



Pre-Health Post-Baccalaureate Program
CHM2211 Study Guide & Practice Problems

Date:

9/28 - 10/2

Topics Covered:

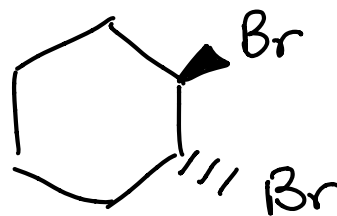
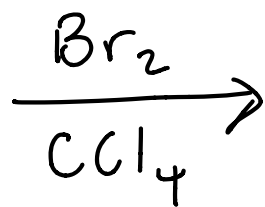
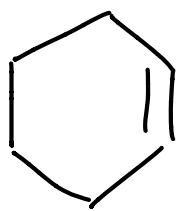
EAS

- Halogenation
- Nitration
- F-C Alkylation
- F-C Acylation

Created by Isaac Loy

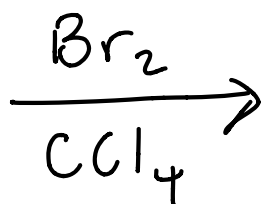
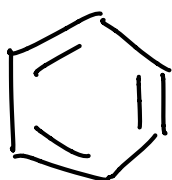
Messing with Benzene

Recall...



+ Enant.

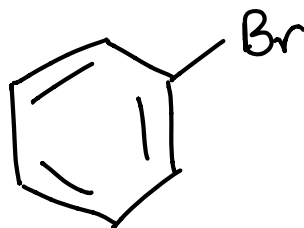
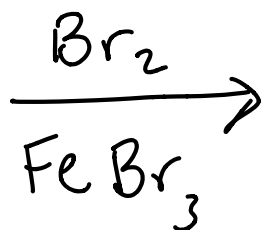
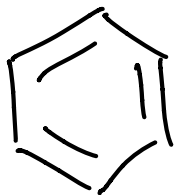
What about with Benzene?



No Rxn

Why? Benzene is a bad nuc., and Br_2 is not reactive enough for anything to happen.

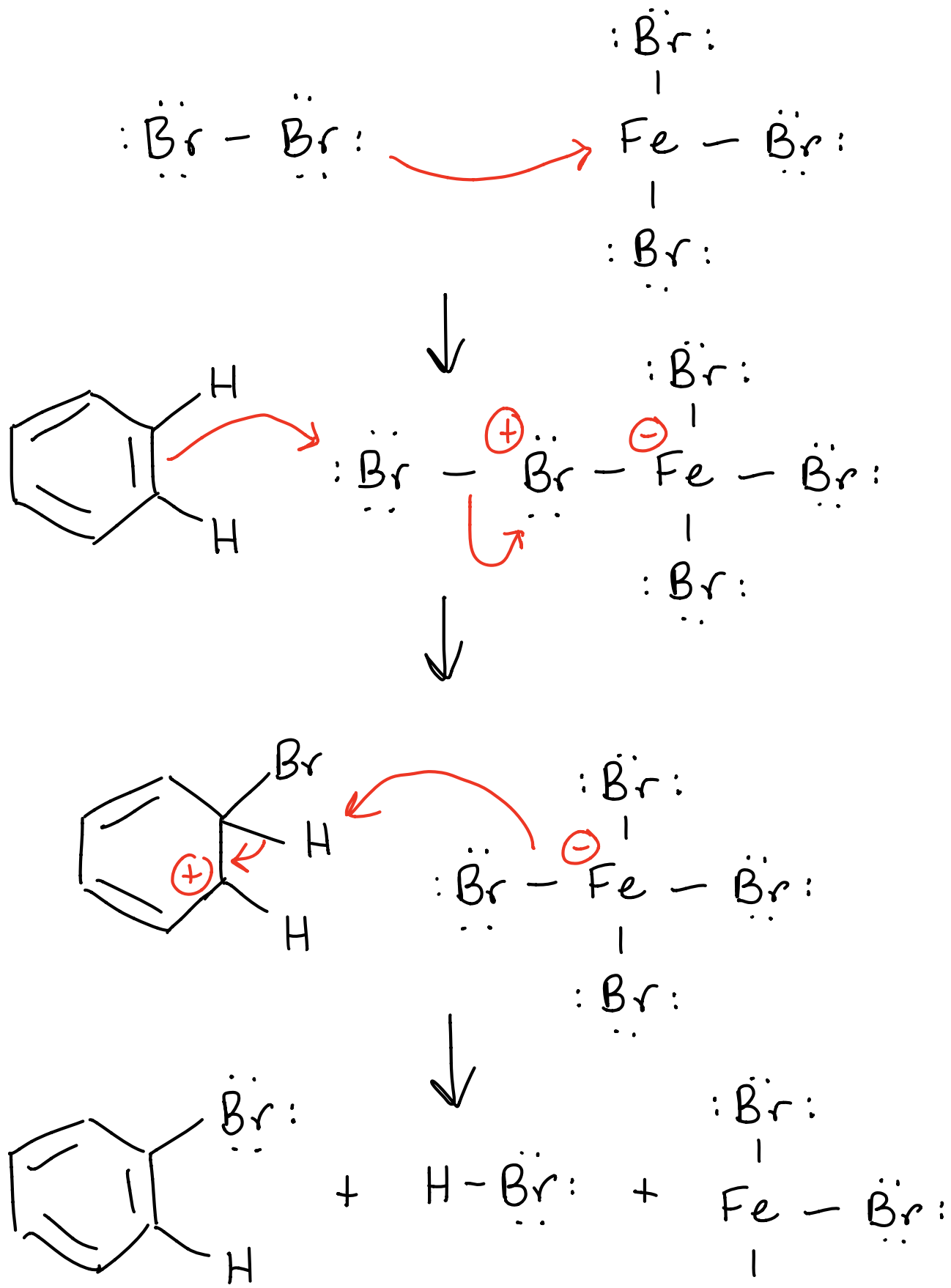
Let's now add a catalyst...



+ HBr

FeBr_3 is a Lewis acid catalyst which bonds to Br_2 , makes it more electrophilic, and allows the reaction to proceed.

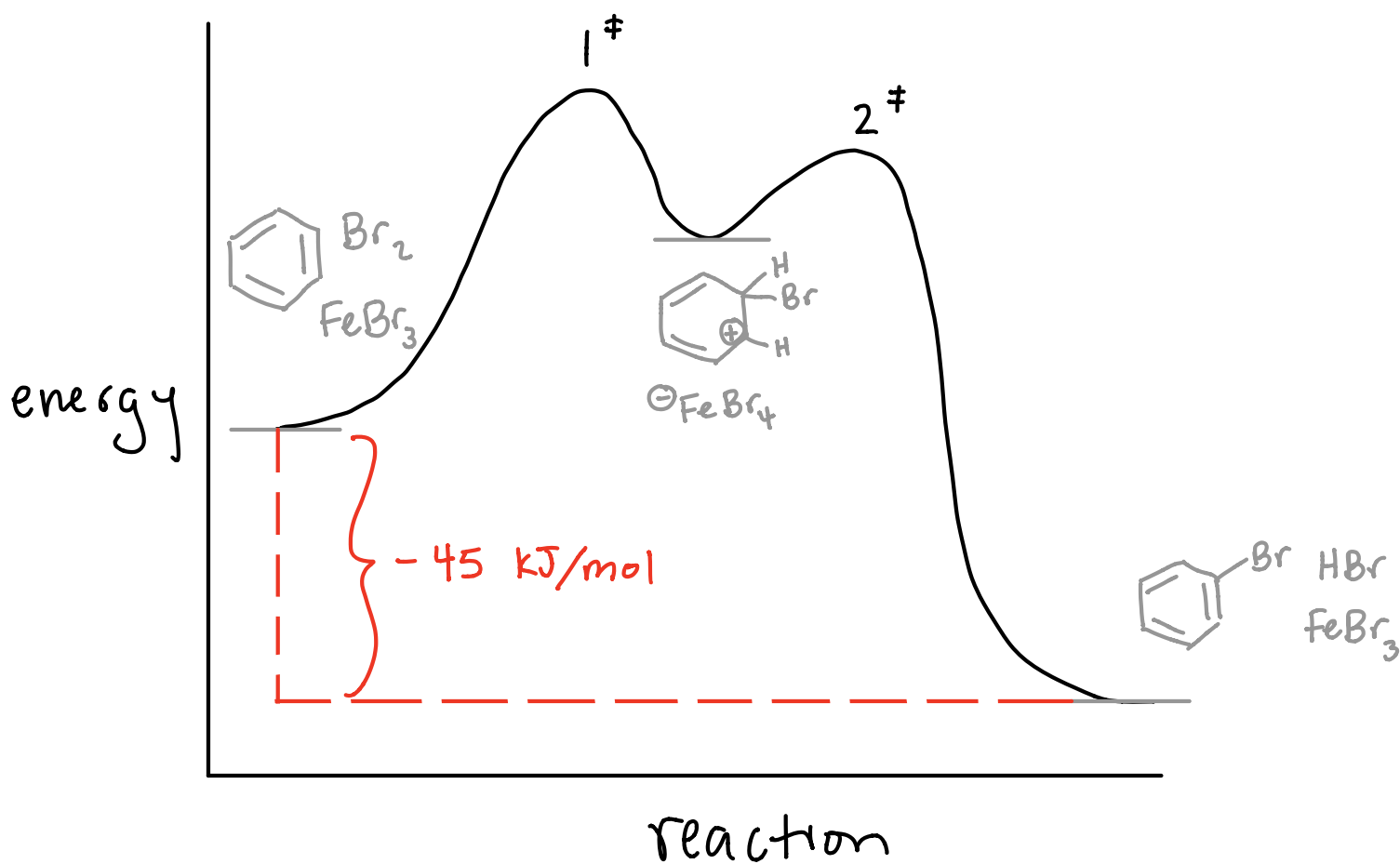
Let's look at the mechanism:



-H is replaced by -Br

Lewis acid catalyst reforms

EAS and energy



Why are the products at a lower energy level (more stable) than the reactants? Because the $\text{C}-\text{Br}$ and $\text{H}-\text{Br}$ bonds formed are better bonds than $\text{Br}-\text{Br}$.

This is called Electrophilic Aromatic substitution (EAS)

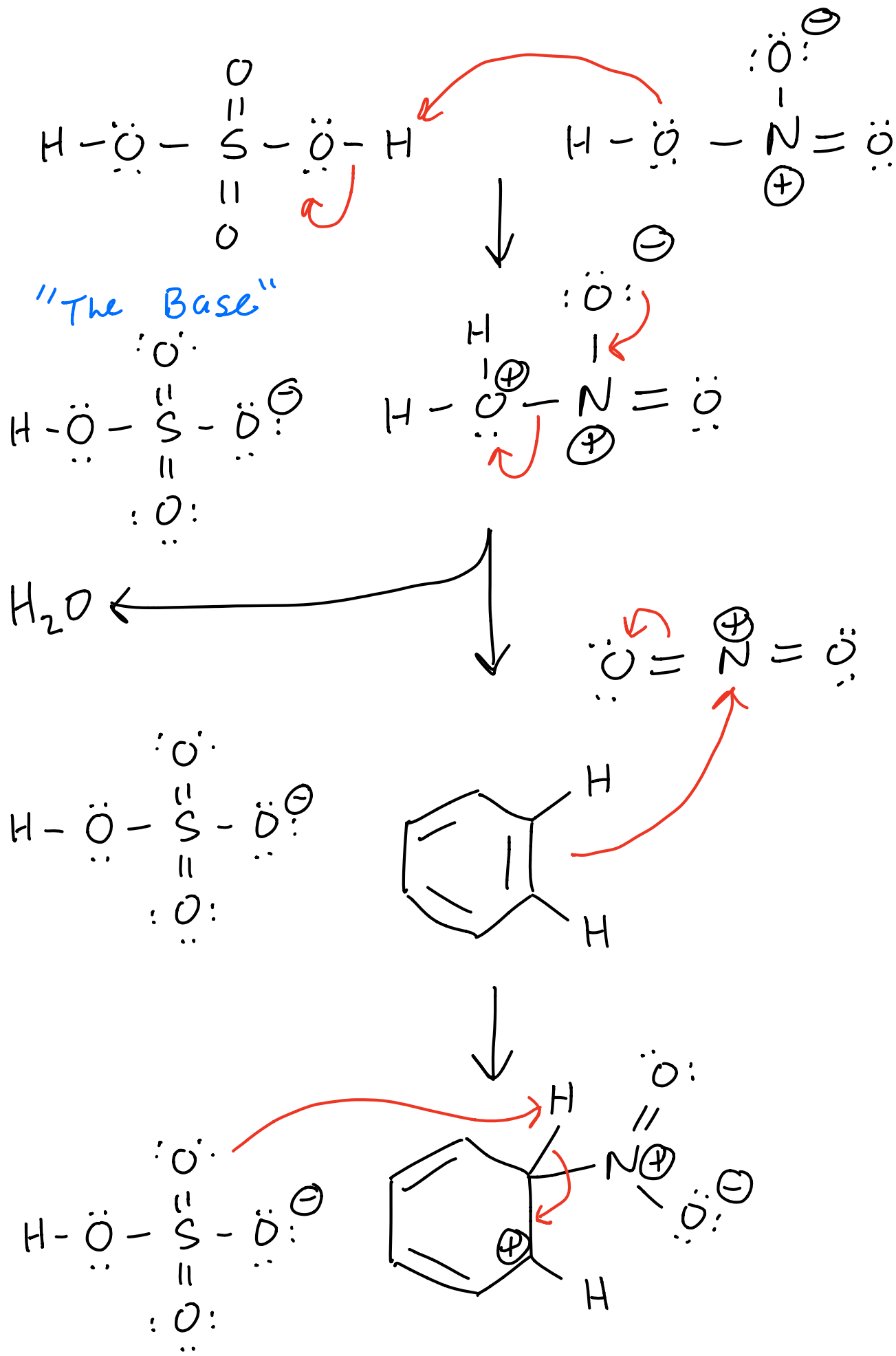
The environment must be devoid of other nucleophiles. If other nucleophiles exist, they will react before benzene.

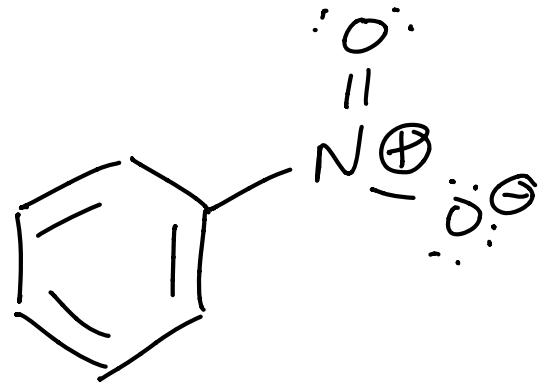
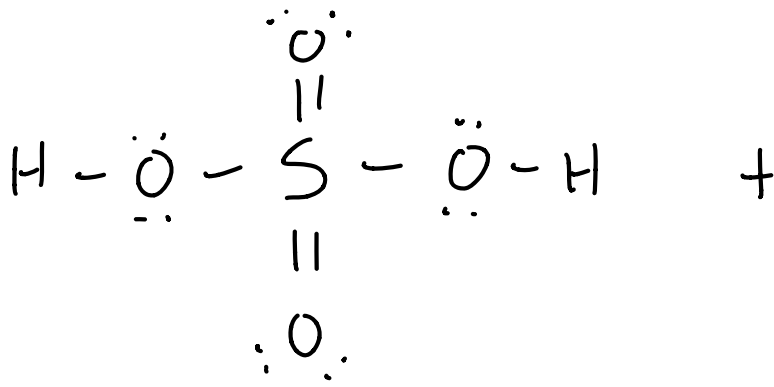
We already looked at the first type (halogenation). The others are:

- Nitration
- Friedel-Crafts alkylation
- Friedel-Crafts acylation

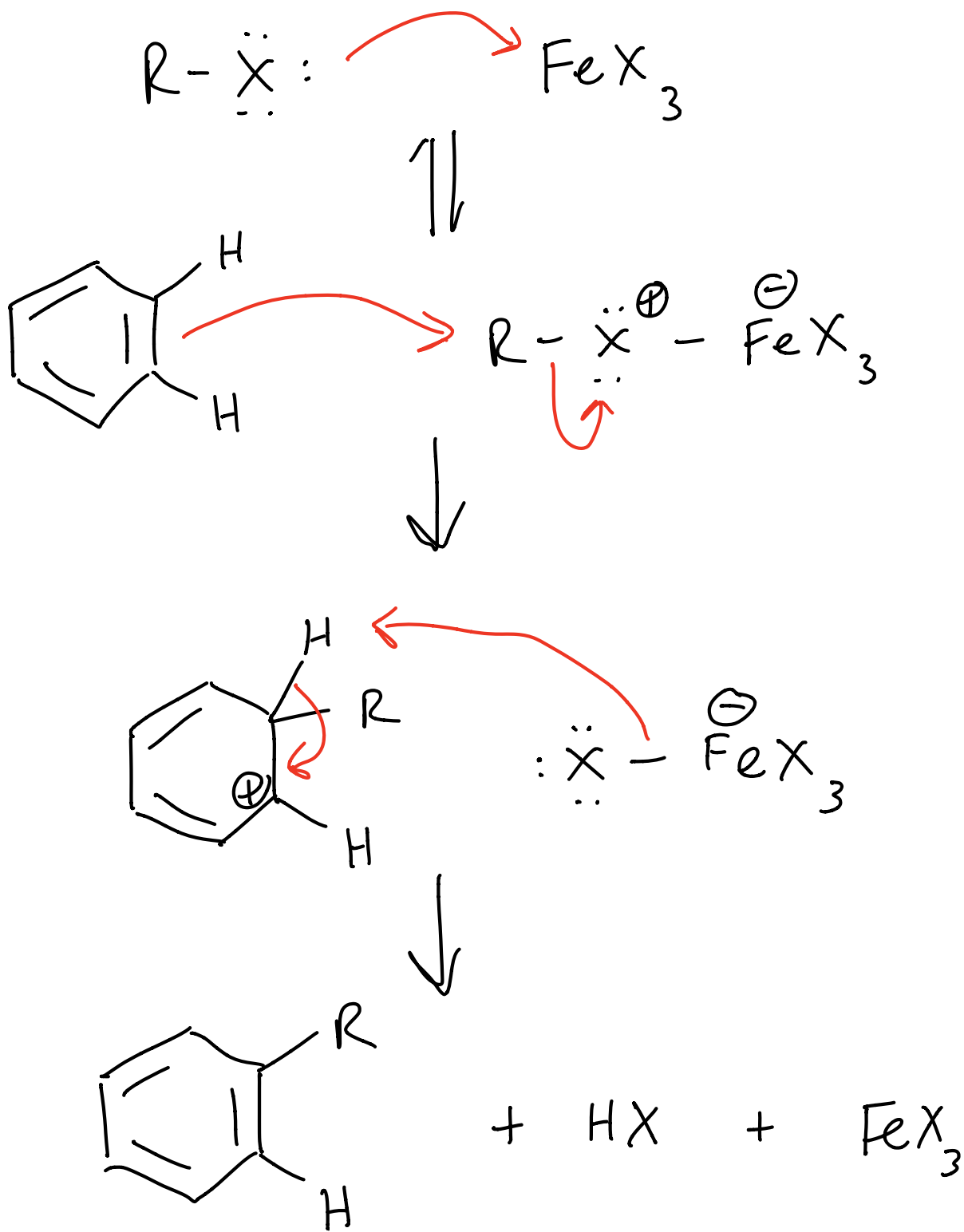
These are outlined below. The good news: the process is the same. Make the reactant more electrophilic, attack the electrophile, regain aromaticity.

Nitration Mechanism



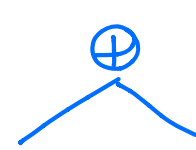




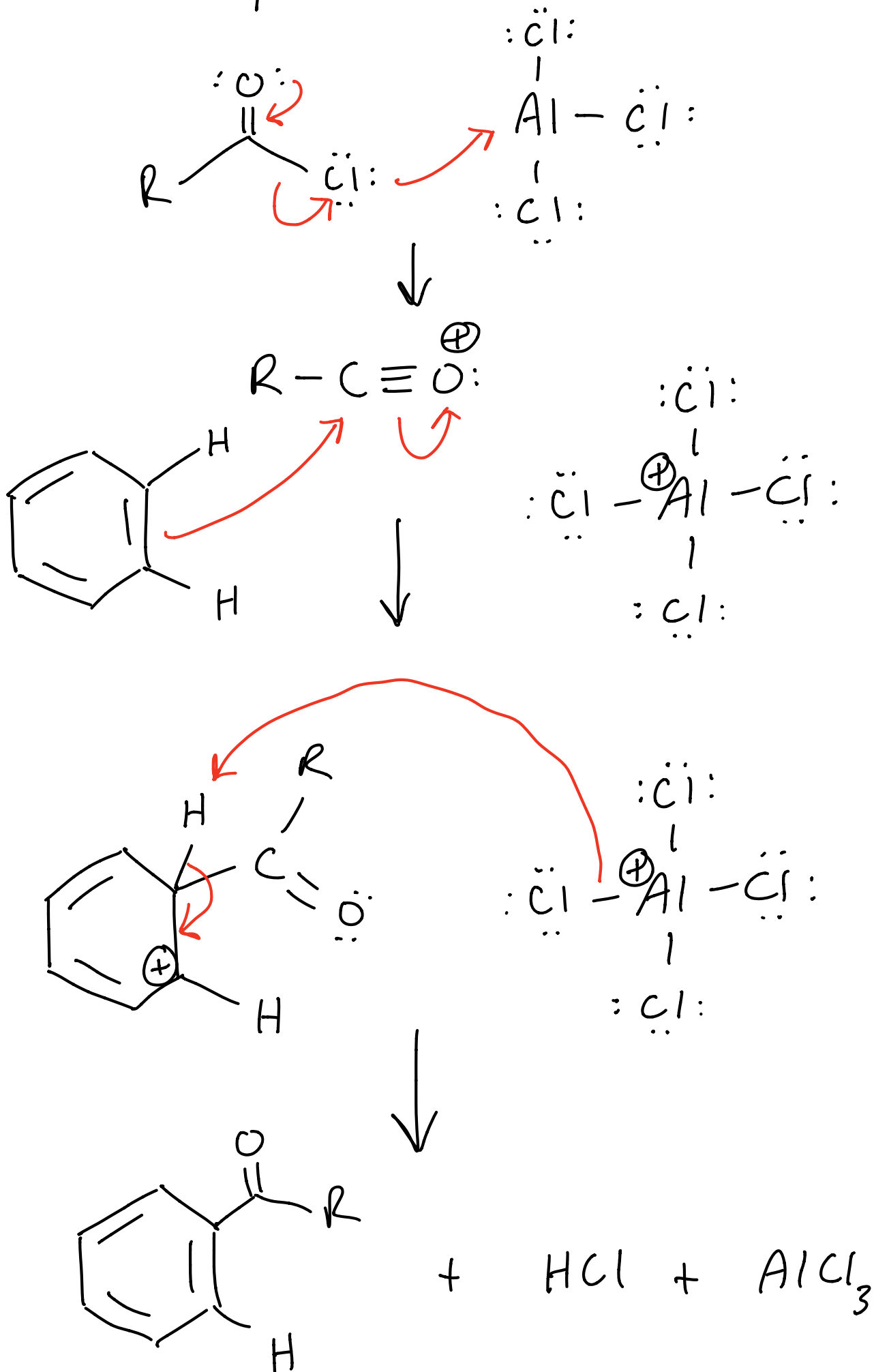
F-C Alkylation Mechanism



- Activator to EAS (donates electron density from sp^3 cloud)
- Open to carbocation rearrangement
- Fails with exclusive meta-directors on the ring (metas pull electron density from the ring, make benzene less nucleophilic and less capable for an "attack")

	Protocol	Example
See:	$RX + FeX_3$	
Think:	R^+	
Do:	Rearrange	

F-C Acylation Mechanism



- Fails with exclusive meta-directors
- Single substitutions only