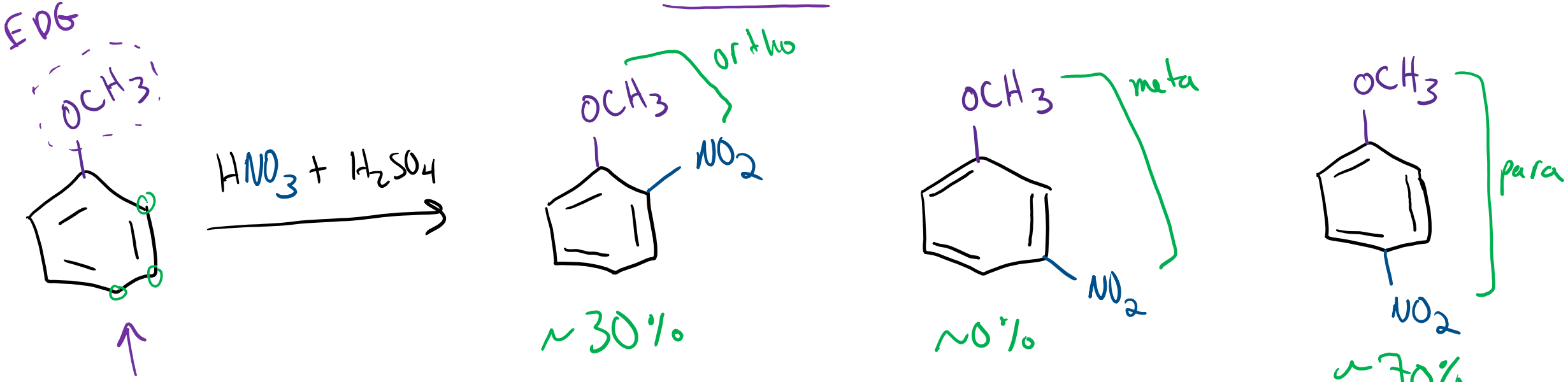
Sacina OH: W 4-5 pm

Substituted Benzenes and EAS

Synthesis Strategies

1/25/2023

Electron **Donating** Groups: "Directing" EAS Regioselectivity



- reacts ~400 times faster than regular benzene

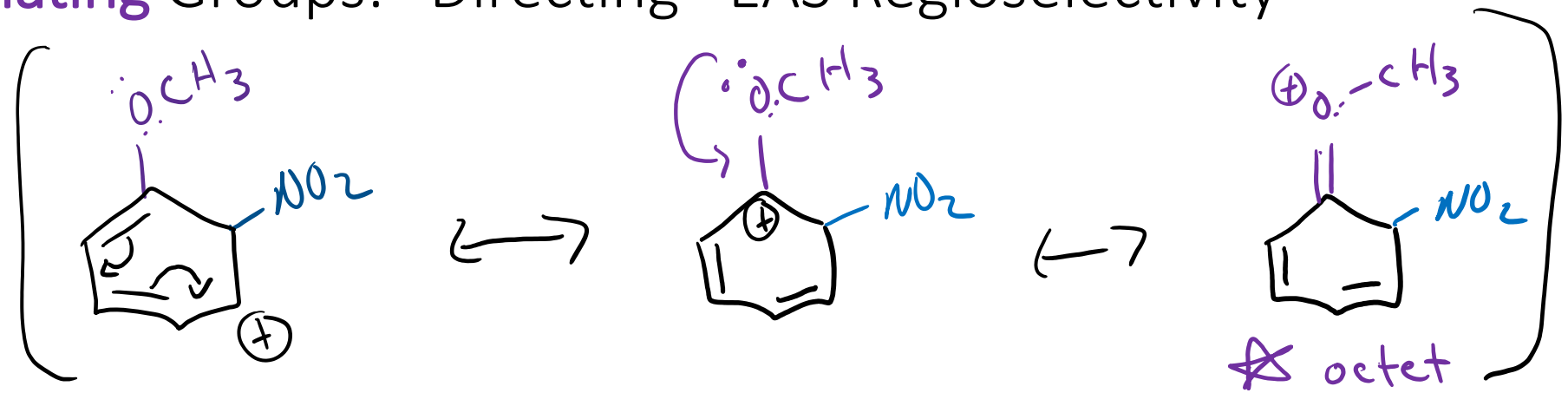
EDG are "activating groups"

- EDG direct new group to ortho + para positions!

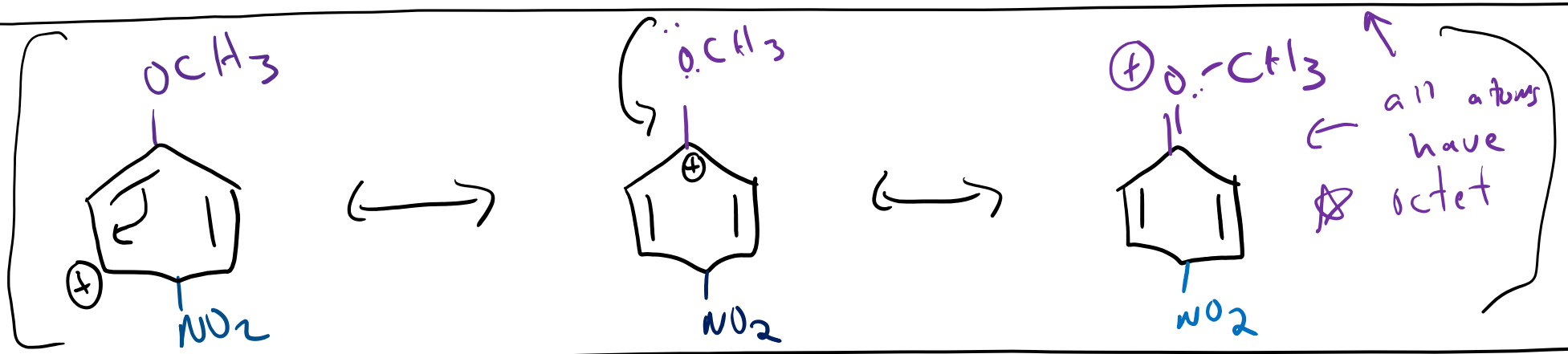
(NO_2 here)

Electron **Donating** Groups: "Directing" EAS Regioselectivity

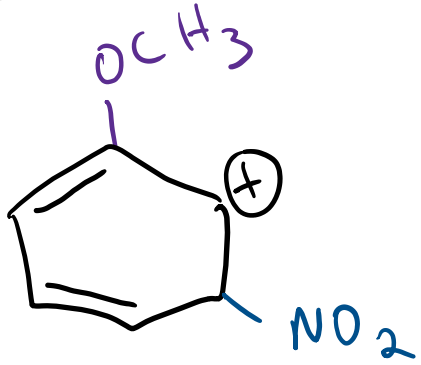
If NO_2 adds ortho:



If NO_2 adds para: ✓



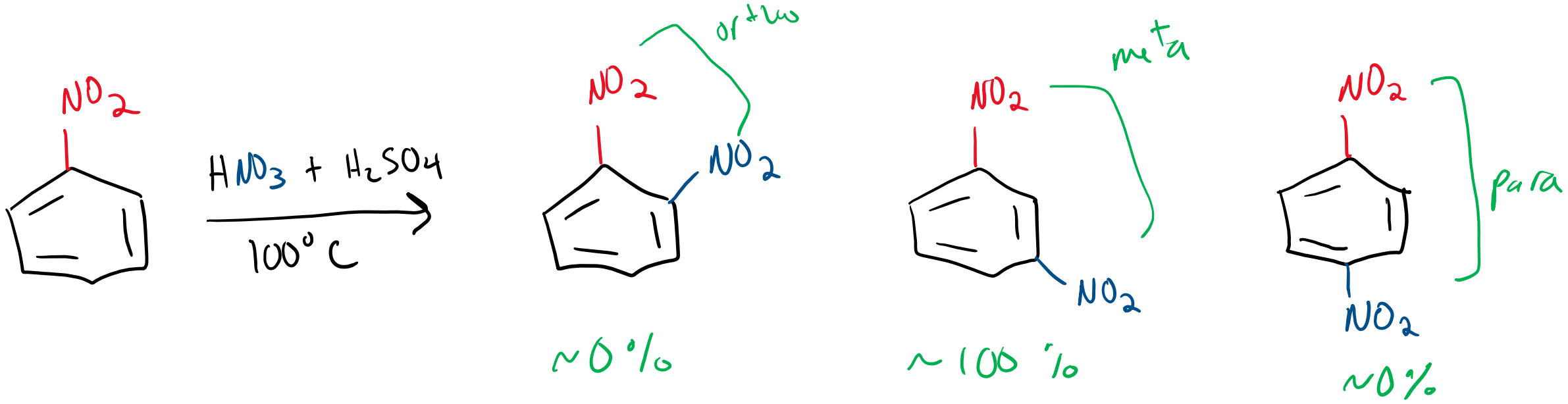
If NO_2 adds ~~meta~~:



can't get ⊕ onto oxygen via resonance!

much less stable intermediate vs. ortho- or para-

Electron **Withdrawing** Groups: "Directing" EAS Regioselectivity



- reacts 100,000 times slower than benzene!

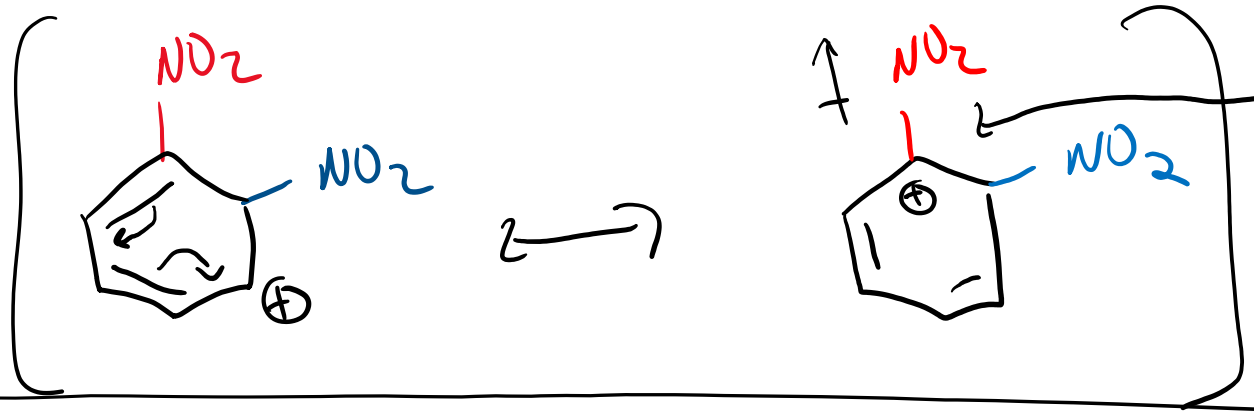
  EWG are "deactivating" groups

- EWG direct new group to <u>meta</u> position

  (ie NO_2 here)

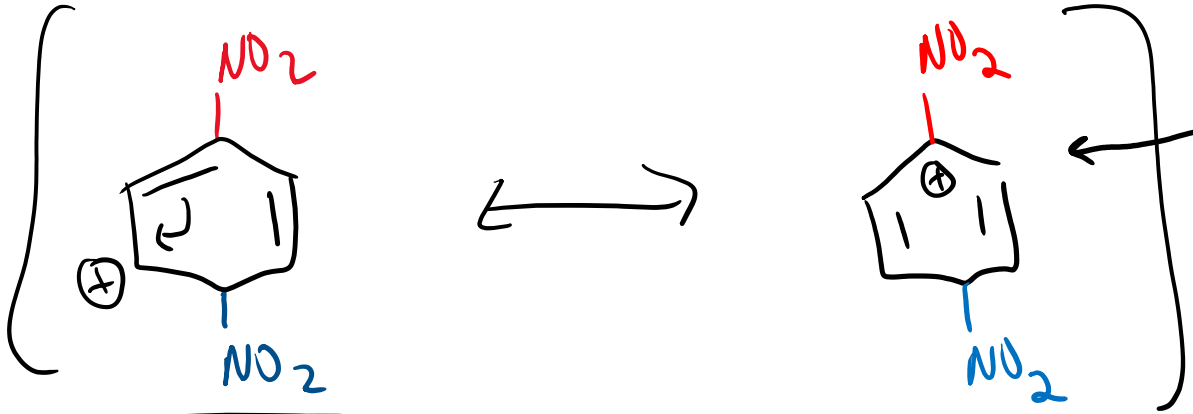
Electron **Withdrawing** Groups: Directing EAS Regioselectivity

If NO_2 adds ~~ortho~~:

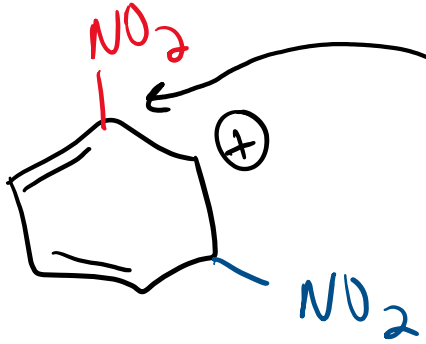


EWG on ⊕ makes it very unstable!

If NO_2 adds ~~para~~:



If NO_2 adds **meta**:



Can't get ⊕ charge onto this carbon via resonance.

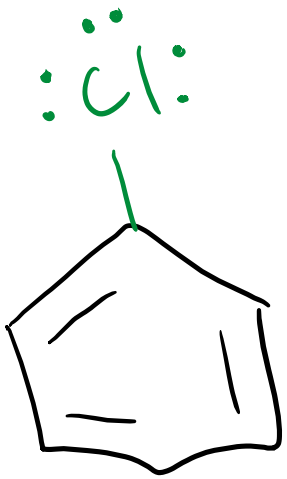
meta gives most stable intermediate!

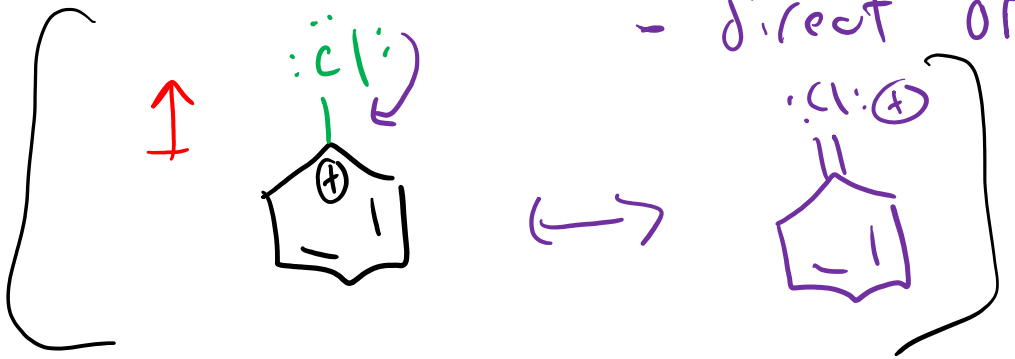
Halogens: Directing EAS Regioselectivity

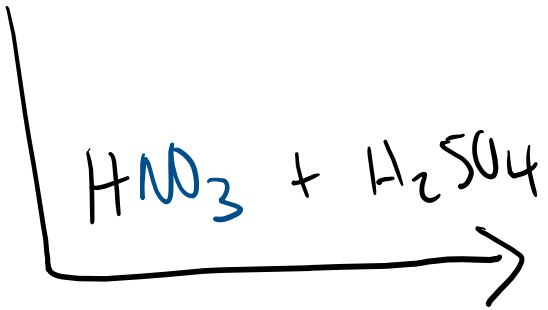
(18.9)

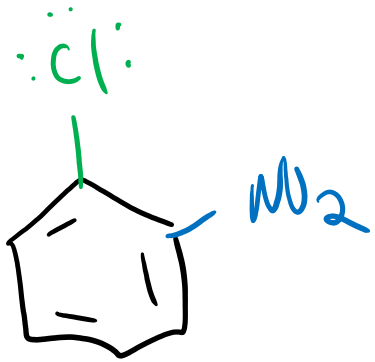
Halogens are
- EWG via induction
- weakly deactivating

but EDG via resonance
- direct ortho + para

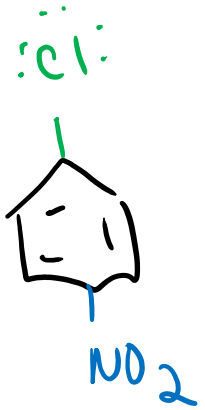








+

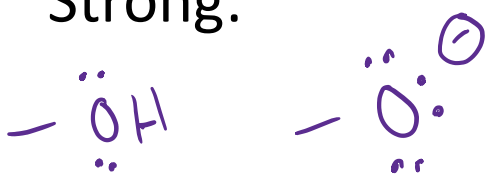


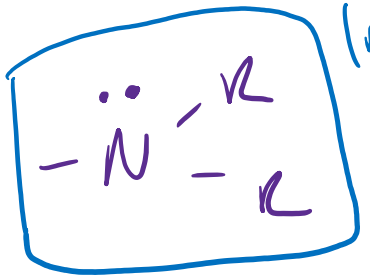
Strengths of Activating/Deactivating Groups

Activating Groups:

not compatible with HNO_3 (nitration rxns)

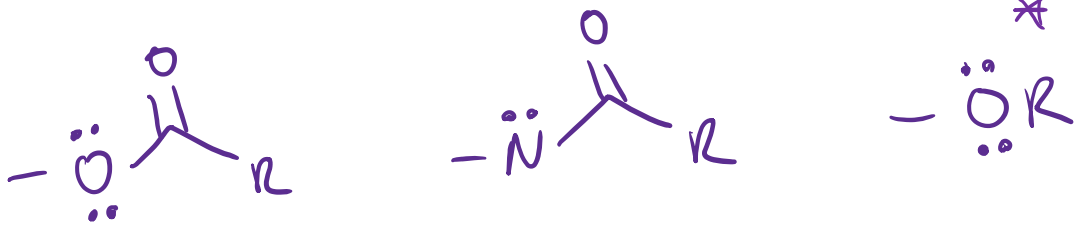
Strong:





Moderate:

borderline *



Weak:

(induction only)

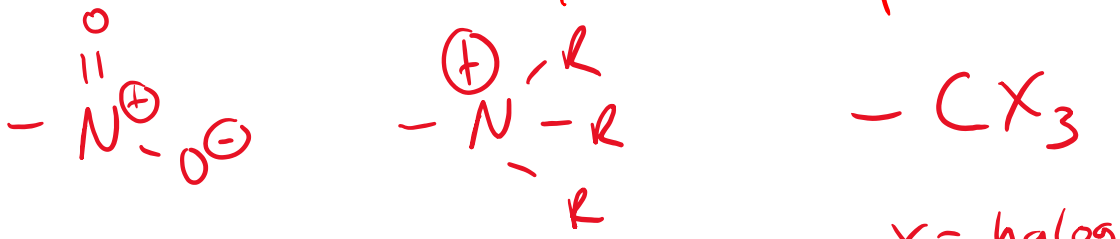
$-R$ (alkyl)

Deactivating Groups:

* not compatible with Friedel-Crafts reactions *

Strong:

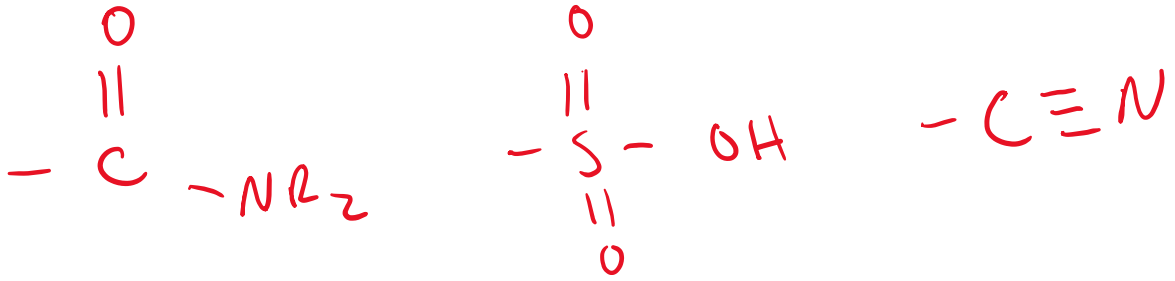
induction only



X = halogen

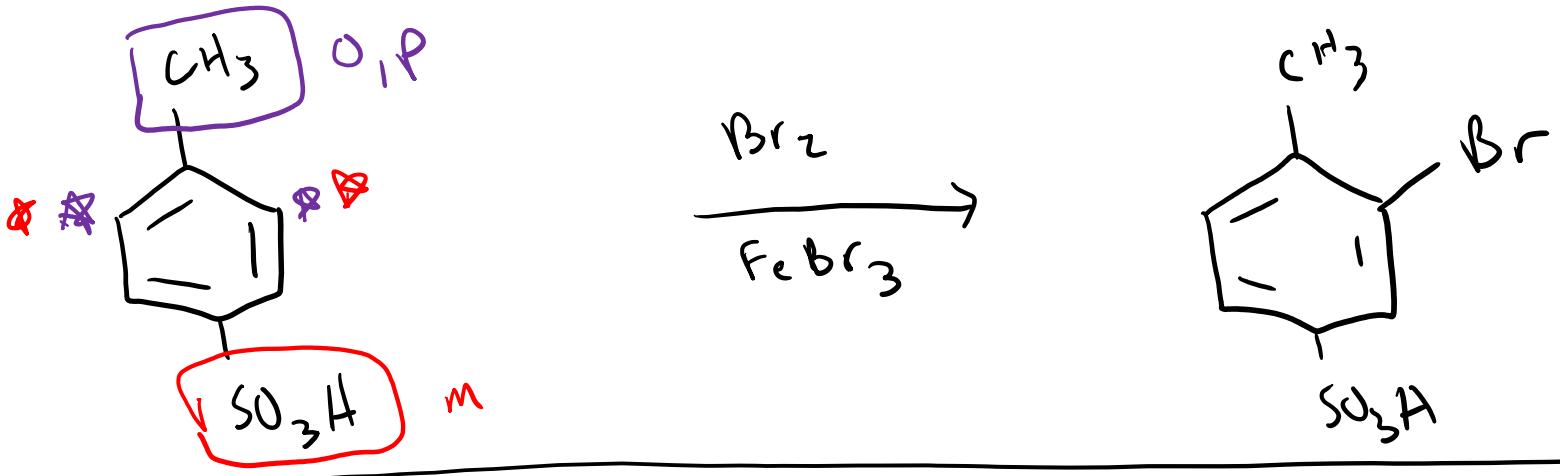
Moderate:

Weak: halogen

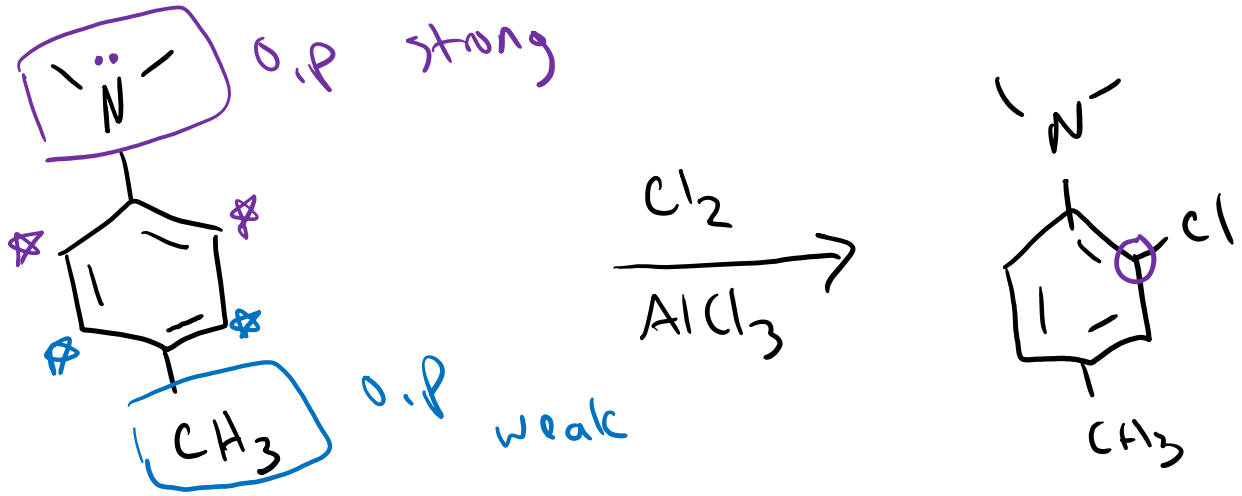


Multiple Substituents & Regioselectivity (18.11)

Case #1: Multiple directing effects "agree with" (or reinforce) each other



Case #2: Multiple directing effects compete.



- strongest activating group determines regioselectivity even if strong deactivator present.

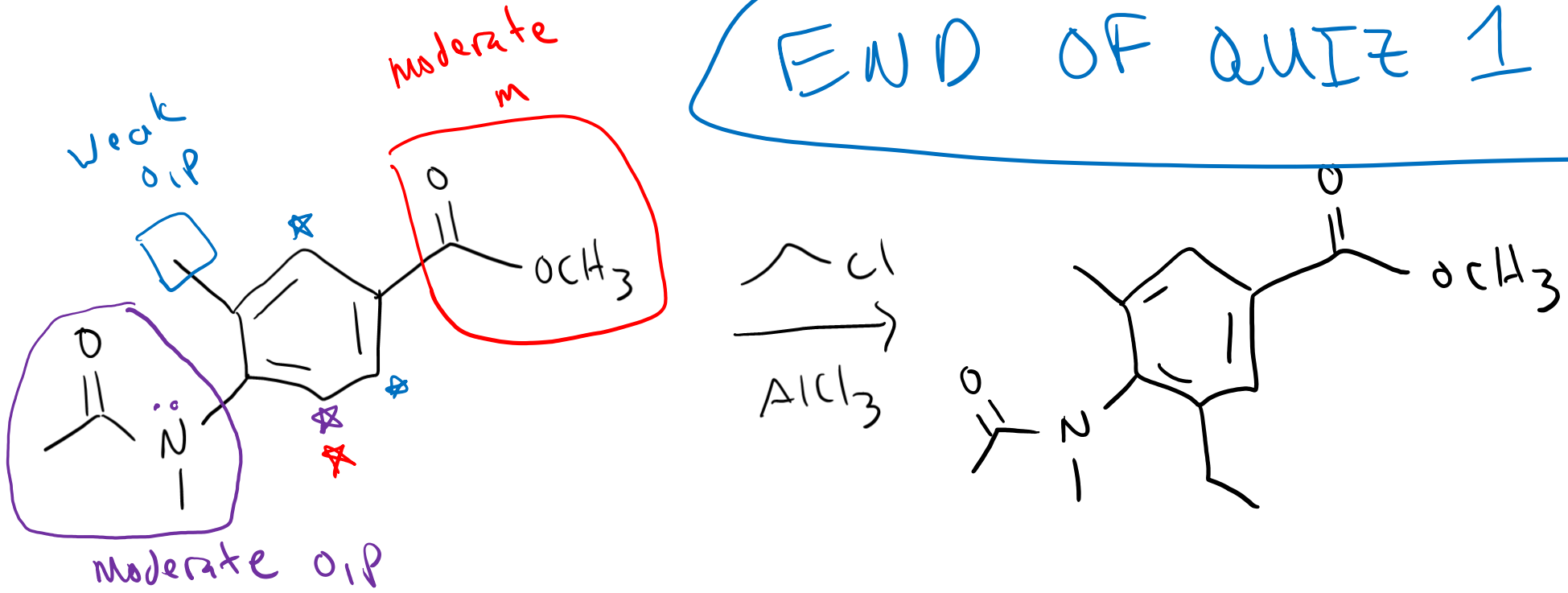
- if two strong activators? sterics! or, don't know (do the experiment!)

EAS with Multiple Substituents: Example

1. label all groups w/ strength & directing effect

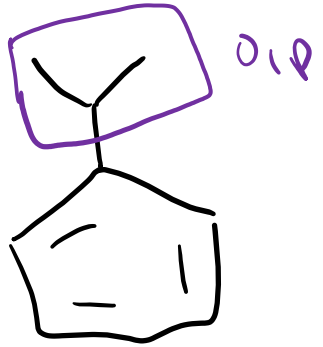
2. check for agreement & give priority to strongest activator (if need be)

END OF QUIZ 1 MATERIAL!



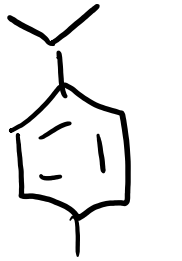
Steric Effects and "Blocking" Groups

(18.11)



o,p

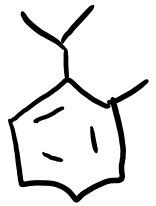
$H_2SO_4 + SO_3$



SO_3H

major

crowding



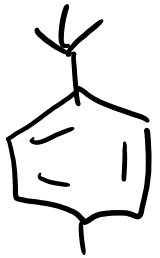
SO_3H

minor

o,p

Br_2

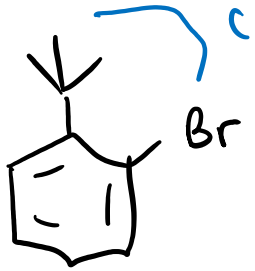
$FeBr_3$



Br

100 %

crowded

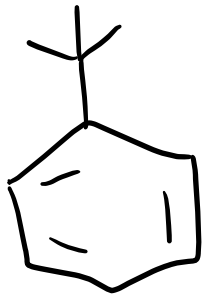


Br

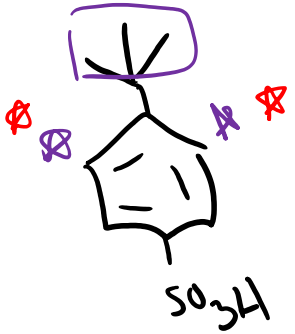
~0 %

how can we make this?

"block" para position!



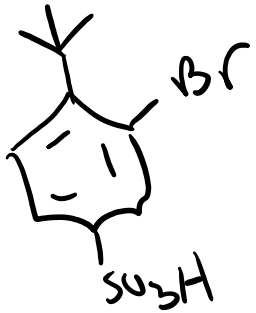
$H_2SO_4 + SO_3$



SO_3H

Br_2

$FeBr_3$



Br

SO_3H

dilute H_2SO_4

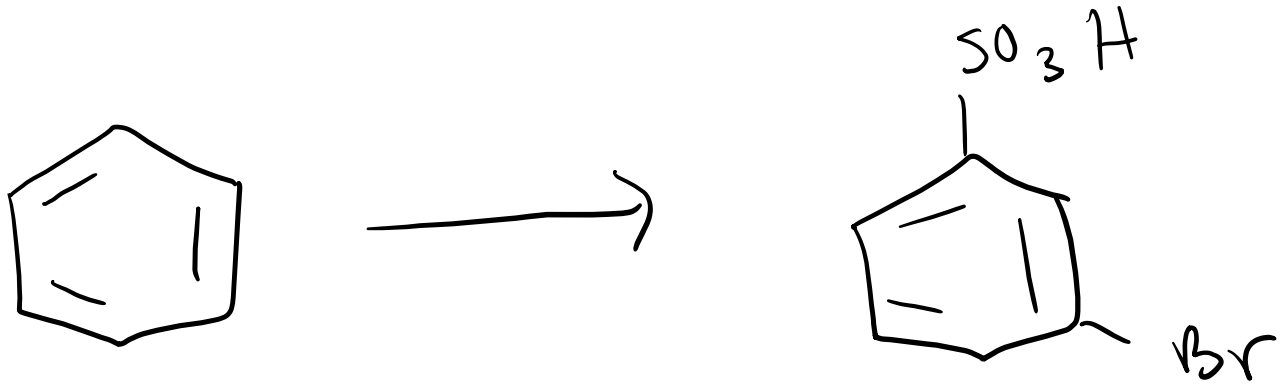
Δ

Br

ortho exclusively!

EAS Synthesis Strategies

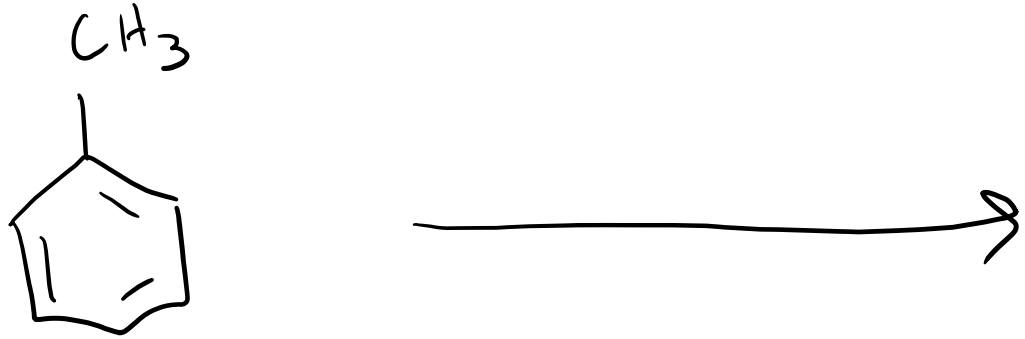
(18.12)

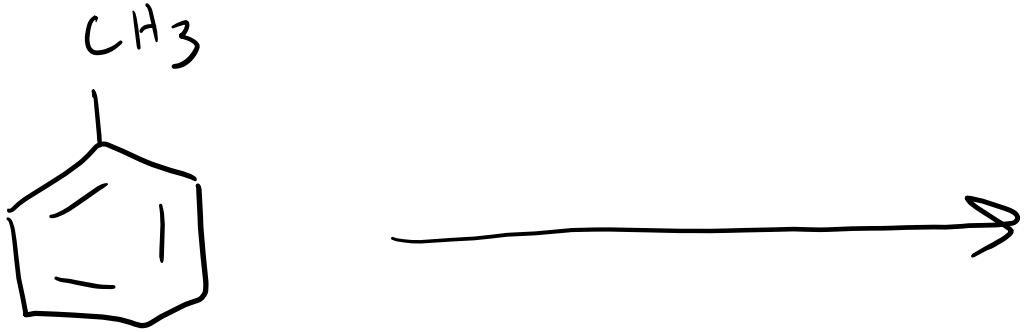


propose a synthesis!

Some Useful Transformations

KNOW THESE RECIPES





EAS Synthesis Strategies

(18.12)