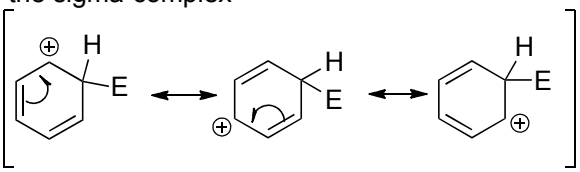
Solutions of exercise 2, FRO-II

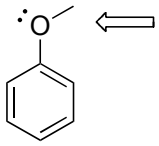
Exercise 1

a) **formation of the cationic sigma-complex** intermediate is the **rate-determining step** in an electrophilic aromatic substitution reaction.

b) mesomeric structure of the sigma-complex



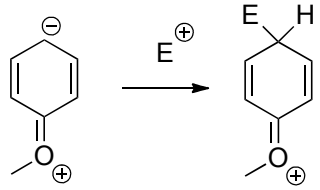
c) a) R=OMe



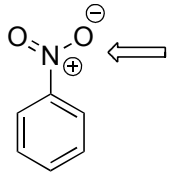
anisole

methoxy is an **electron-donating group**, the sigma-complex is stabilized (by **mesomeric donor effect** which **stabilizes the cation**)

So anisole **reacts faster** than benzene in SE_{Ar}



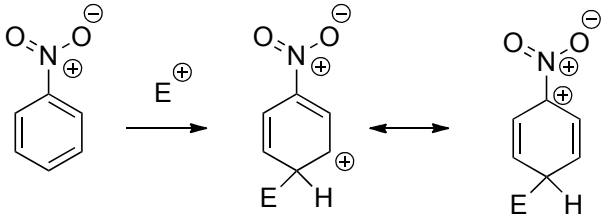
b) R=NO_2



nitrobenzene

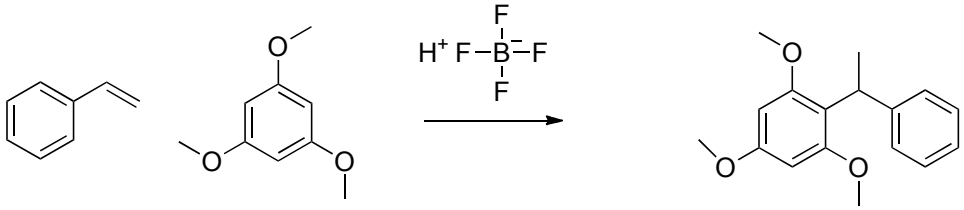
nitro group is an **electron-withdrawing** group, the sigma complex is destabilized (by **mesomeric withdrawing effect**, which **destabilizes the cation**).

So nitrobenzene **reacts slower** than benzene in SE_{Ar}

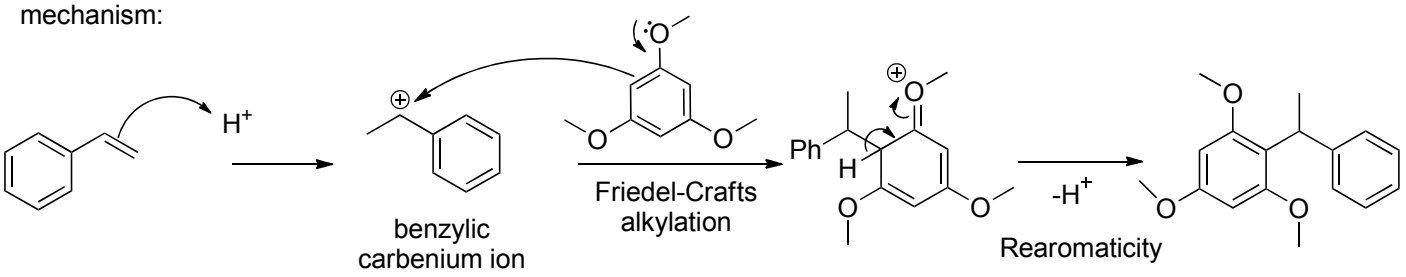


2 adjacent cations => **not stable**

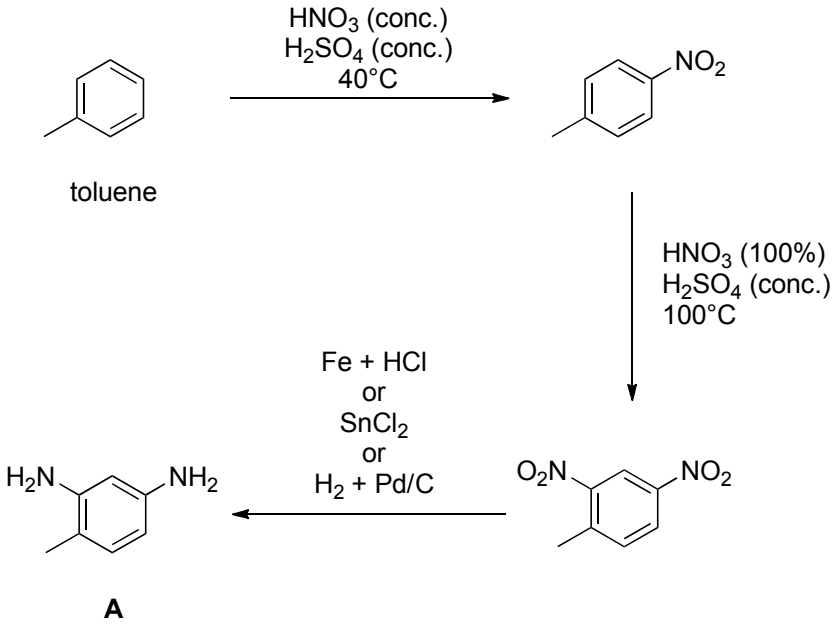
Exercise 2



mechanism:



Exercise 3


HNO3 (conc.)
H2SO4 (conc.)
40°C
NO2
toluene
HNO3 (100%)
H2SO4 (conc.)
100°C
Fe + HCl
or
SnCl2
or
H2 + Pd/C
H2N
NH2
O2N
NO2

A