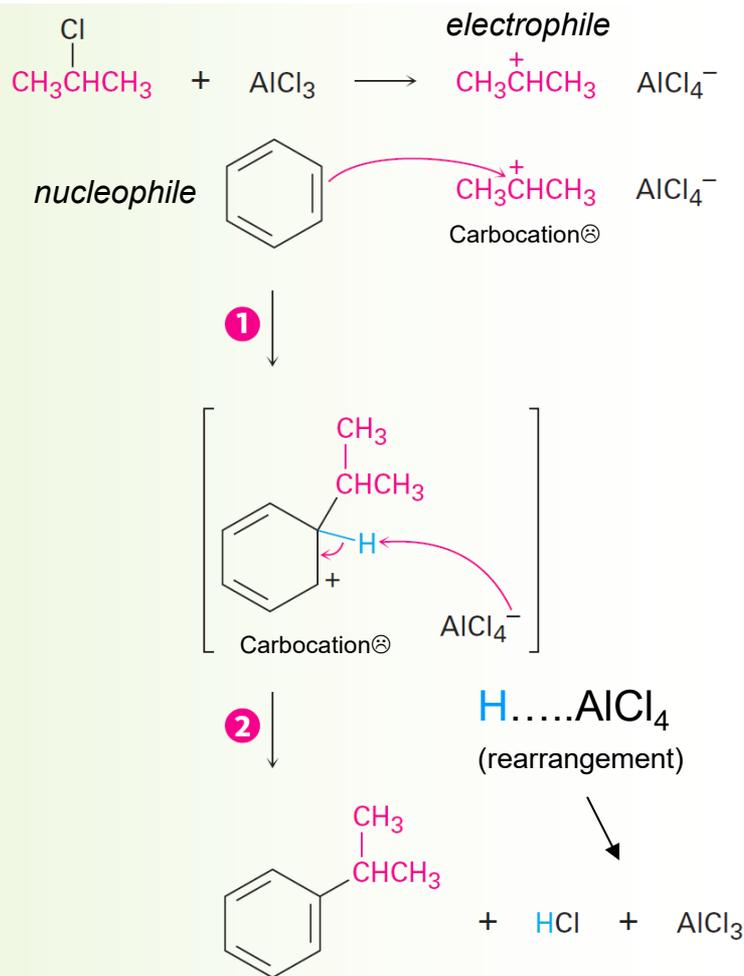


Mechanism of Friedel-Crafts Alkylation RXN

You Draw 😊



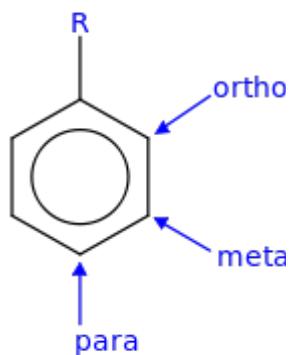
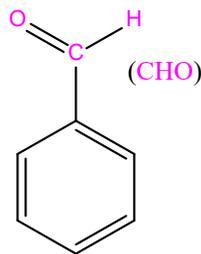
1 An electron pair from the aromatic ring attacks the carbocation, forming a C–C bond and yielding a new carbocation intermediate.

2 Loss of a proton then gives the neutral alkylated substitution product.

Handout 2a



Substituents affect the orientation of the reaction.



The 3 possible disubstituted products: *ortho* (*o*), *meta* (*m*), *para* (*p*) are NOT formed in equal amounts.

(HNO₃)

Table 16.1 Orientation of Nitration in Substituted Benzenes

	Product (%)				Product (%)		
	Ortho	Meta	Para		Ortho	Meta	Para
Meta-directing deactivators				Ortho- and para-directing deactivators			
-N ⁺ (CH ₃) ₃	2	87	11	-F	13	1	86
-NO ₂	7	91	2	-Cl	35	1	64
-CO ₂ H	22	76	2	-Br	43	1	56
-CN	17	81	2	-I	45	1	54
-CO ₂ CH ₃	28	66	6	Ortho- and para-directing activators			
-COCH ₃	26	72	2	-CH ₃	63	3	34
1) -CHO	19	72	9	2) -OH, -NH ₂	50	0	50
				-NHCOCH ₃	19	2	79

The chemical **nature** of the **1st substituent** (Y, e.g. -CHO, -CH₃, -OH...) on benzene ring determines the position of **2nd substituent**...

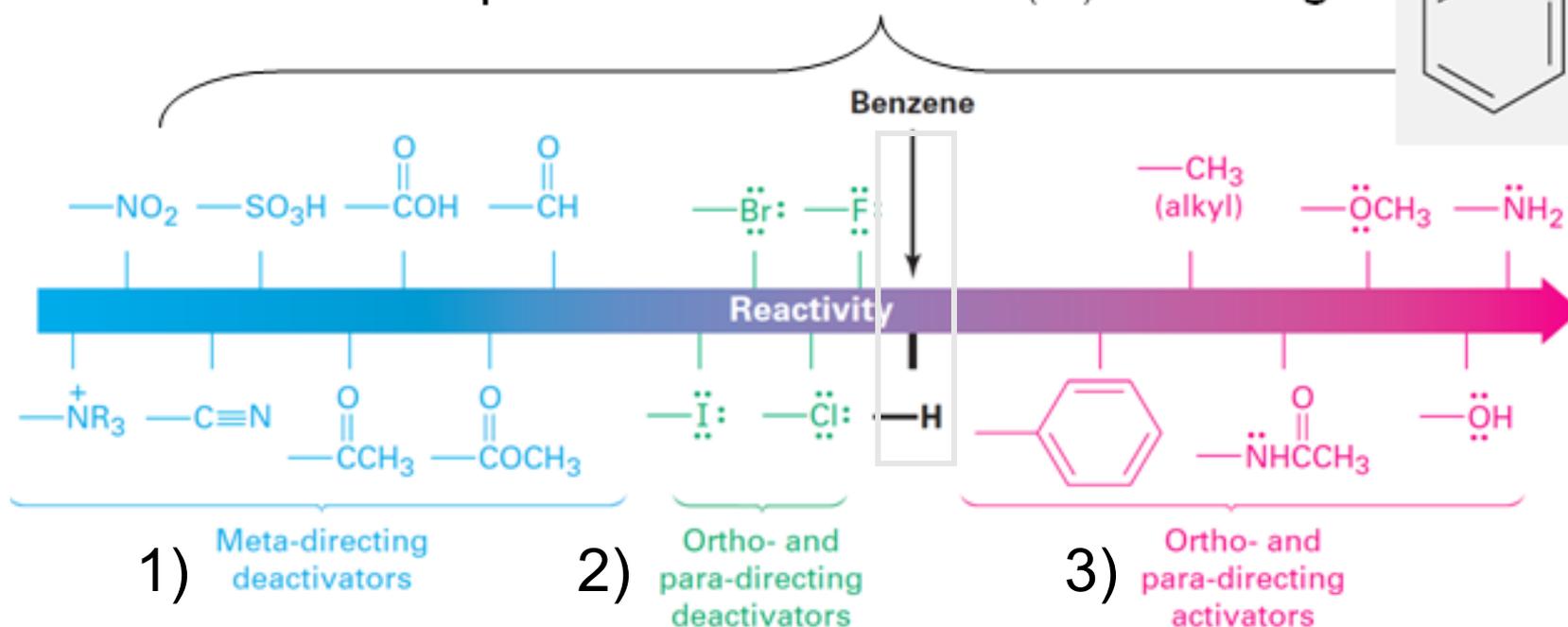
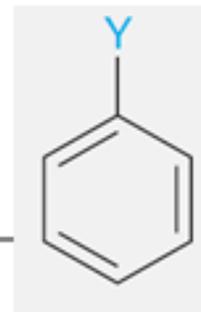
e.g. 1) if Y = -CHO (structure above), this directs NO₂ *mainly to meta* positions (72%)

2) If Y = -OH, this directs NO₂ to the *ortho* (50%) & *para* (50%) positions



Substituents can be classified into three groups (please *annotate* below)

NOTE: below are potential substituents (Y) on a ring



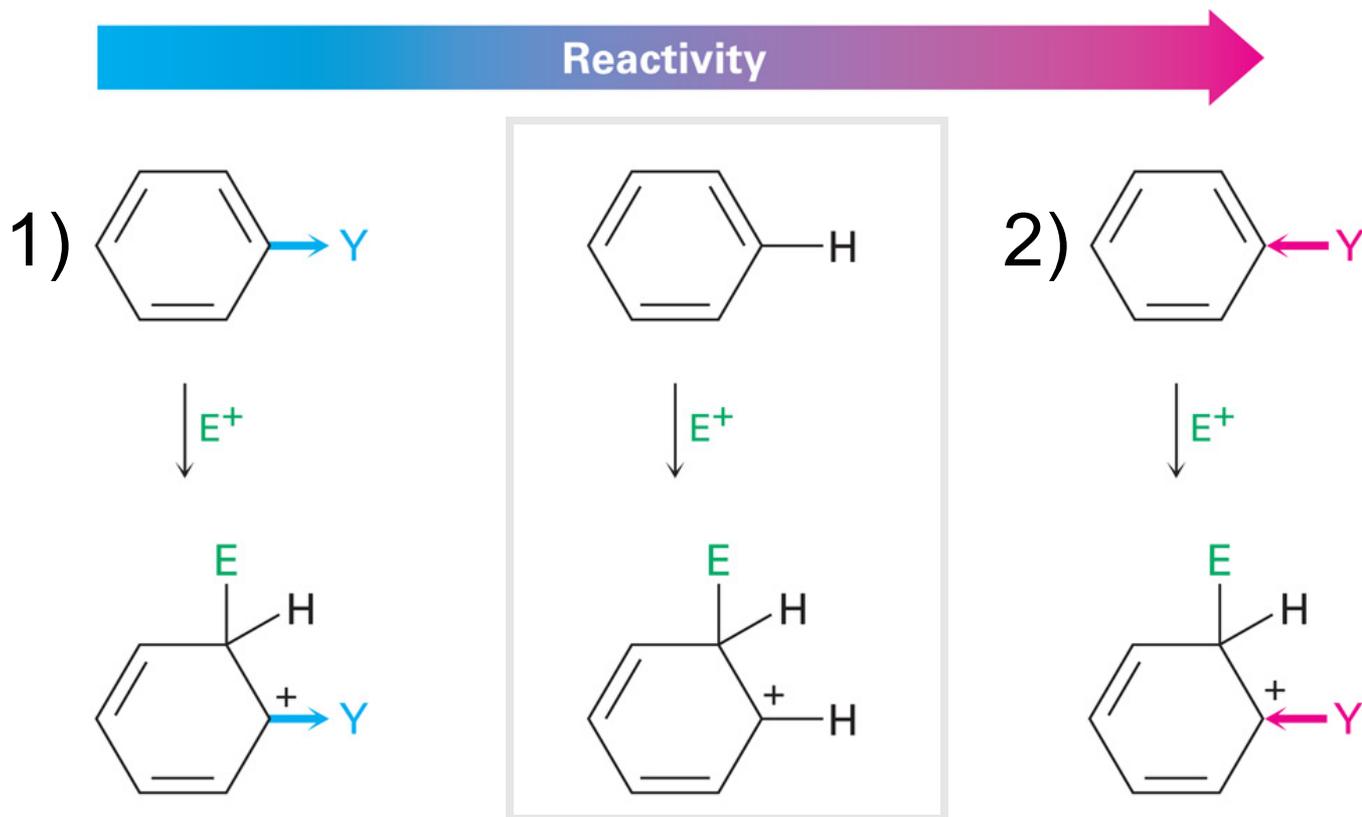
NOTES: 1) There are *Meta*-directing de-activators.

2) Halogens are weakly *-ortho* & *-para* directing de-activators

3) *Ortho* and *-para* directing activators



What makes a group either: 1) *de-activating* or 2) *activating*?



If substituent-
Y withdraws electrons;
carbocation intermediate
is less stable, and ring
is less reactive.

benzene = standard.
(neutral)

If substituent-
Y donates electrons;
carbocation intermediate
is more stable, and ring
is more reactive.