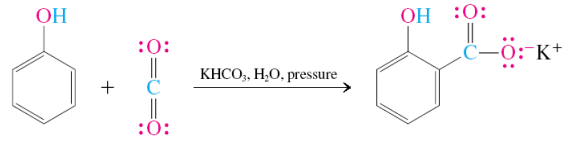
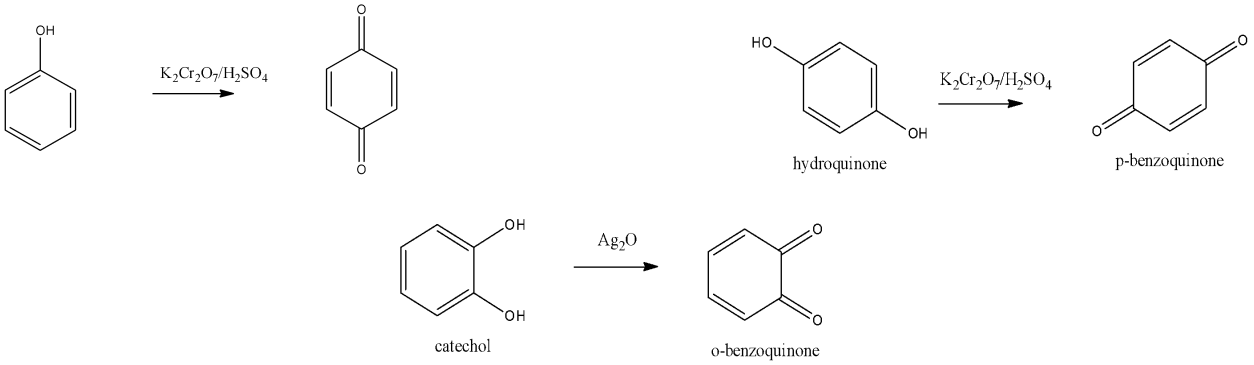
Reactions

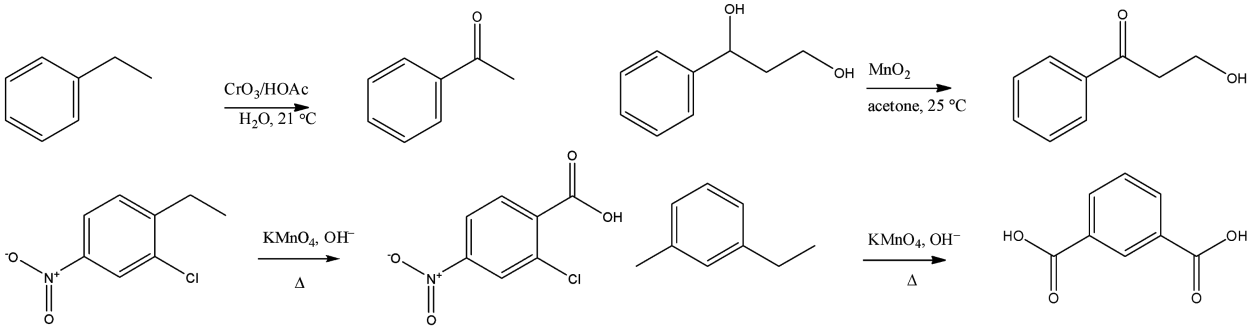
Carboxylation



Oxidations



(The Oxidations Below Require at Least 1 Benzylic Hydrogen)



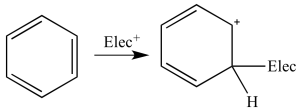
Addition to Benzene

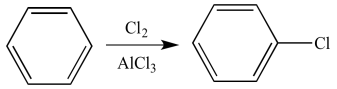
Table 22.2 Directing Effects of Substituents on Further Substitution

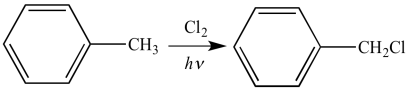
Ortho-Para Directing	Strongly activating	—$\ddot{N}H_2$	—$\ddot{N}HR$	—$\ddot{N}R_2$	—$\ddot{O}H$	—$\ddot{O}R$		
	Moderately activating	—$\ddot{N}HCR$ (O)	—$\ddot{N}HCAr$ (O)	—$\ddot{O}CR$ (O)	—$\ddot{O}CAr$ (O)			
	Weakly activating	—R						
	Weakly deactivating	—$\ddot{F}$:	—$\ddot{Cl}$:	—$\ddot{Br}$:	—$\ddot{I}$:			
Meta Directing	Moderately deactivating	—CH (O)	—CR (O)	—COH (O)	—COR (O)	—CNH_2 (O)	—SOH (O)	—C≡N
	Strongly deactivating	—NO_2	—NH_3^+	—CF_3	—CCl_3			

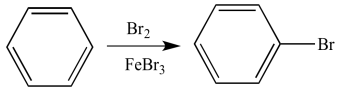
Relative importance in directing further substitution

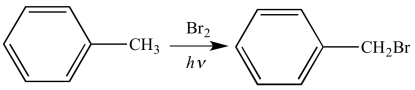
Reactions

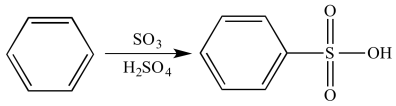

Elec+
Elec
H

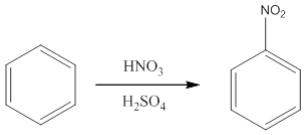

Cl2
AlCl3
Cl

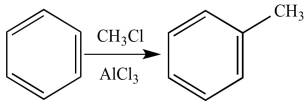

CH3
Cl2
hν
CH2Cl

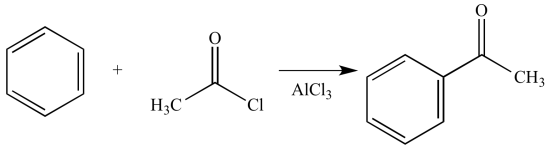

Br2
FeBr3
Br

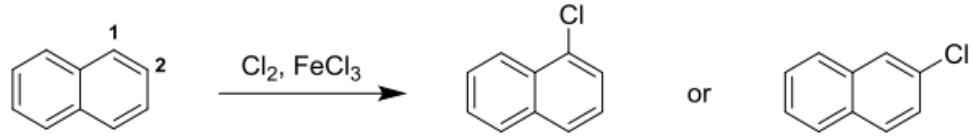

CH3
Br2
hν
CH2Br

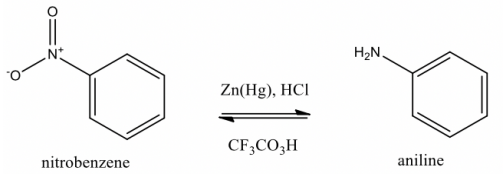

SO3
H2SO4
O
S
OH
O

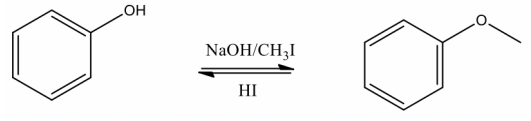

NO2
HNO3
H2SO4

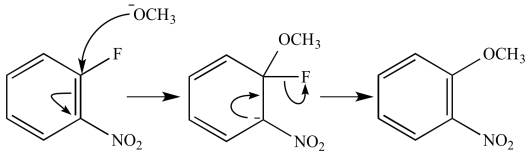

CH3Cl
AlCl3
CH3


+
O
H3C
Cl
AlCl3
O
CH3

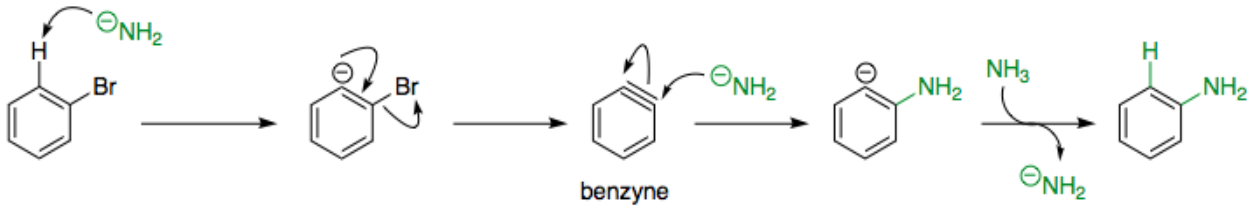

1
2
Cl2, FeCl3
Cl
or
Cl

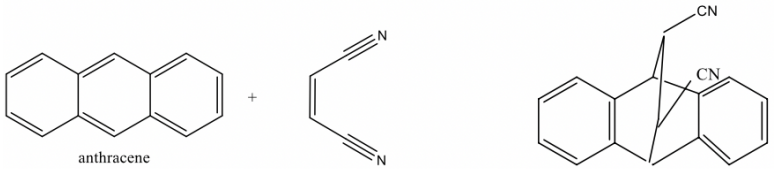

O
N+
-O
nitrobenzene
Zn(Hg), HCl
CF3CO3H
H2N
aniline


OH
NaOH/CH3I
HI
O

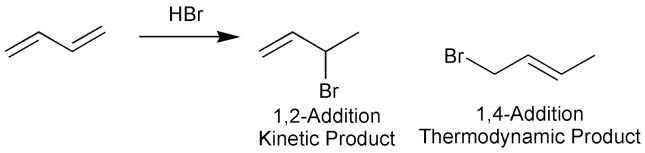

-OCH3
F
NO2
OCH3
F
NO2
OCH3
NO2

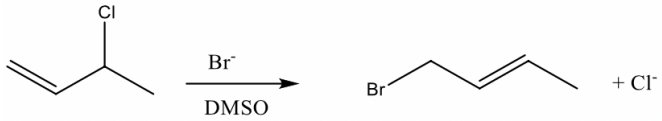
Reactions

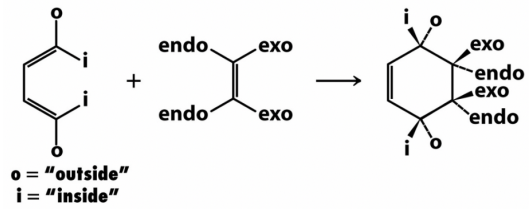


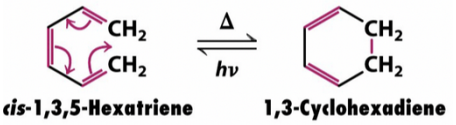


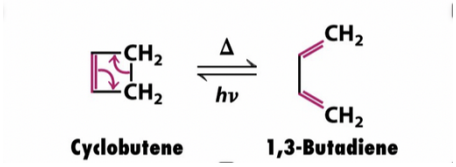
Reactions

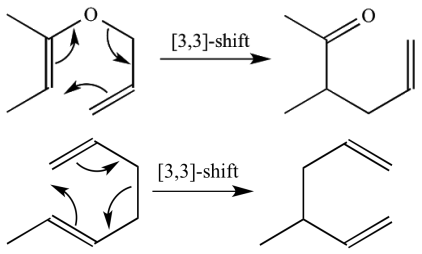

HBr
Br
1,2-Addition
Kinetic Product
Br
1,4-Addition
Thermodynamic Product


Cl
Br⁻
DMSO
Br
+ Cl⁻


o
i
i
o
+
endo
exo
endo
exo
i
o
exo
endo
exo
endo
i
o
o = "outside"
i = "inside"


CH2
CH2
Δ
hν
CH2
CH2
cis-1,3,5-Hexatriene
1,3-Cyclohexadiene


CH2
CH2
Δ
hν
CH2
CH2
Cyclobutene
1,3-Butadiene


O
[3,3]-shift
O
[3,3]-shift