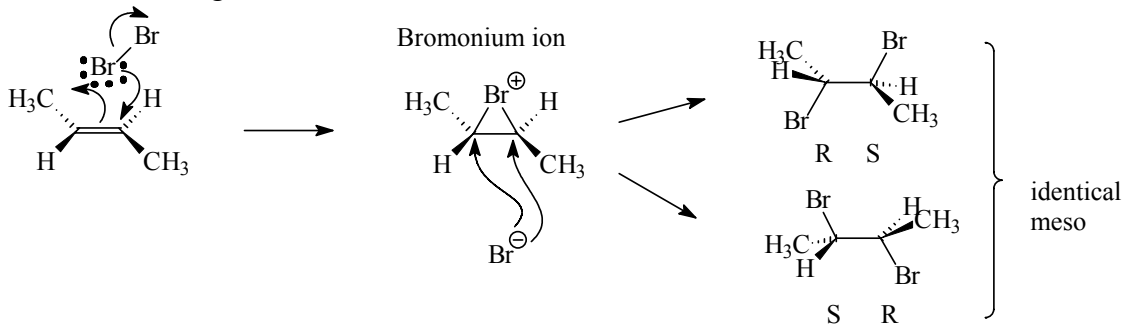
Attack of HCl on π -electrons with formation of a carbocation

Carbocation (carbenium ion)

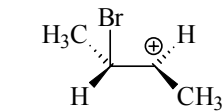
Attack of Cl^- on the carbocation to give product (Lewis base, Cl^- attacks Lewis acid R^+)



Addition of halogens to alkenes

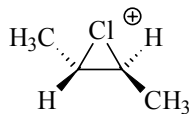


simple electrophilic attack would give a carbocation, with an unfilled valence shell

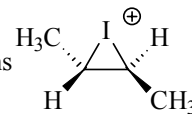


bromonium ion, with filled valence shells on all atoms, is better

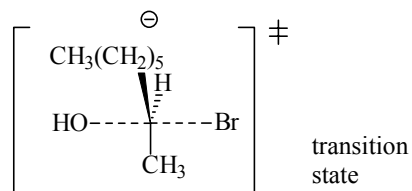
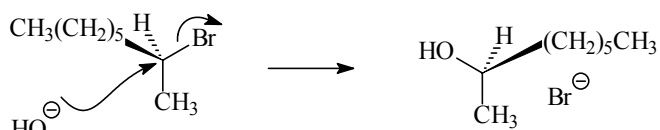
there are also chloronium



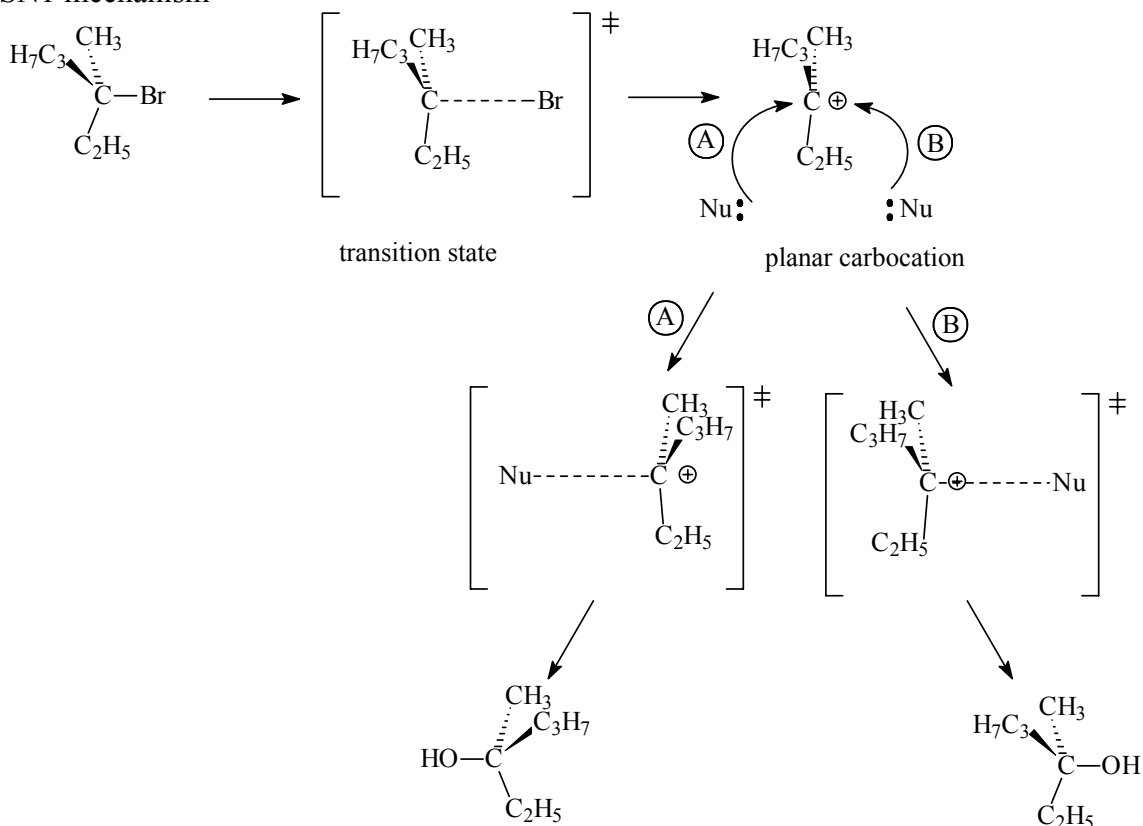
and iodonium ions



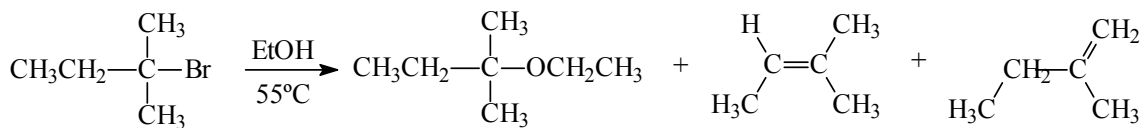
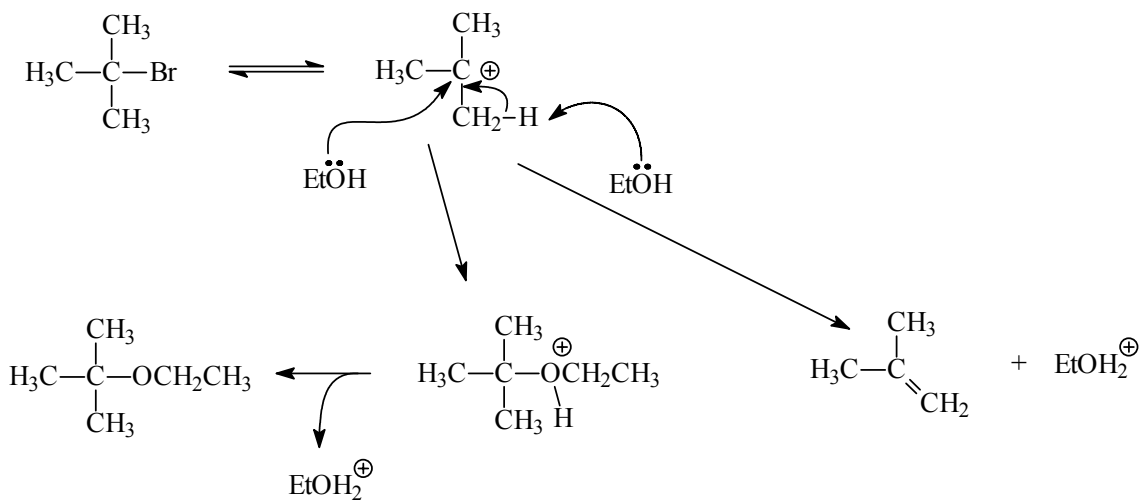
$\text{S}_{\text{N}}2$
bimolecular nucleophilic substitution



SN1 mechanism



E1 Mechanism



65%

30%
more stable

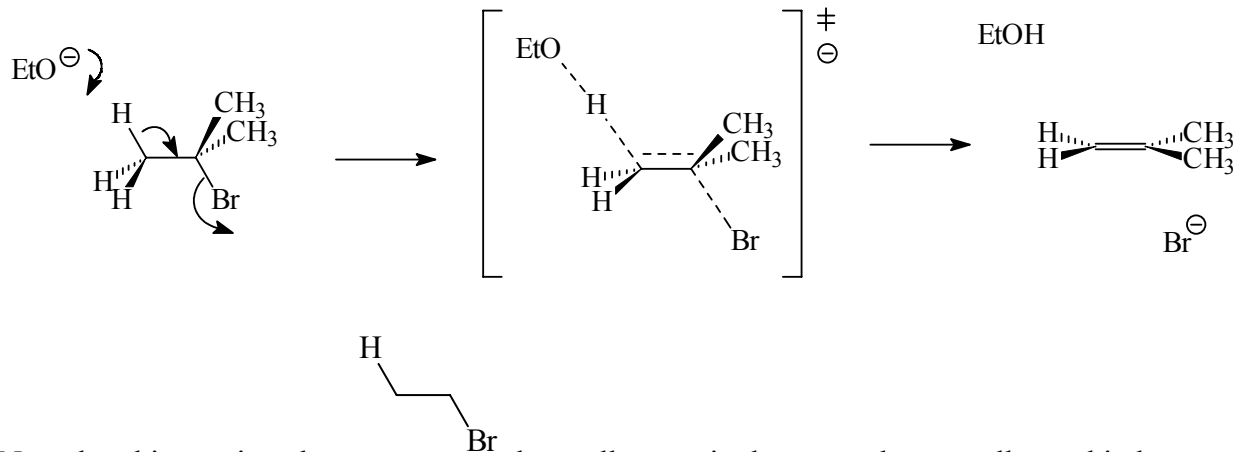
5%
less stable

E1 and SN1 mechanisms have a common rate determining steps

The E1 mechanism can be made predominant by:

- use of a stronger base (but this may change the mechanism)
- higher temperature (activation energies for elimination are higher than for substitution: more bonds are being made/broken in the transition state)
- use of a very poorly nucleophilic solvent

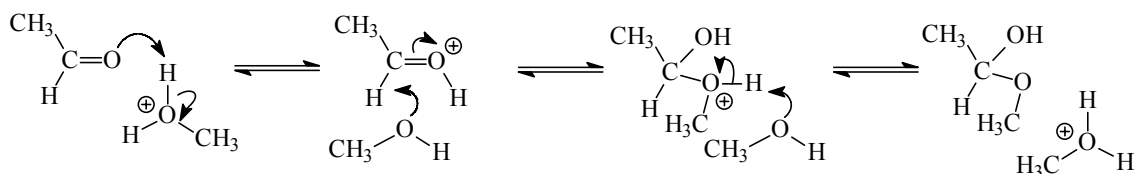
The E2 mechanism



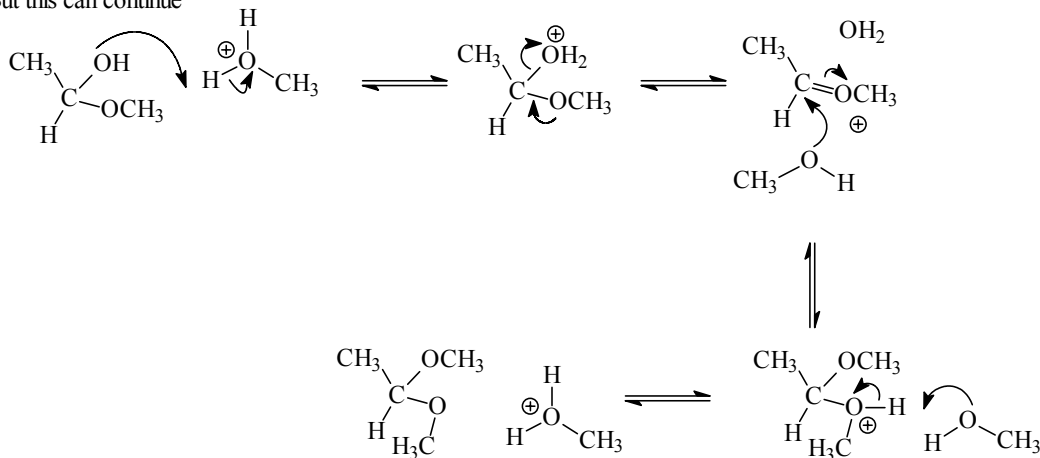
Note that this requires that have all atoms in the same plane, to allow orbital overlap.

Carbonyl reactions

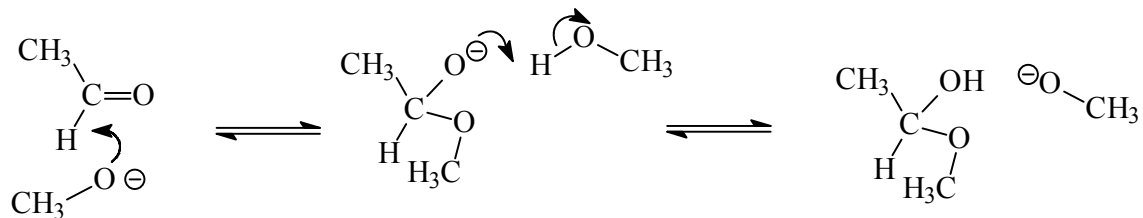
Acetal formation



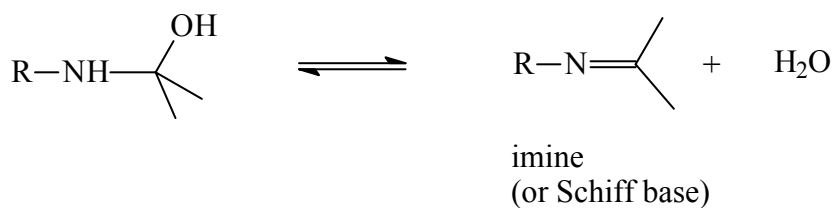
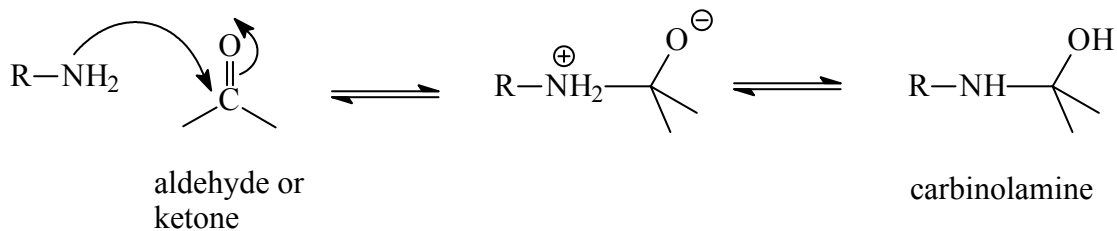
But this can continue



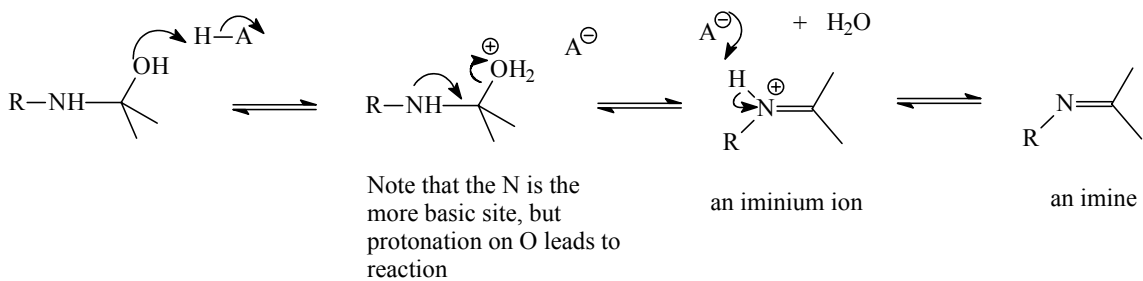
Acetal formation is only possible in acid; in base reaction proceeds only as far as the hemiacetal.



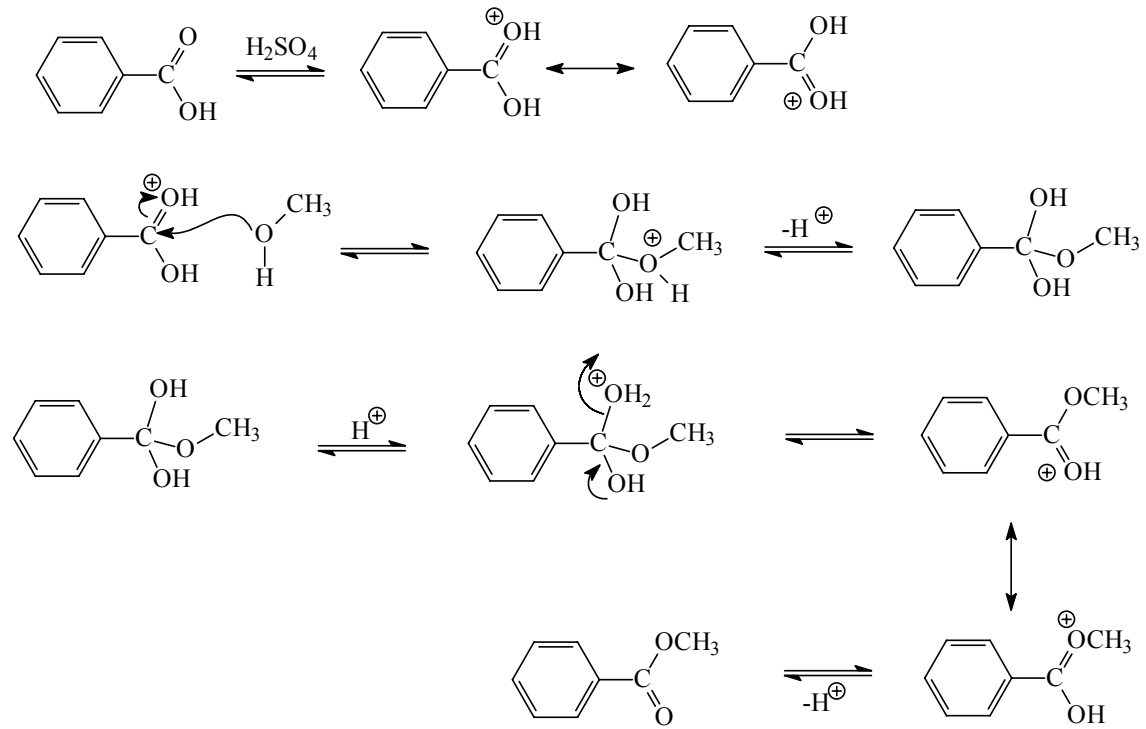
Imine formation



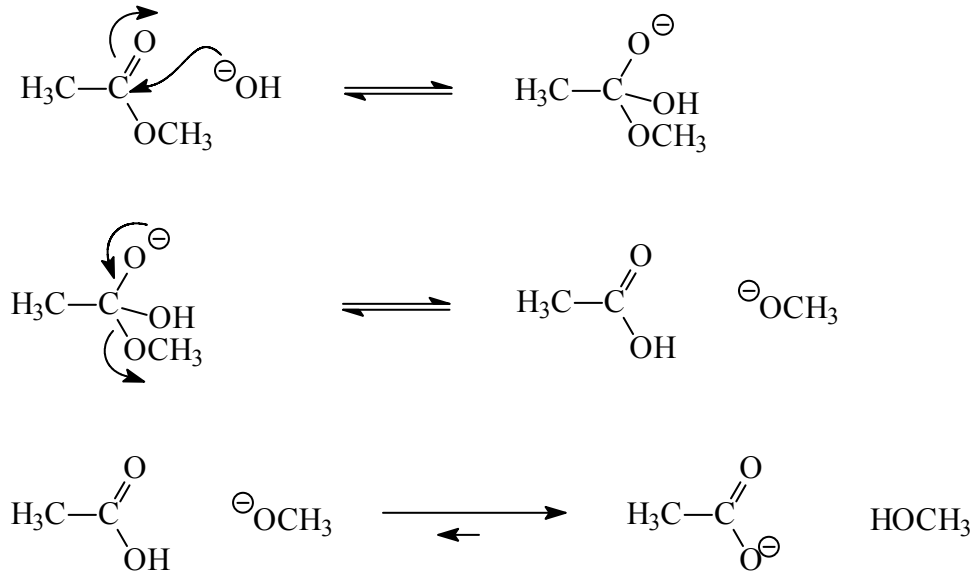
The loss of water is acid catalyzed:



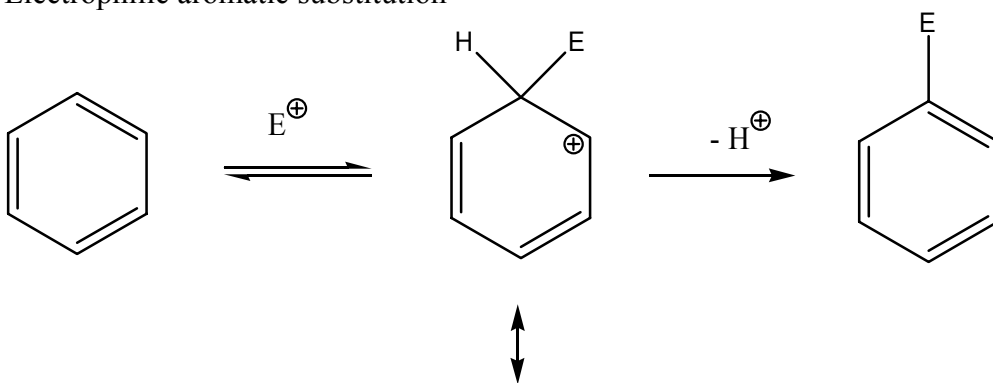
Ester Hydrolysis: acid



Ester hydrolysis: base



Aromatic substitution mechanisms:
Electrophilic aromatic substitution



Nucleophilic aromatic substitution

