Course 343 | Lecturer Hackenberger
Day Wed | Date 9/18/2013
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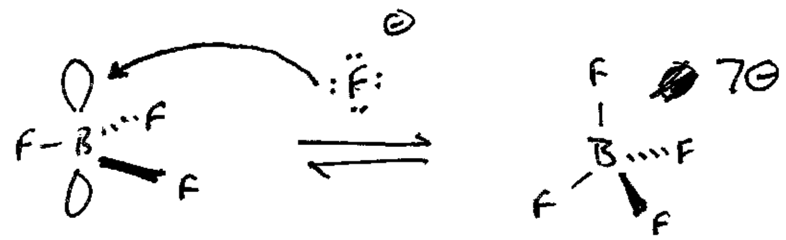
Last day: - functional groups + nomenclature
- introduction into acid/base chemistry (Arrhenius, Bronsted, Lewis)

· Recall:



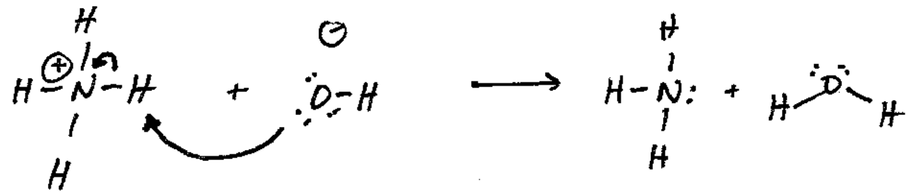
e^- pushing

· Brønsted - Lowry - acid/base chemistry

$$NH_4^{\oplus} + :\ddot{O}^{\ominus}-H \rightleftharpoons :NH_3 + H_2\ddot{O}:$$

Br. acid — Br. base — conj. base — conj. acid

e^- pushing diagram:



<u>General features:</u>

1) Convert acid/base pair to a <u>different</u> acid/base pair (i.e. conj. acid/base)

2) A Bronsted base is always a Lewis base
A Bronsted acid is always a Lewis acid, but not all Lewis acids are B/L acids

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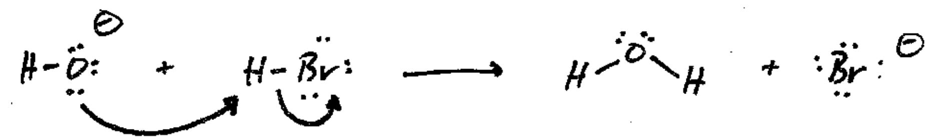
· Relationship between different mechanistic themes

Proton transfer vs. nucleophilic displacement (p 377)

ex:



compare to:

bromomethane

- $^{\ominus}$OH attacks C instead of H
- C gives up one bond (C-Br) in favor of new bond (C-O)

Terminology

Nucleophilic displacement	Proton Transfer
$H-\ddot{O}:^{\ominus}$ → nucleophile (nucleus-loving) e^- rich	Brønsted base → $:\ddot{O}-H^{\ominus}$
H_3C-Br → electrophile (electron-loving) e^- poor	Brønsted acid → H-Br
$Br^{\ominus}$ leaving group	Conjugate base → $Br^{\ominus}$

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Equilibria and pKa values: Strength of Brønsted acids

$$H\text{-}A + H_2O \rightleftharpoons A:^{\ominus} + H_3O^{\oplus}$$

generic acid

$$K_{eq} = \frac{[A^-][H_3O^+]}{[HA][H_2O]}$$

acidity constant (K_a) $K_a = K_{eq}[H_2O] = \dfrac{[A^-][H_3O^+]}{[HA]}$

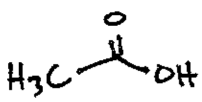
for convenience, use log values: $pK_a = -\log[K_a]$

Table 3A: database of important acids

The stronger the acid, the lower the pKa, and the higher the K_a

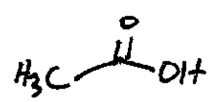
H_2O: pKa 16

Alcohol: pKa ~16

 : pKa 5

Mineral acids: HCl, pKa −6

HCl is ~10^{11} times more acidic than



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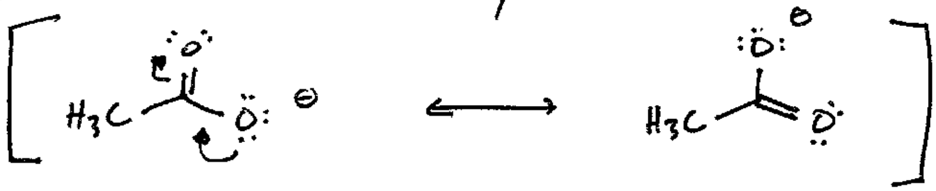
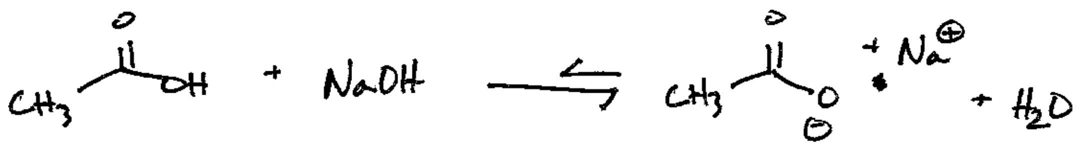
- Why is a carboxylic acid more acidic than H_2O/alcohol?
  - conjugate base is stabilized by resonance



- Knowing characteristic pKa values allows you to predict positions of acid/base equilibria

eg: 

pKa 5 16

equilibria favors weak acid/weak base pairs