Course Ch 343 Sec 003 Lecturer Sam Gellman

Day Monday 1:20 Date 9/19/11

Notes Taken By Alicia Phelps Total # of Pages 4

Submit a *Single-sided Copy* to the Office
DO NOT STAPLE

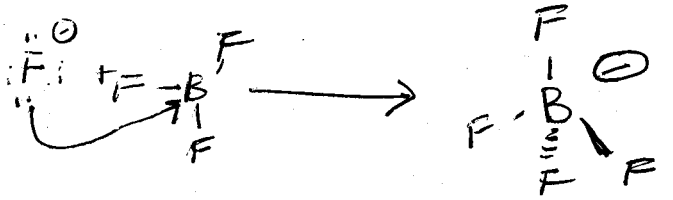
Recall: Lewis Acid-Base Rxns

- Curved arrows to indicate e⊖ flow (mechanism)

EX:

$BF_3 + :\ddot{F}:^{\ominus} \rightleftharpoons BF_4^{\ominus}$

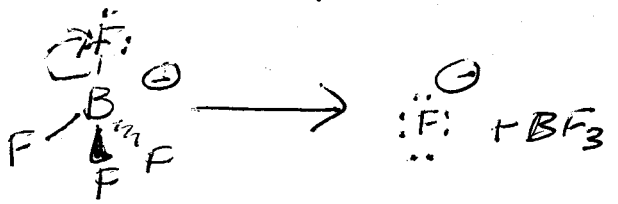
L.A. + L.B. "Adduct"



Lone pair ---⇒ bond

* Curved arrows start at source of e⊖!

Reverse reaction:



Curved arrows in proton transfer (Brønsted-Lowry acid-base theory)

EX:

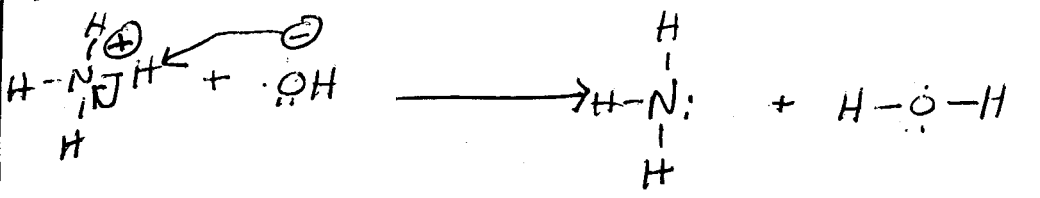
$NH_4^{\oplus} + :\ddot{O}H^{\ominus} \longrightarrow \ddot{N}H_3 + H_2O$

ammonium hydroxide ammonia water

↓ ↓

Brønsted acid Brønsted base

"Mechanism"



("e⊖ pair displacement")
- indicates interchange of lone prs + bonds

Course CH342 Sec 003 Lecturer Sam Gellman

Day Monday 1:20 Date 9/19/11

Notes Taken By Alicia Phelps Total # of Pages 4

Submit a *Single-sided Copy* to the Office
DO NOT STAPLE

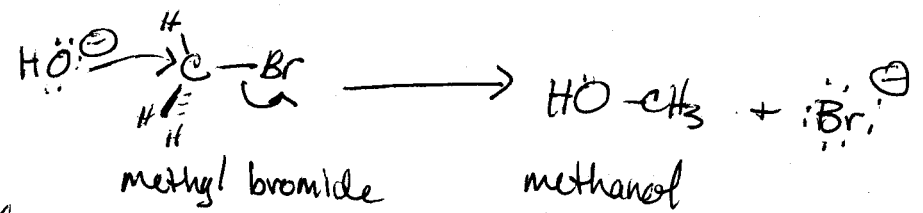
Note:

1) BL. mech. converts 1 A-B pair to another acid-base pair (conjugates)
(Contrast to L.A. example)

2) A Bronsted base is always a lewis base, a Bronsted acid ($H^{\oplus}$) is always a Lewis acid, BUT a lewis acid is not necessarily a Bronsted acid. (BF_3)

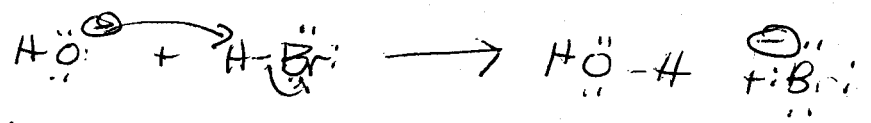
Compare BL mechanism to mech. for "nucleophilic displacement"

EX:



methyl bromide methanol

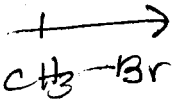
Compare:



Terminology:

1) In context of nucleophilic displacement, $^{\ominus}OH$ is the "nucleophile": "nucleus-loving" ≈ $e^{\ominus}$ rich

2) CH_3Br is the "electrophile" → "electron loving" ≈ $e^{\ominus}$ poor



3. $^{\ominus}Br$ is the "leaving group"

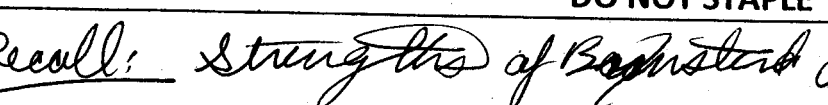
Course CH 343 Sec 003 Lecturer Sam Gellman

Day Monday 1:20 Date 9/19/11

Notes Taken By Alicia Phelps Total # of Pages 4

Submit a *Single-sided Copy* to the Office
DO NOT STAPLE

Recall: Strengths of Bronsted acids (pKa scale)



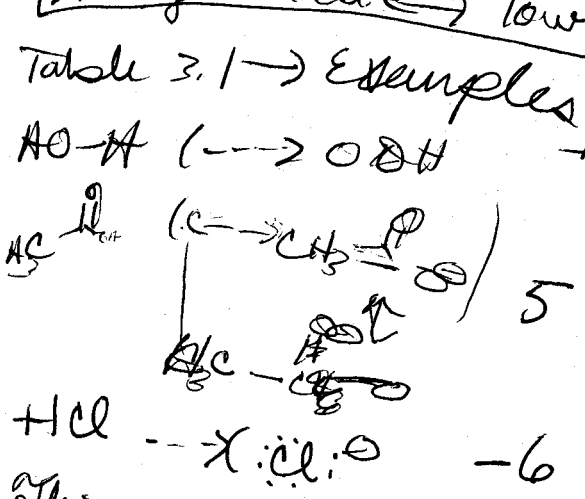
$$K_{eq} = \frac{[A^-][H_3O^+]}{[H_2O][A-H]}$$

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

$$pK_a = -\log K_a$$

Stronger acid $\Leftrightarrow$ lower pK_a

Table 3.1 → Examples



Things you can do when you know pKa values

1) Predict which acid-base pair will be favored

Ex

Weaker acid/base pair is favored

2) Predict relative reactivity

$^{\ominus}OH$ is a stronger base than $CH_3-\ddot{C}(=O)-O^{\ominus}$ because ... →

Course CH 343 Sec 003 Lecturer Sam Hellman

Day Monday 1:20 Date 9/19/11

Notes Taken By Alicia Phelps Total # of Pages 4

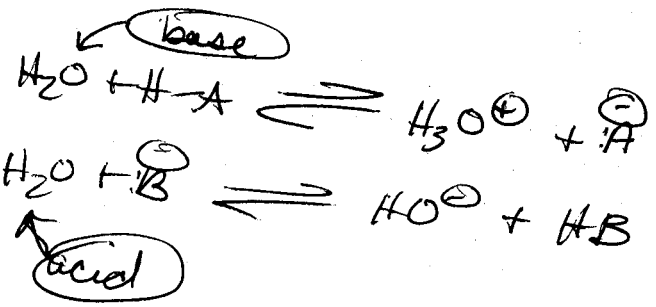
Submit a *Single-sided Copy* to the Office
DO NOT STAPLE

... H_2O is a weaker acid than H_3C-C(=O)-OH

- Reactivity of base reasoned from pKa of conjugate acid.

Note: Be careful with amphoteric acids (multiple $H^{\oplus}$ donation possibilities)

Ex: Water...



But,

H-OH pKa = 16

$H-OH_2^{\oplus}$ pKa = -2

Relationships between molecular structure & acidity (pKa)

1) Periodic table

a) Other things being comparable, pKa decreases left-to-right along a row

Consider:

H_3C-H	H_2N-H	H-O-H	F-H
~55	~35	16	3

Rationale: Electronegativity C<N<O<F