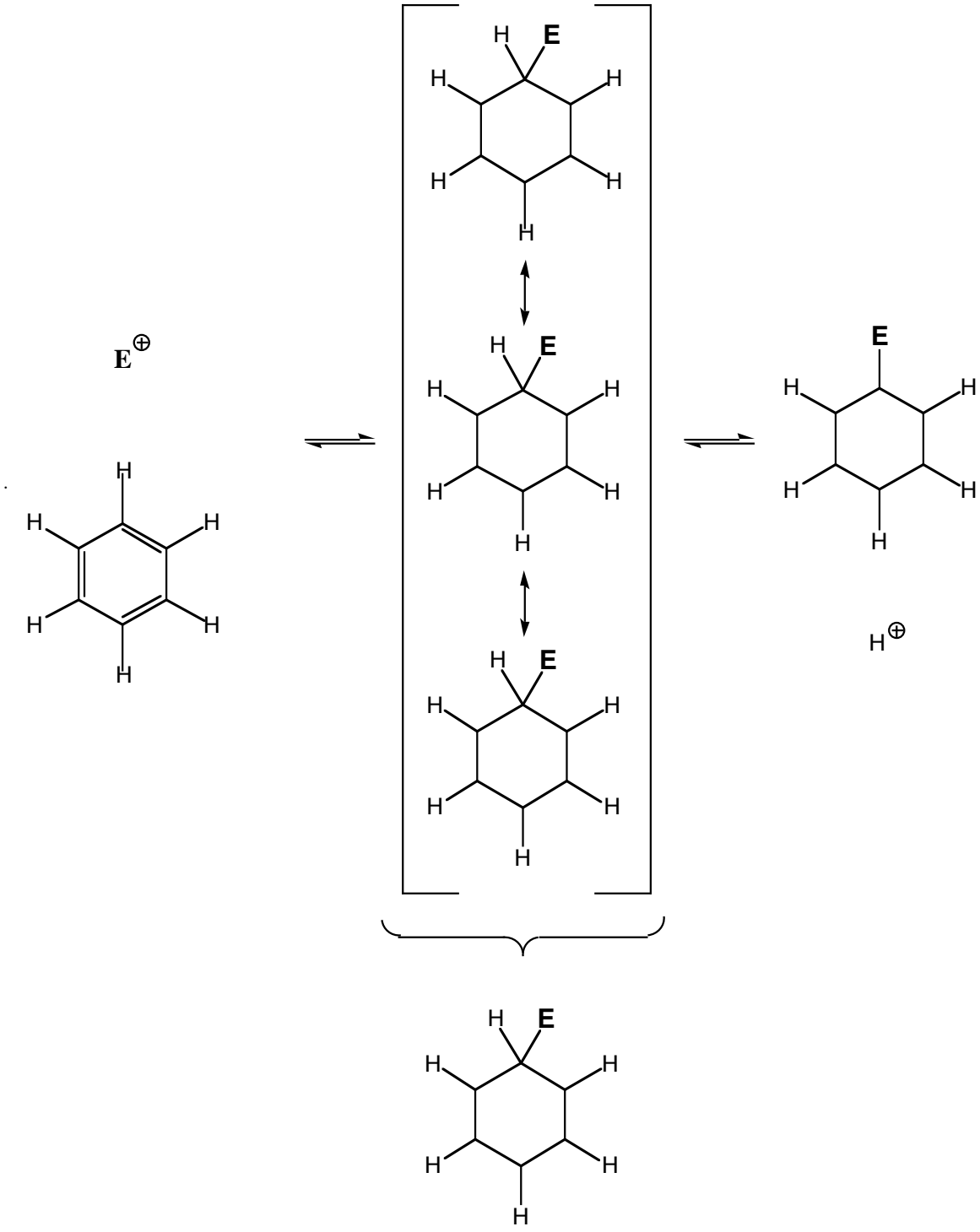
General mechanism for Electrophilic Aromatic Substitution

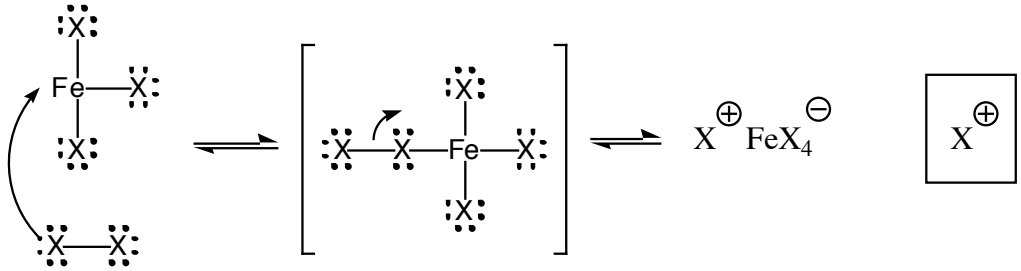


Reagents

Wicked strong electrophile

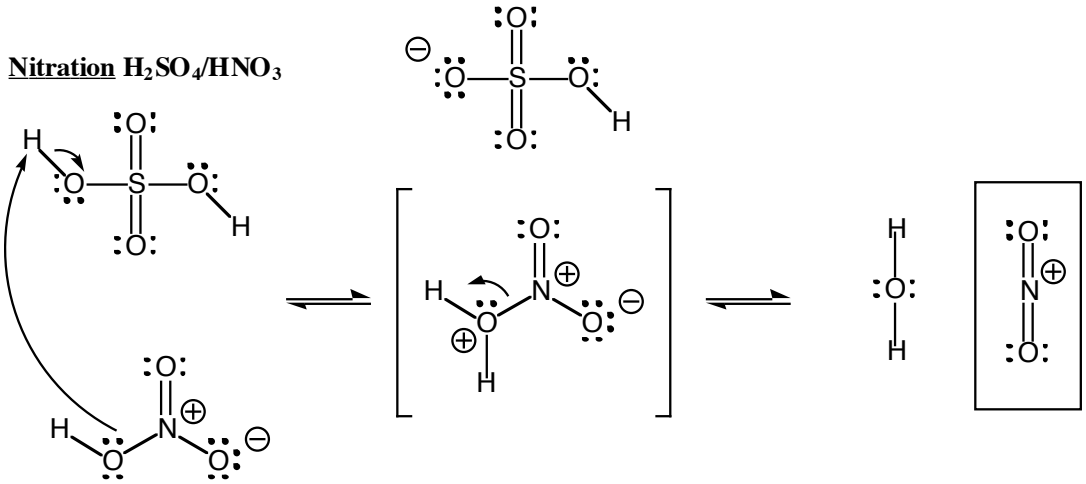
$E^{\oplus}$

Halogenation X_2, FeX_3

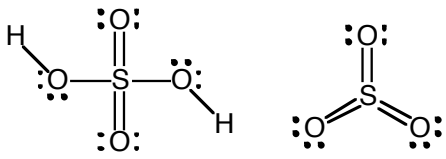


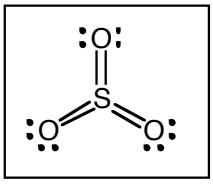
X = Br, Cl

Nitration H_2SO_4/HNO_3



Sulfonation H_2SO_4/SO_3





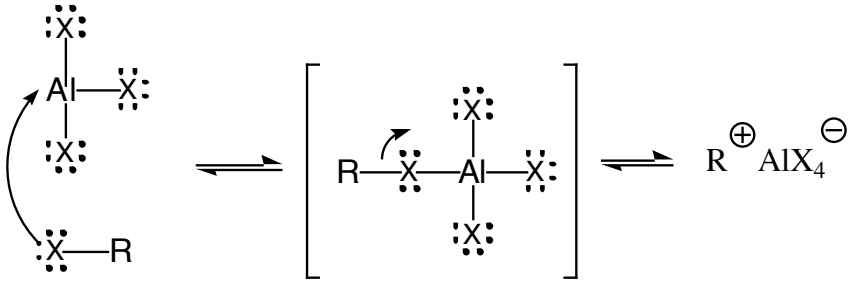
Fuming sulfuric acid contains both of the above reagents, the SO_3 is the important one

Reagents

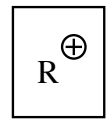
Wicked strong electrophile

$E^{\oplus}$

Friedel-Crafts Alkylation **R-X, AlX_3**

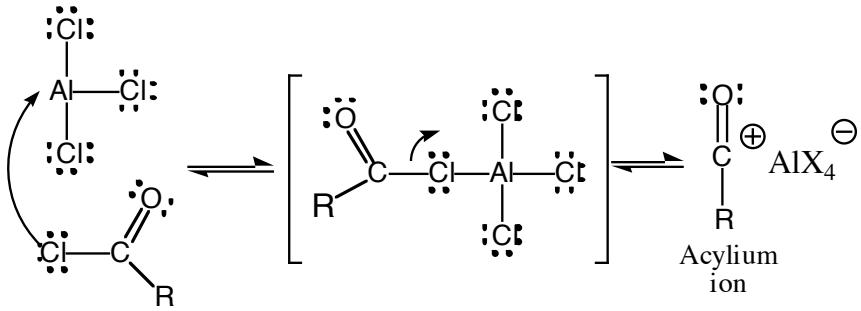


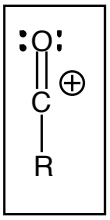
X = Br, Cl



Note this is a carbocation, so it will rearrange if it is a primary or a rearrangment-prone secondary cation

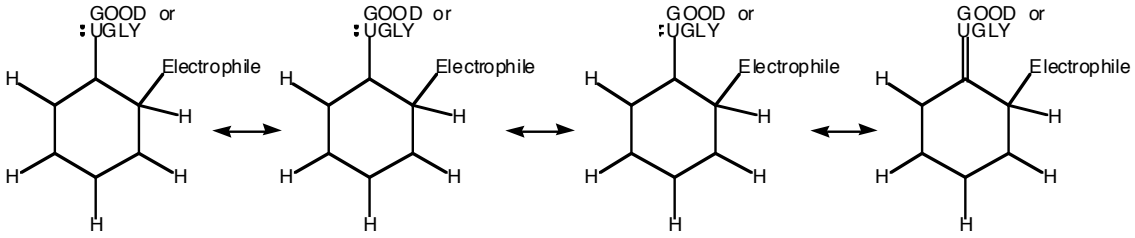
Friedel-Crafts Acylation **$RCOCl, AlCl_3$**



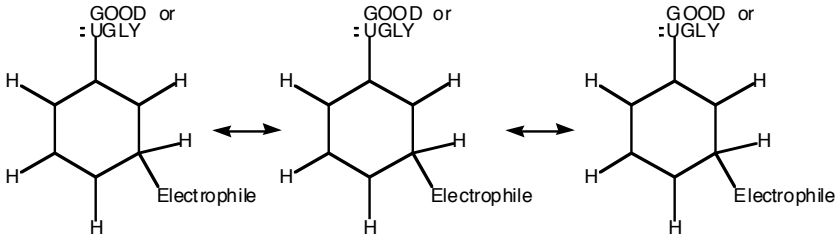


Other notes: 1) It is hard to stop the Friedel-Crafts alkylation after one alkyl group adds (because alkyl groups are "good", that is, activating), but it can be done. 2) Neither Friedel-Crafts reaction works if there is already an electron withdrawing (bad) group on the ring.

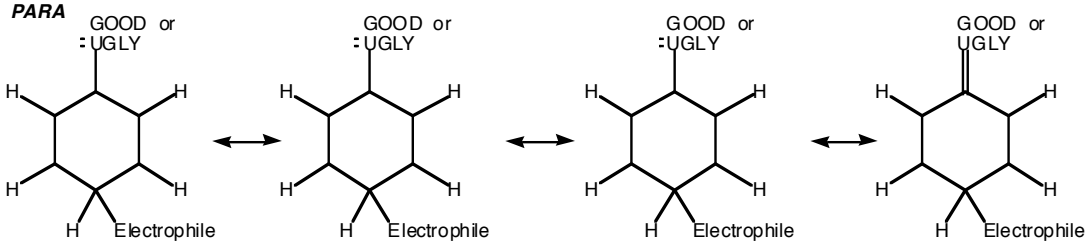
ORTHO



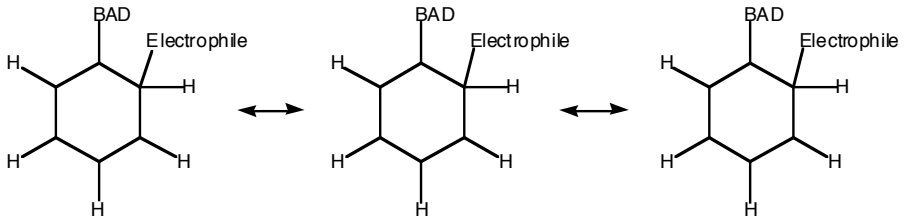
META



PARA



ORTHO



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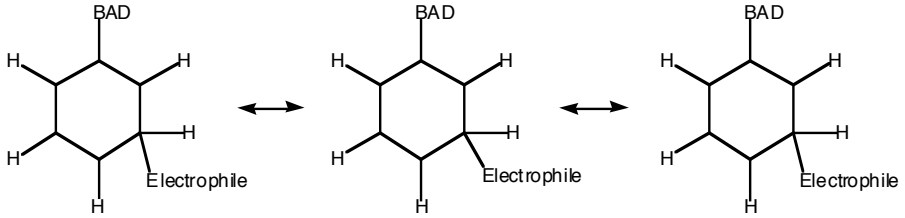

PARA