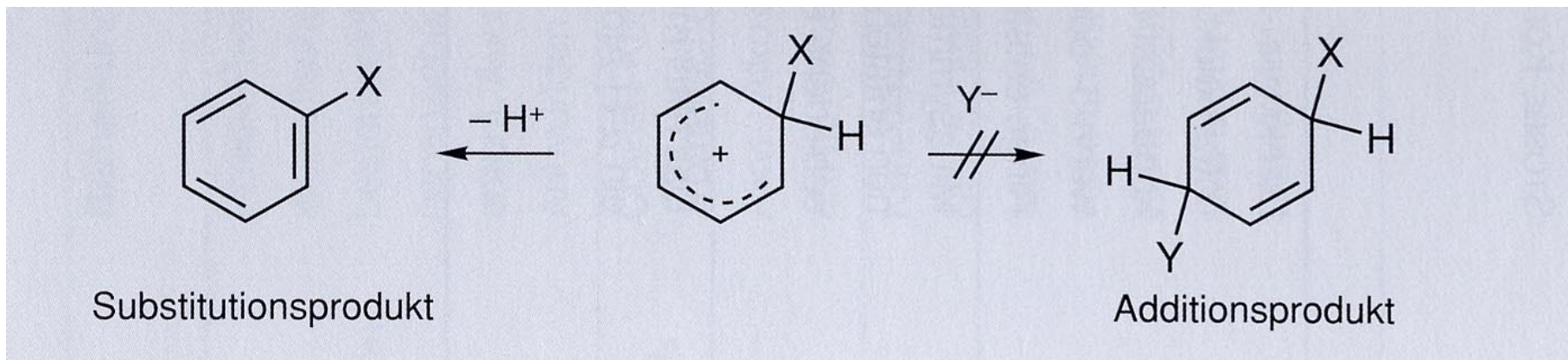
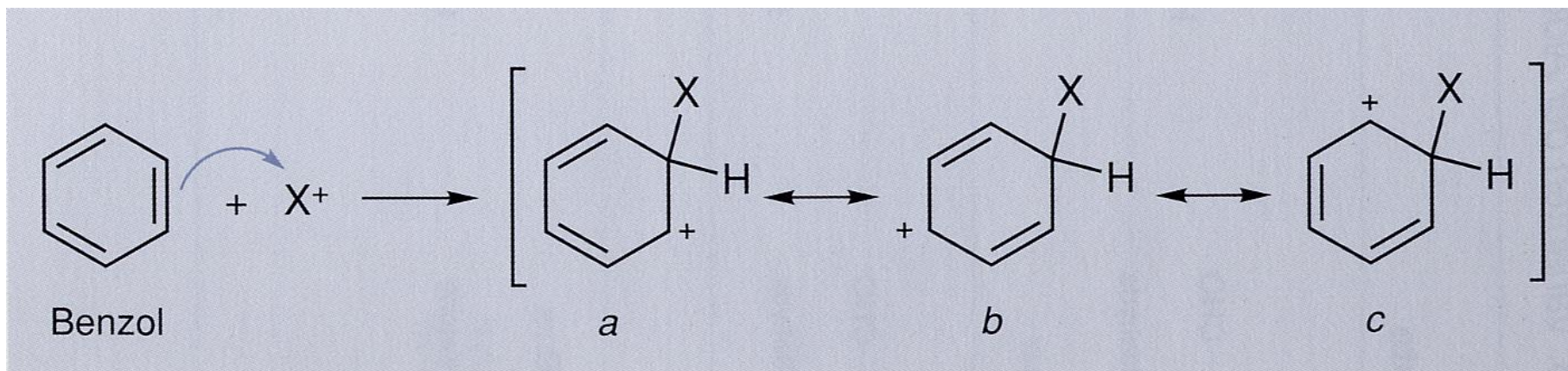
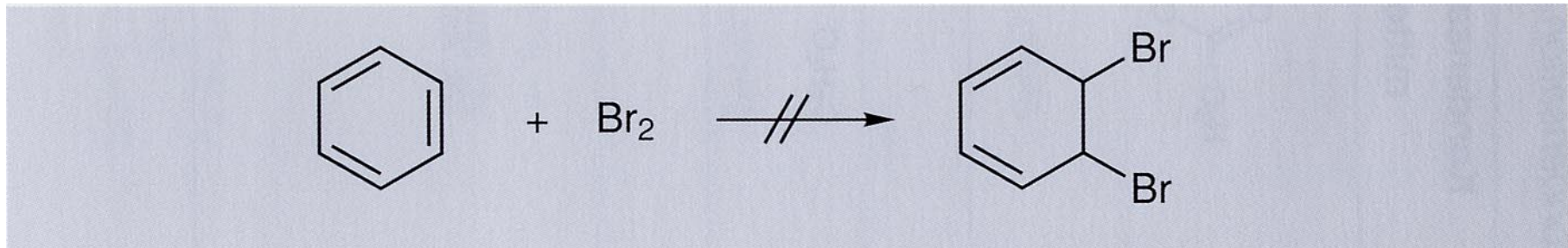
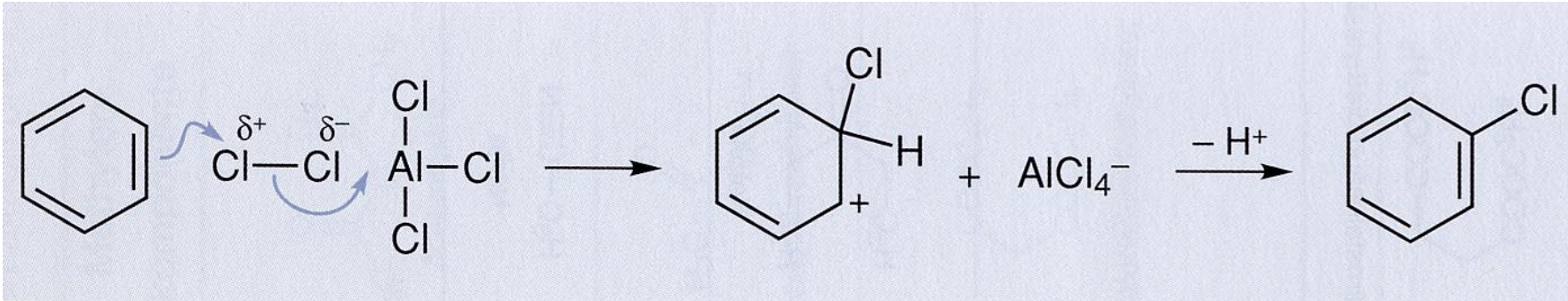
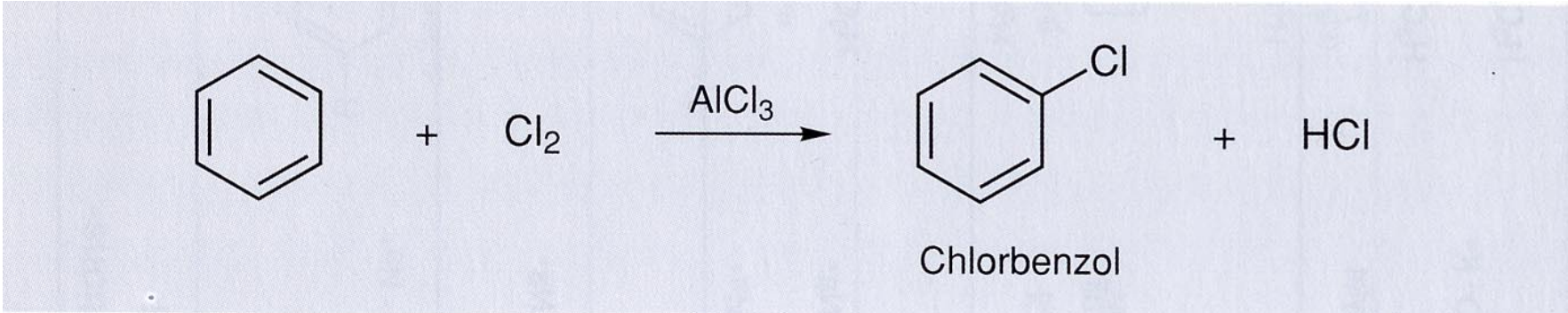


4.6 Die elektrophile aromatische Substitution

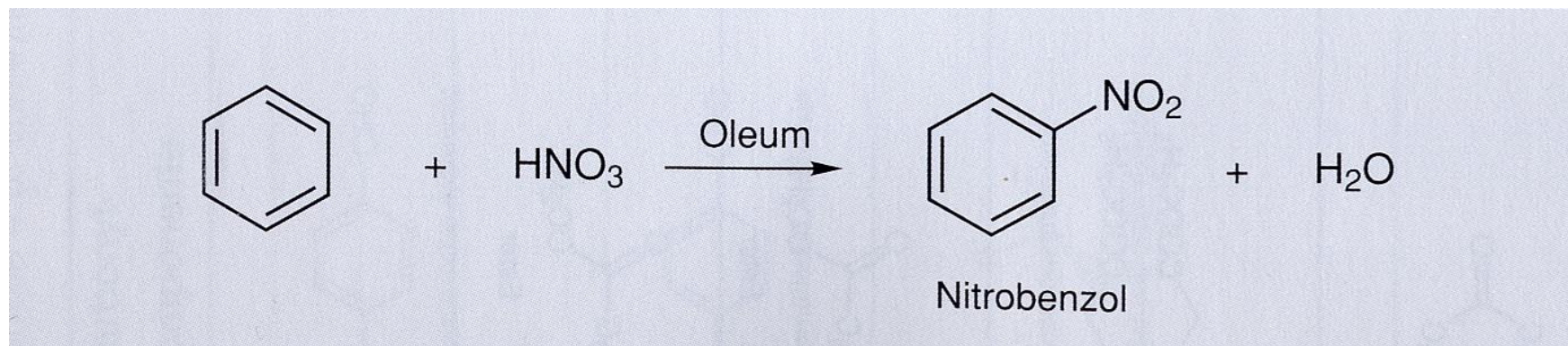
Wiederholung:



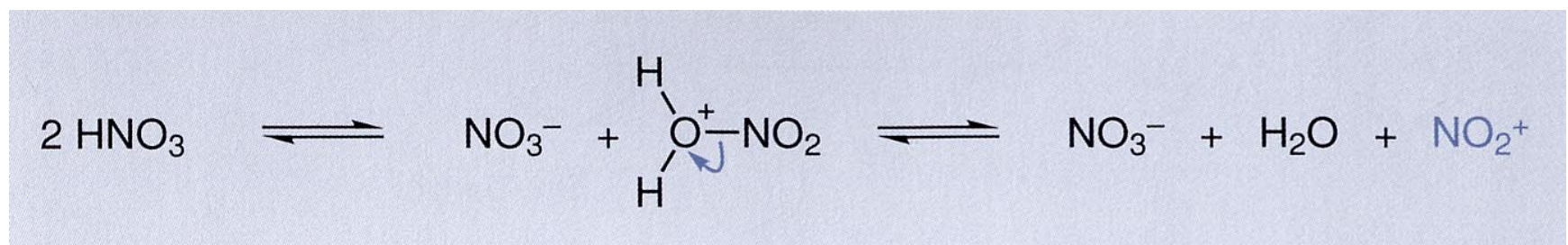
Halogenierung von Aromaten:



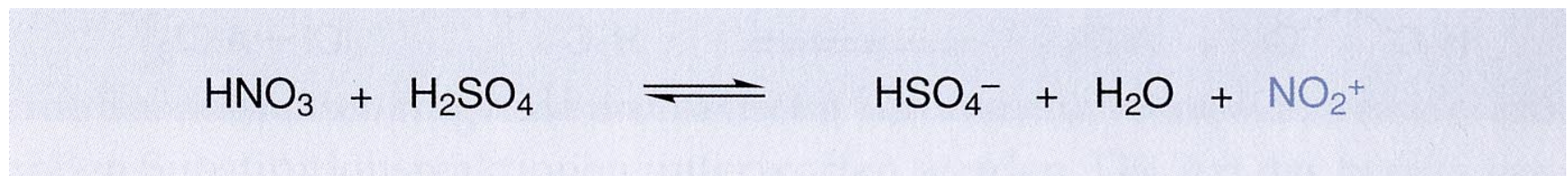
Nitrierung von Benzol:



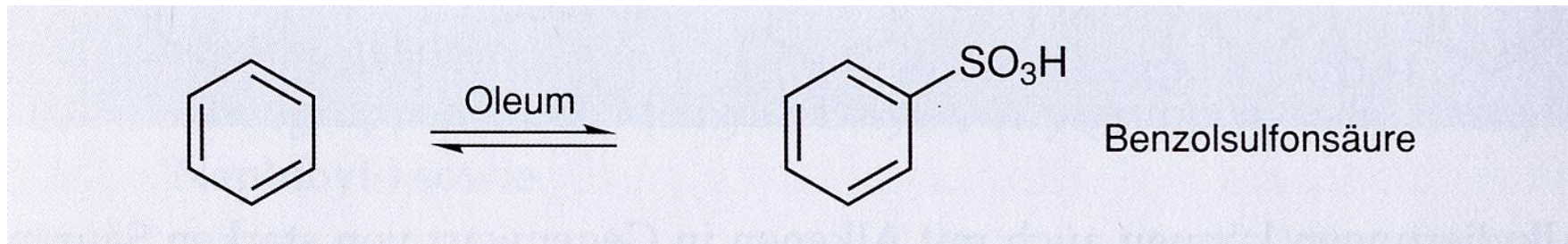
Das benötigte Elektrophil NO_2^+ (Nitroniumion) entsteht in geringer Konzentration durch Autoprotolyse der Salpetersäure



Höhere Konzentrationen an NO_2^+ in Kombination mit Schwefelsäure

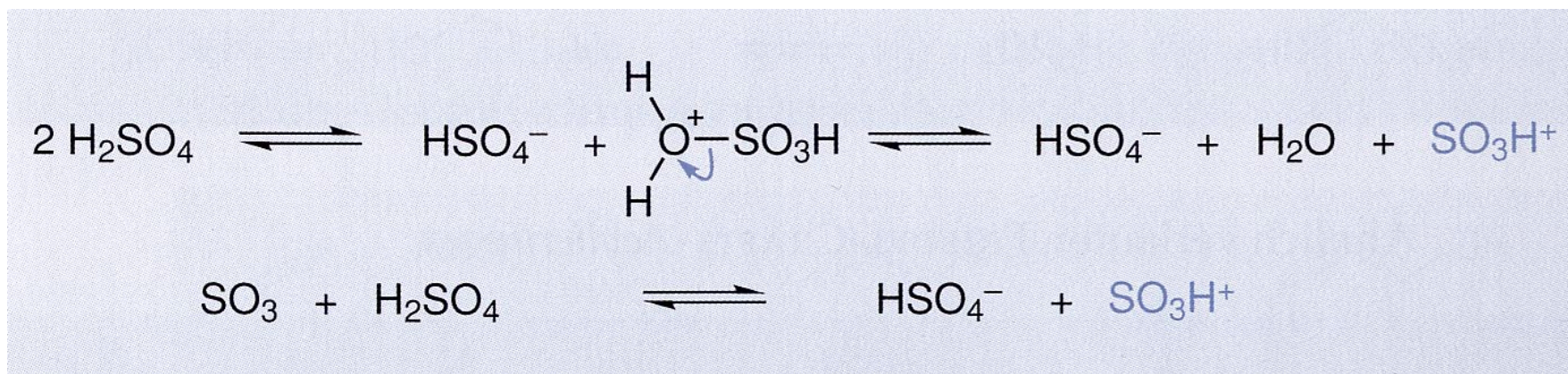


Sulfonierung:

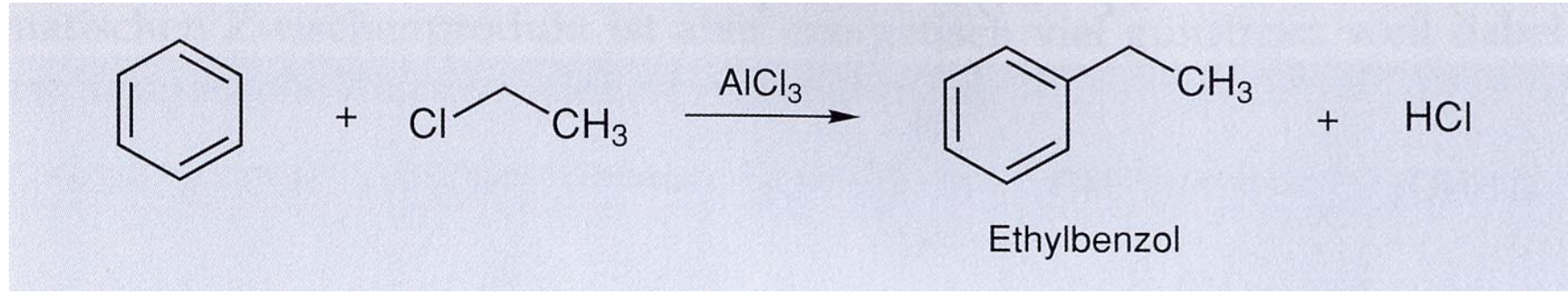


Oleum:

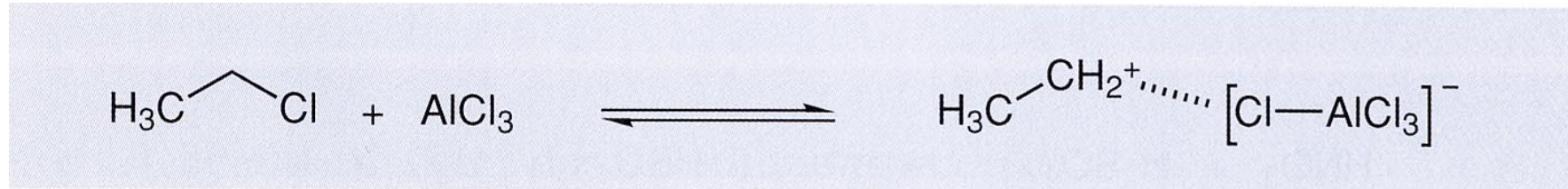
Elektrophil:



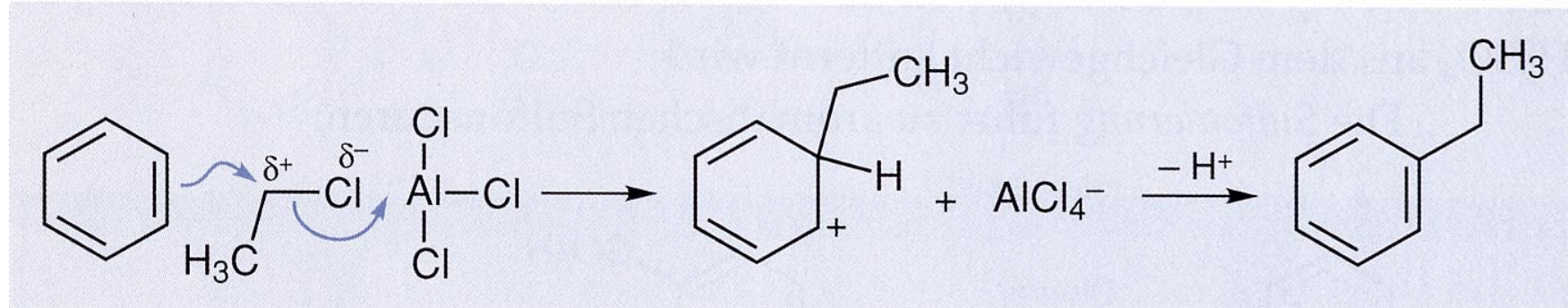
Friedel-Crafts-Alkylierung:



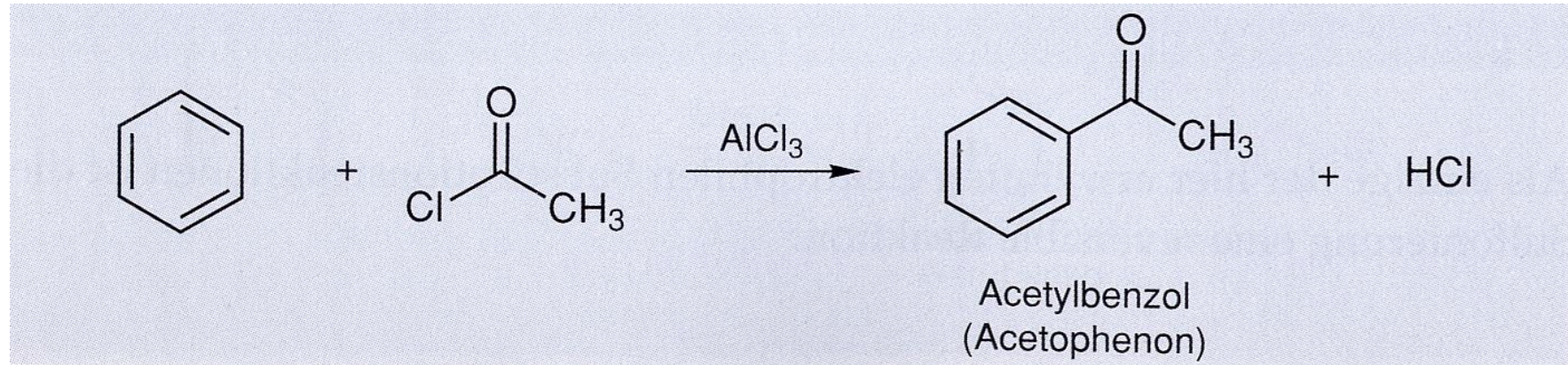
Entstehung des Elektrophils:



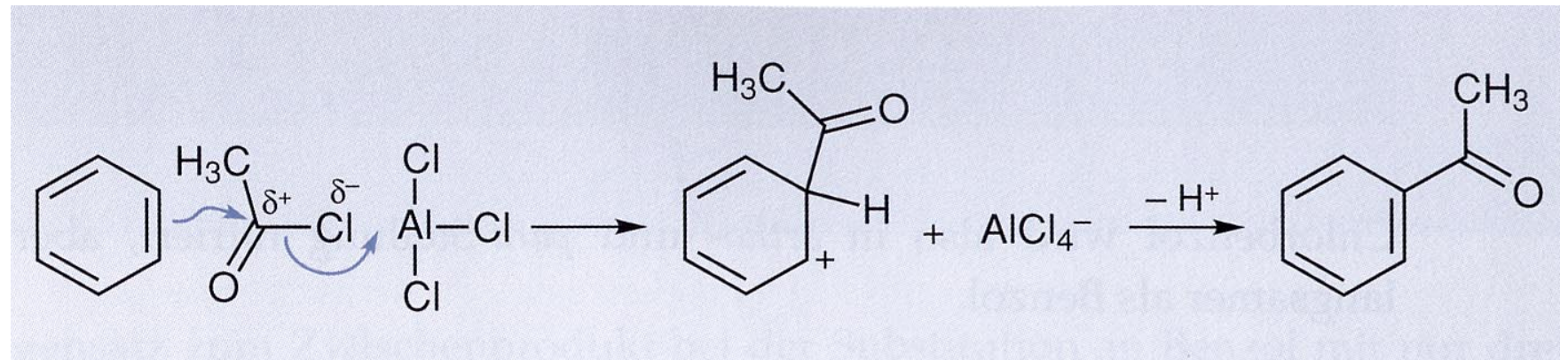
S_E am Aromaten:



Friedel-Crafts-Acylierung:



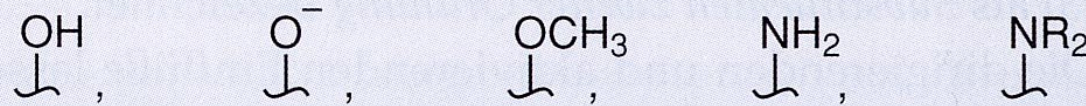
Elektrophiles Reagens entsteht aus Säurechlorid und AlCl_3 :



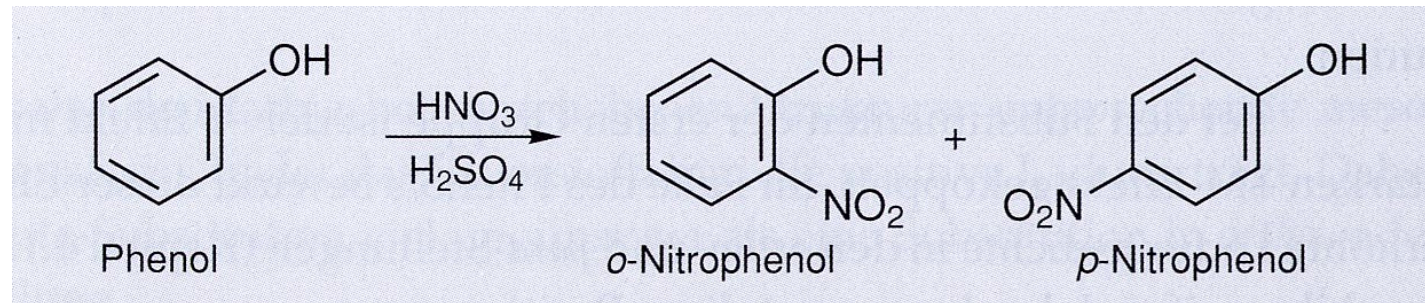
Substitutionsregeln:

Substituenten am Aromaten beeinflussen die weitere Reaktivität gegenüber Elektrophilen

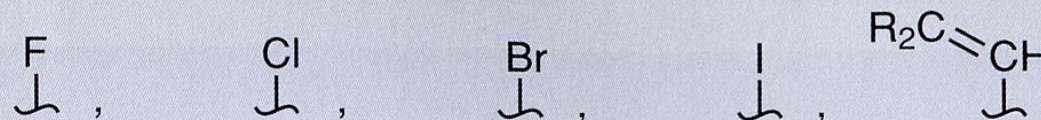
1. *ortho*-, *para*-dirigierend und aktivierend



Beispiel:

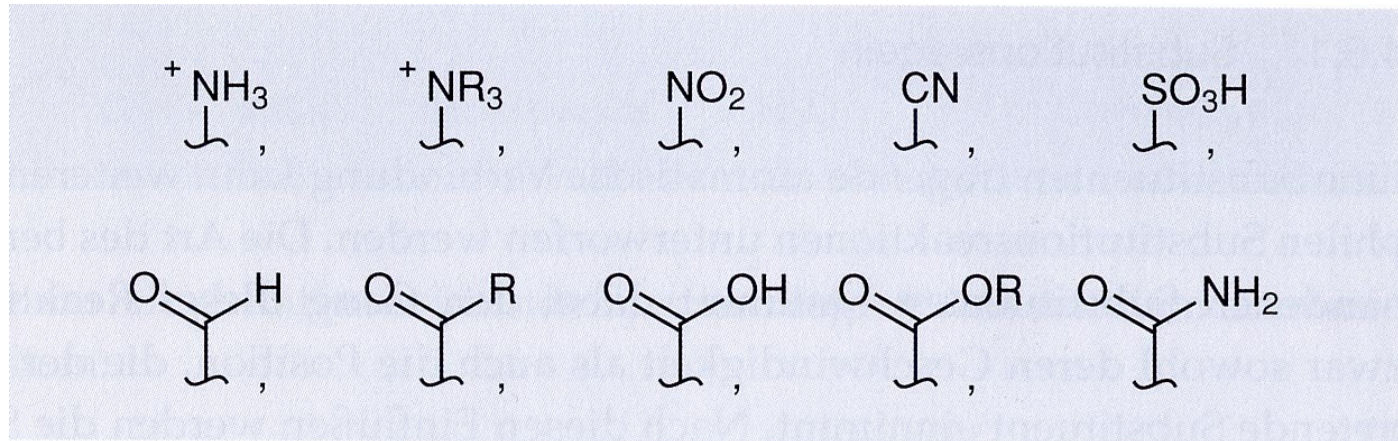


2. *ortho*-, *para*-dirigierend und desaktivierend

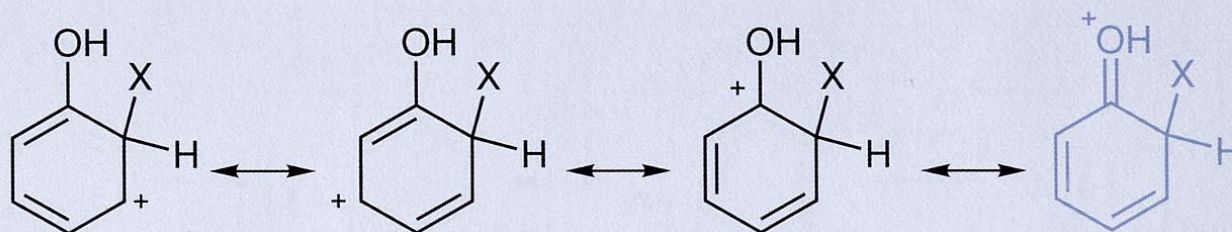
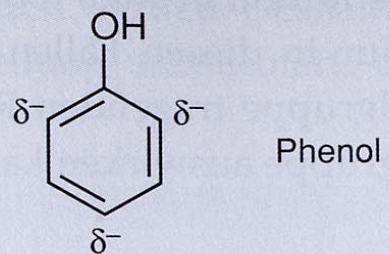


Chlorbenzol wird in *o*- und *p*-Stellung nitriert aber langsamer als Benzol

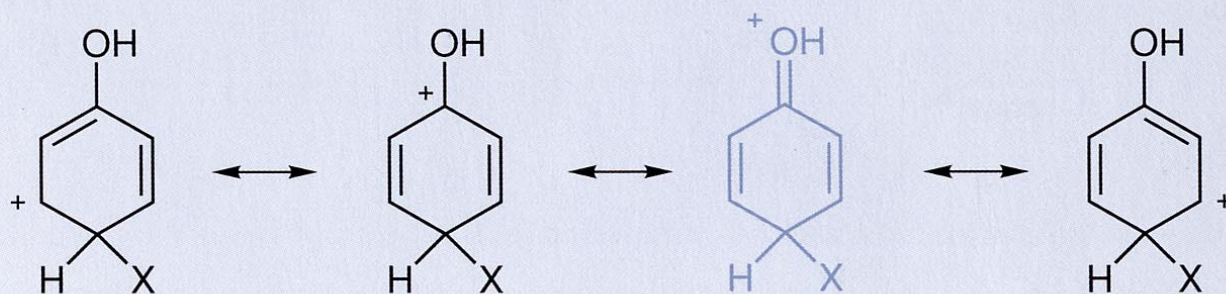
3. **meta-dirigierend** und **desaktivierend**



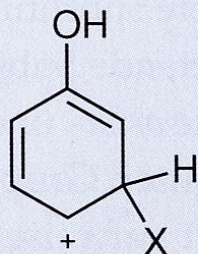
Gemeinsames Merkmal:



***ortho*-Addition:**

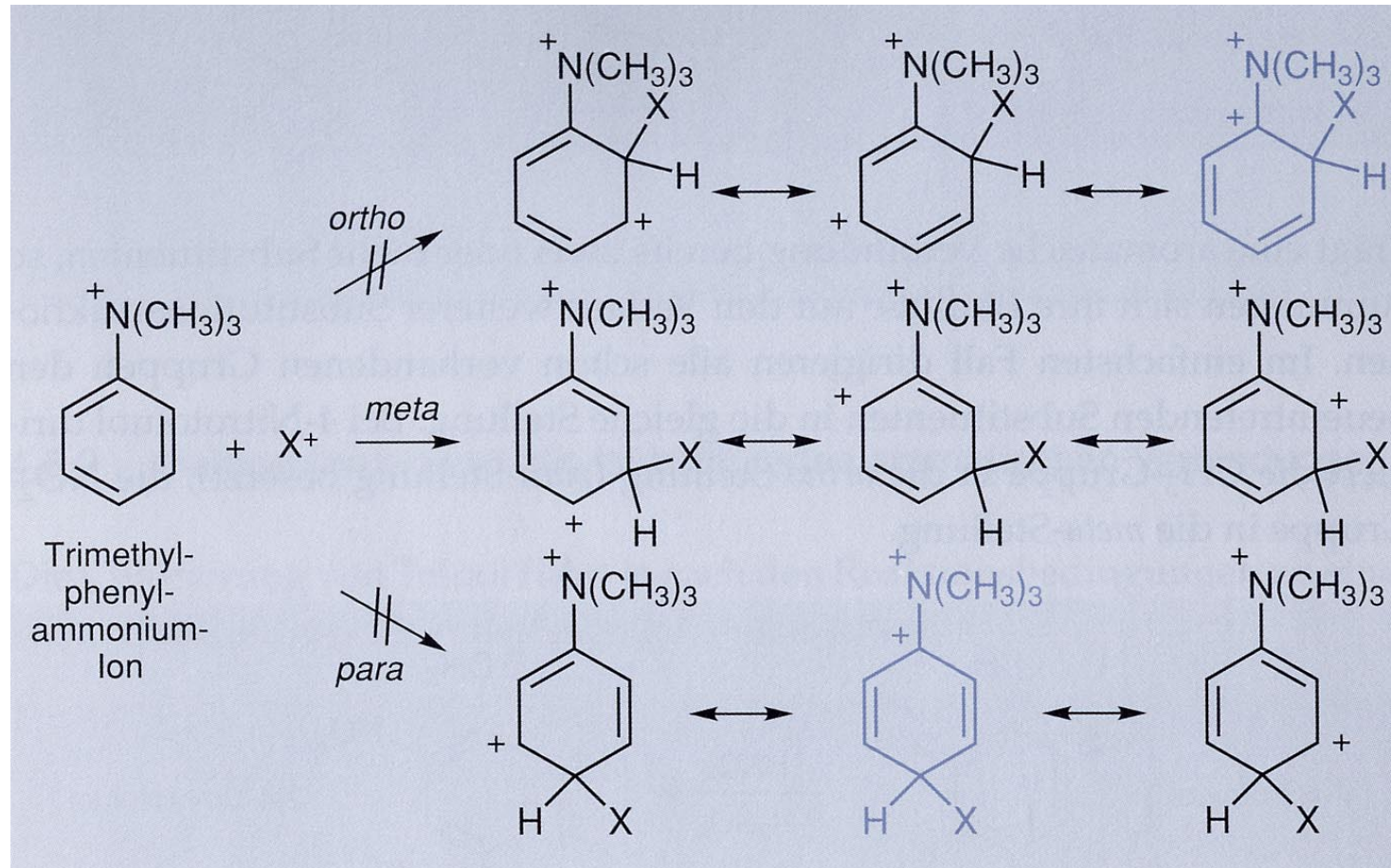


***para*-Addition:**



***meta*-Addition:**

S_E am Trimethylphenylammonium-Ion:

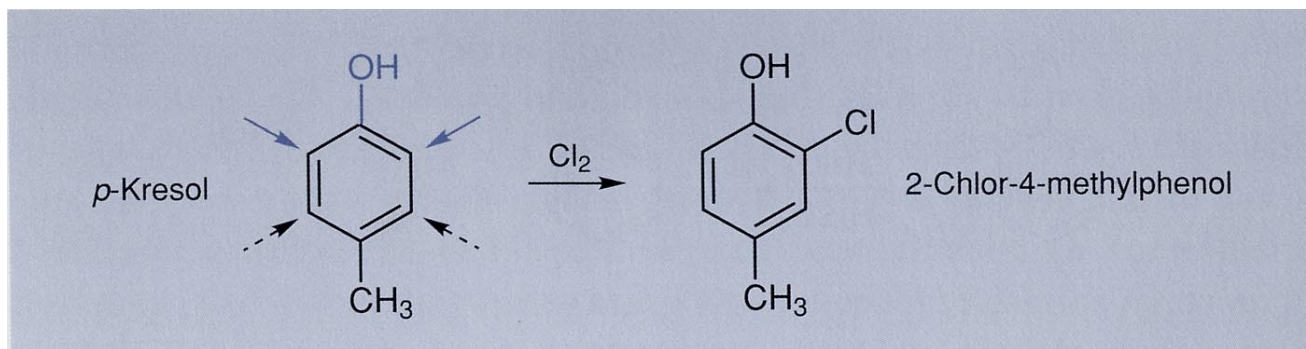
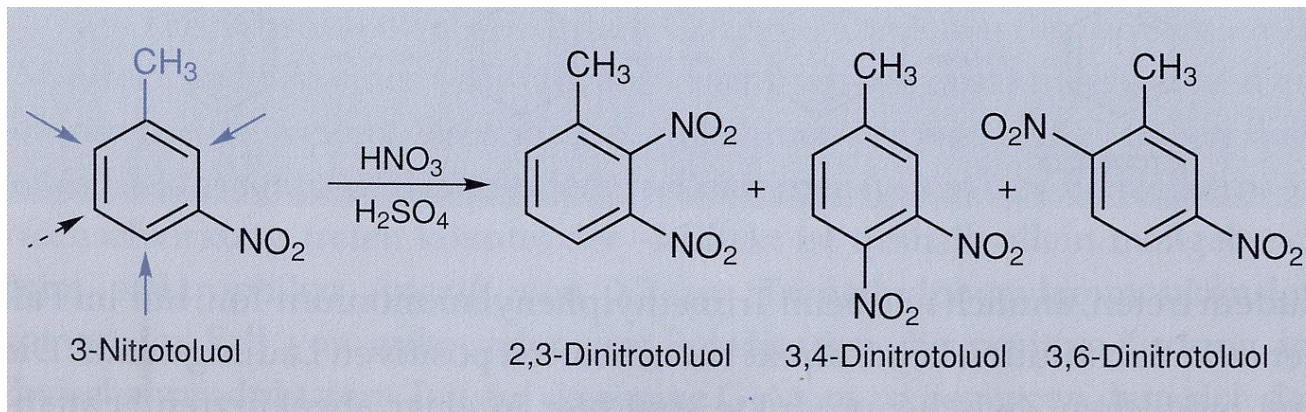
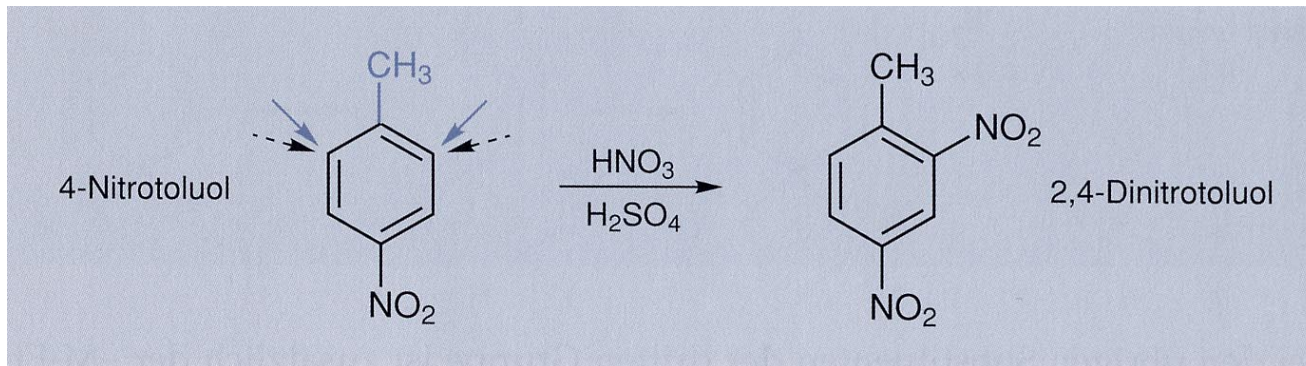


ortho-Addition:

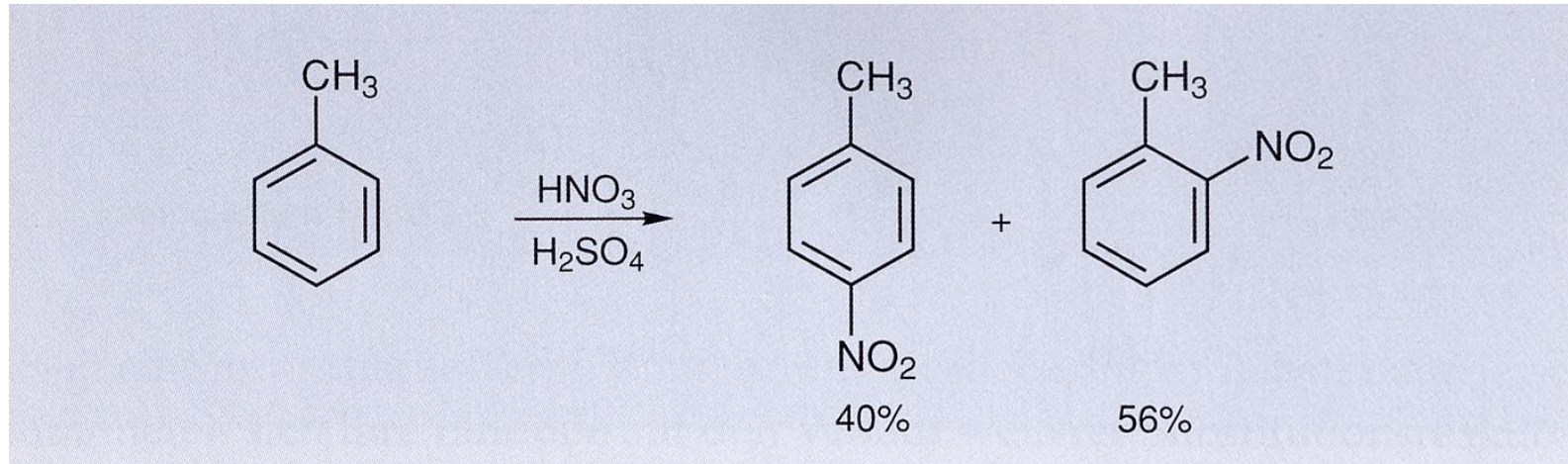
meta-Addition:

para-Addition:

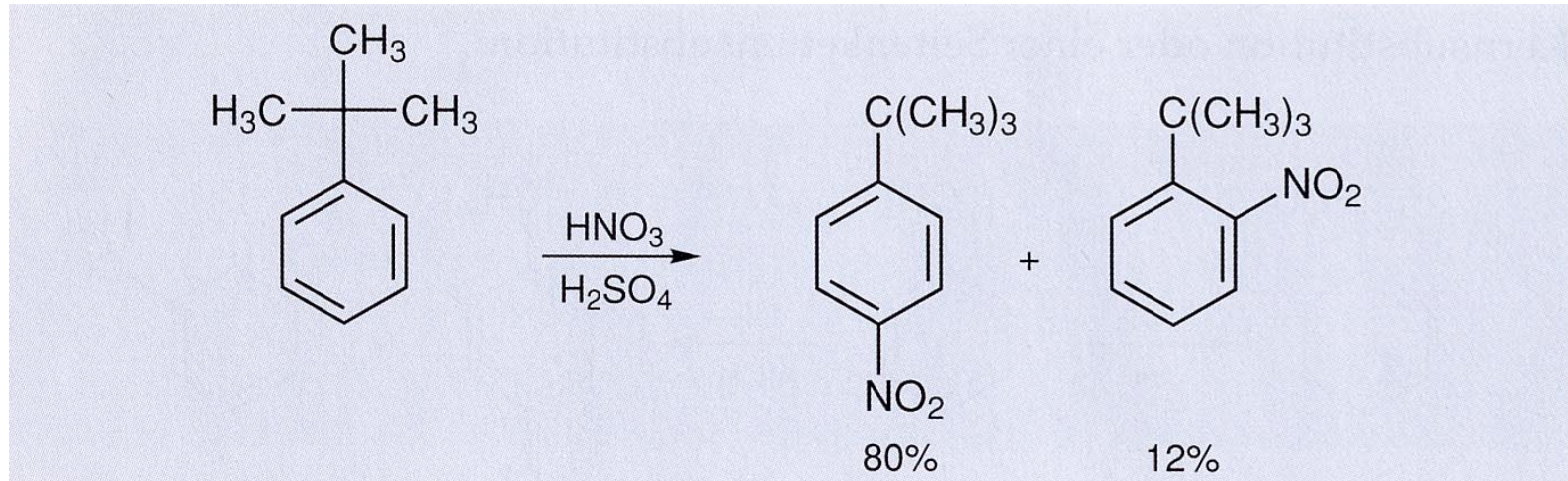
S_E an mehrfach substituierten aromatischen Verbindungen:



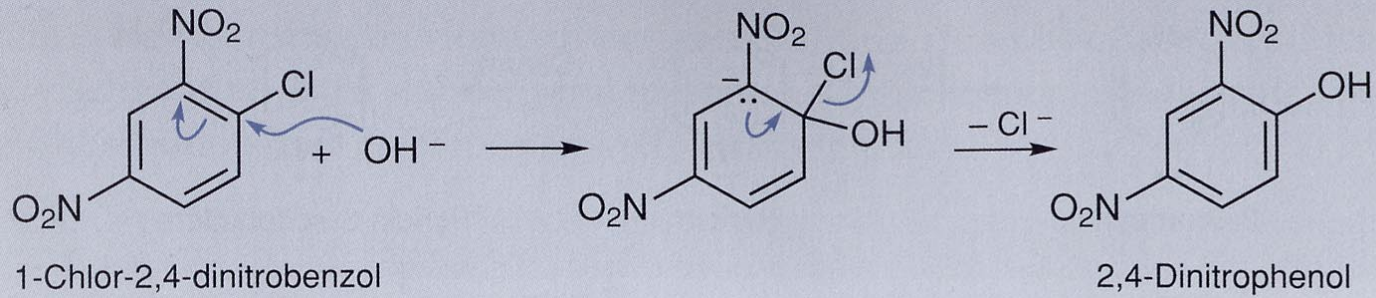
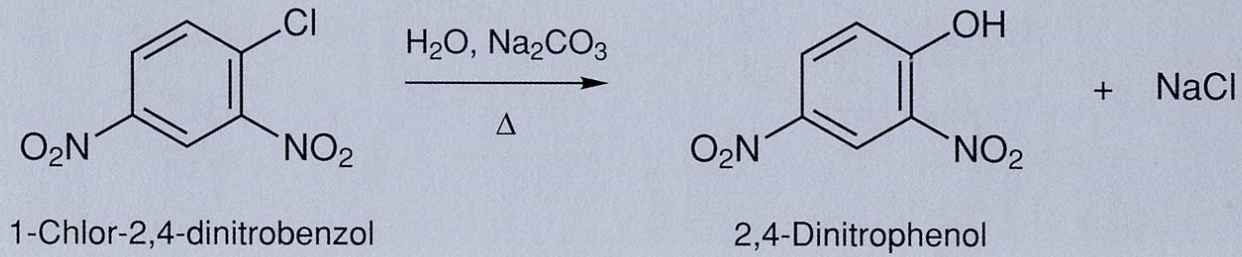
Verhältnis zwischen *ortho*- und *para*- Substitution



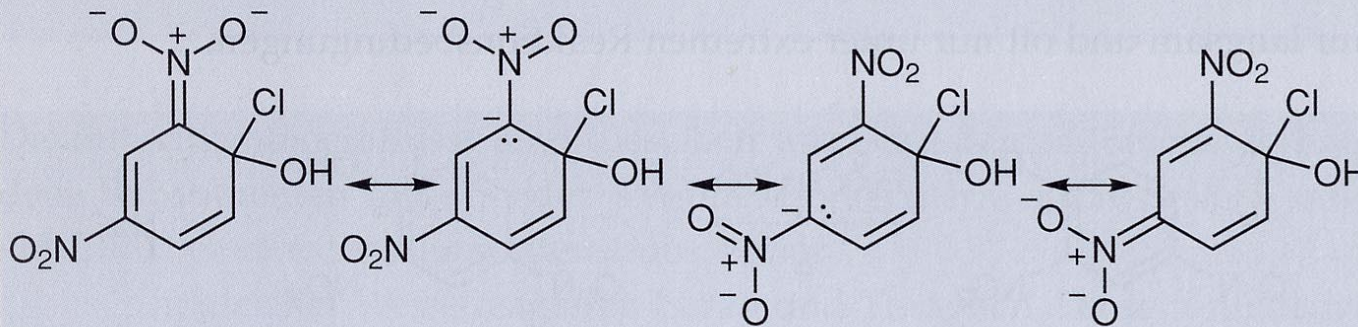
bei sterisch anspruchsvoller Substituenten:

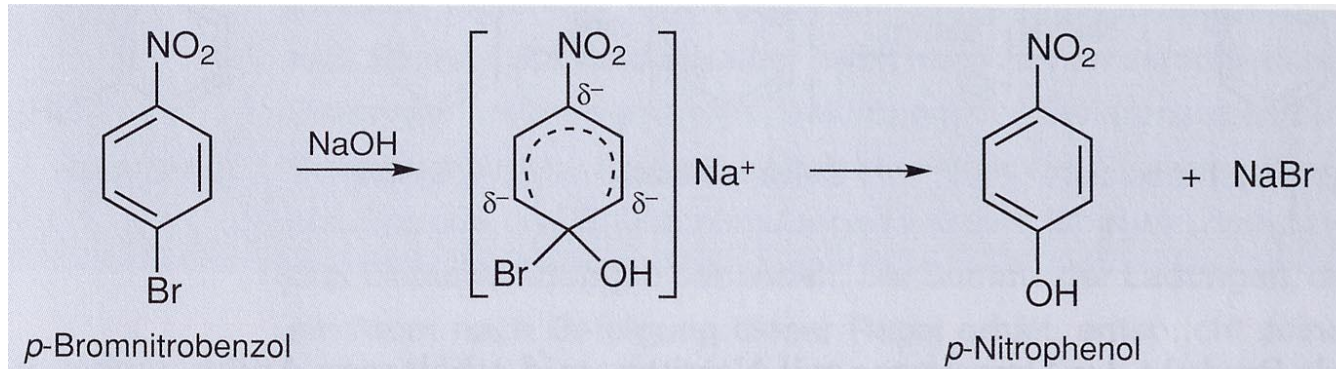


4.7 Die nucleophile aromatische Substitution



Wichtig:





wenn Substituent keinen -M-Effekt aufweist, kann die Substitution über ein Arin verlaufen;

erster Schritt:

