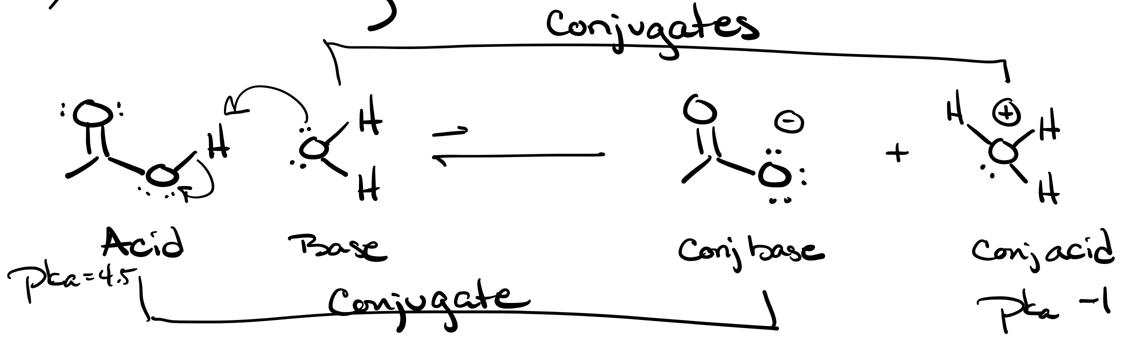
Acid - Base

Brønsted - Lowry



Acid = proton donar

Base = proton acceptor

At equilibrium the weaker acid & weaker base are the major species in solution.

Strong Acid ⟶ Conj. Base of Strong Acid = Weak Base

↑ Increasing strength of Acid

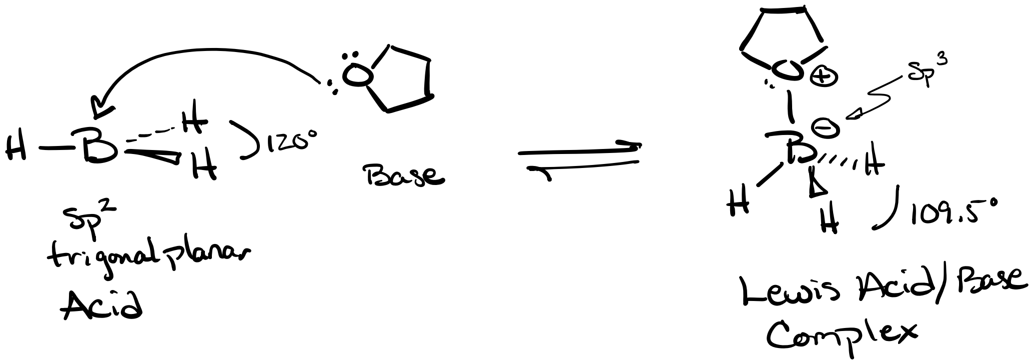
↓ Increasing strength of base

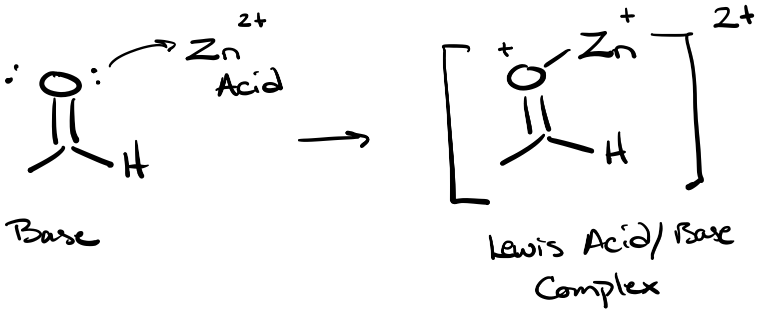
weak Acid ⟶ Conj Base of weak acid = Strong Base

Lewis Acid-Base (focus on e^-)

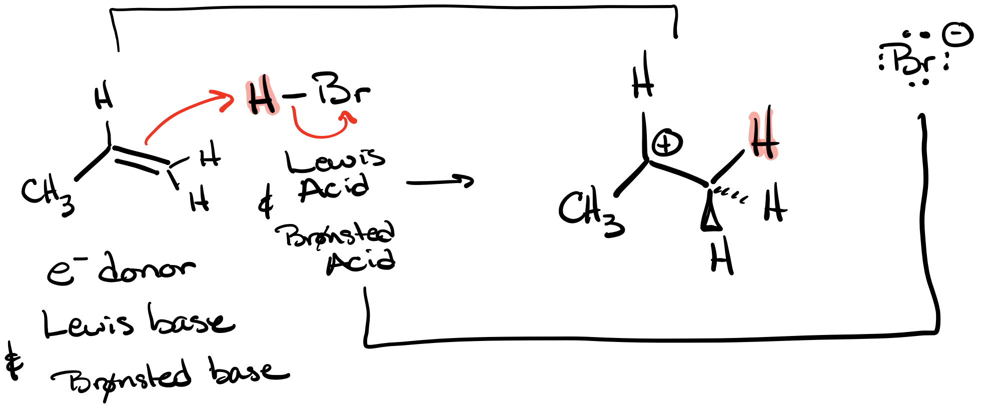
Lewis Acid - e^- acceptor

Lewis Base - e^- donor



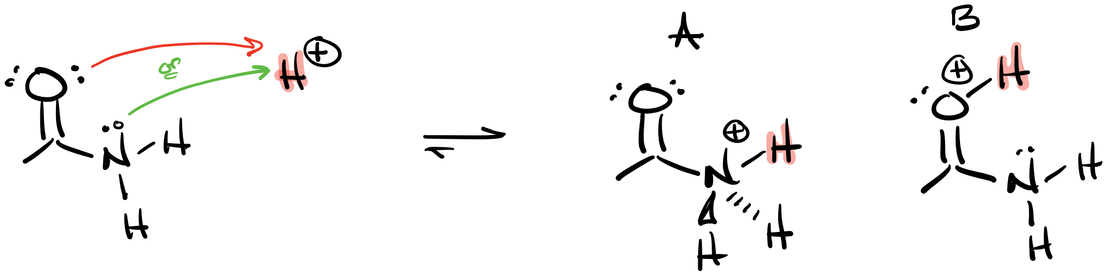


Compounds w/ π-bonds can also be Lewis base



$$A + B \longrightarrow C + D$$

+ = "And"



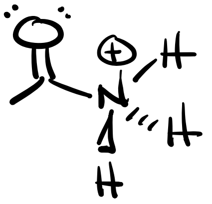
which lone pair is more basic?

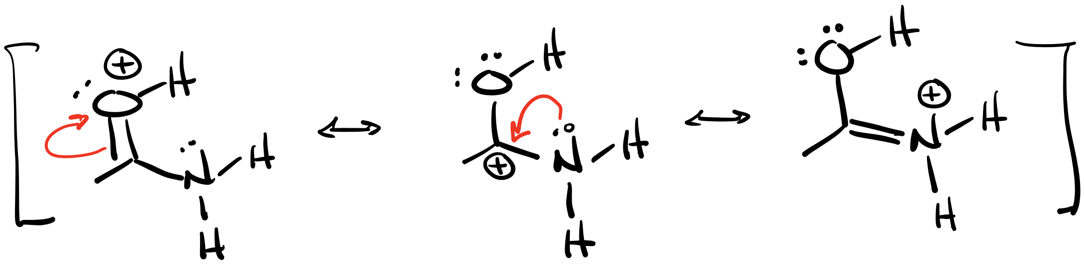
which location is more likely to be protonated?

we can ask which product is more stable?
(which is lower in energy?)

more stable = less reactive = weaker Acid or weaker Base } As appropriate

How do we assess relative stability?
⟹ Resonance for one, there are other factors that we will see later.

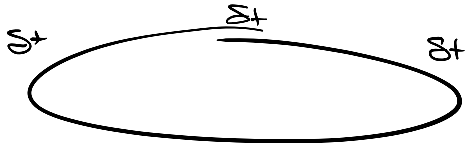
A)  ⟷ no resonance that moves the + charge

B) 

A structure with more resonance contributors, *that are good resonance contributors, is more stable than one with less. The is due to the delocalization of Charge.

Small "Hard" Ion

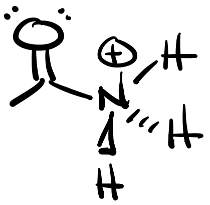
Very High in energy



delocalized Charge is much more stable = lower energy

"Soft"

A)

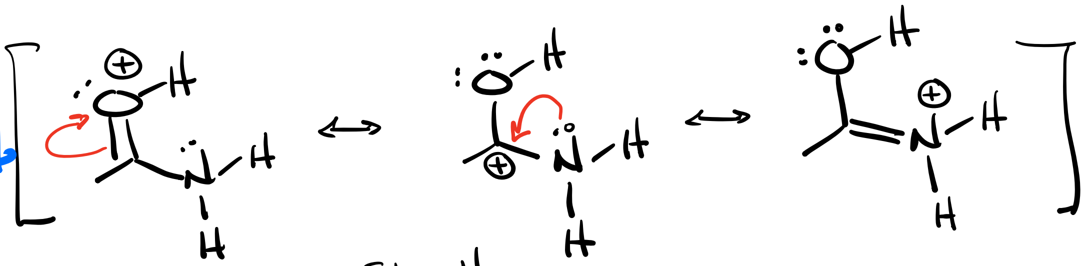


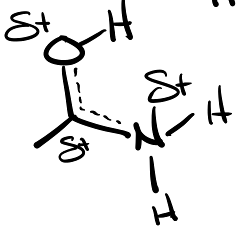
+ charge is localized

Small & Hard = High energy

Strong Conj. Acid

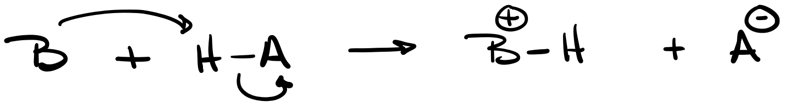
B)





+ is delocalized and is more stable than in Structure A

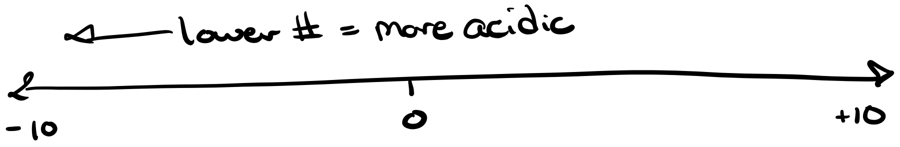
Weaker Conj Acid ⇒ more likely to be protonated



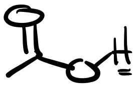
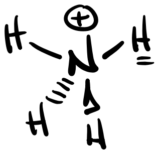
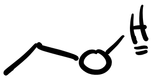
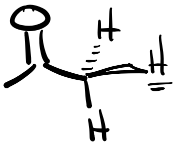
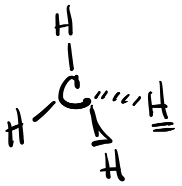
$$B + H{-}A \rightarrow B^{\oplus}{-}H + A^{\ominus}$$

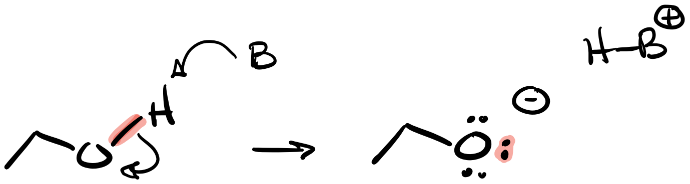
$$K_a = \frac{[B^{\oplus}{-}H][A^{\ominus}]}{[B][H{-}A]}$$

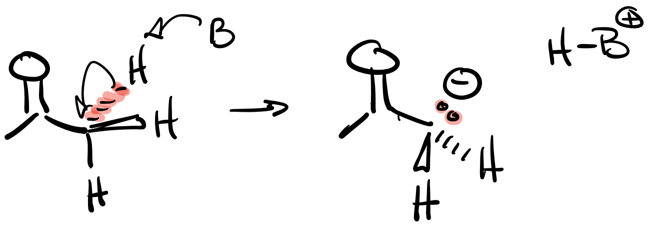
$$pK_a = -\log K_a$$



	pka	
HF	3.1	
HCl	-3.9	
HBr	-5.8	
⇒ HI	-10.4	most acidic

	pka
H_3O^+	-1.7
	4.7
	9.3
	15.2
	19
	60





B = Base

How Structure affects Acidity & Basesicity

① strength of the bond w/ proton

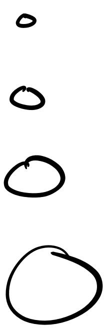
② Electronegativity of atoms envolved

③ Resulting delocalization that has many factors

Contributing Factors

why is HI most acidic?

		pka	
	HF	3.1	F^-
~6	HCl	-3.9	Cl^-
~2	HBr	-5.8	Br^-
~4	HI	-10.4	I^-



2~6 pka unit difference

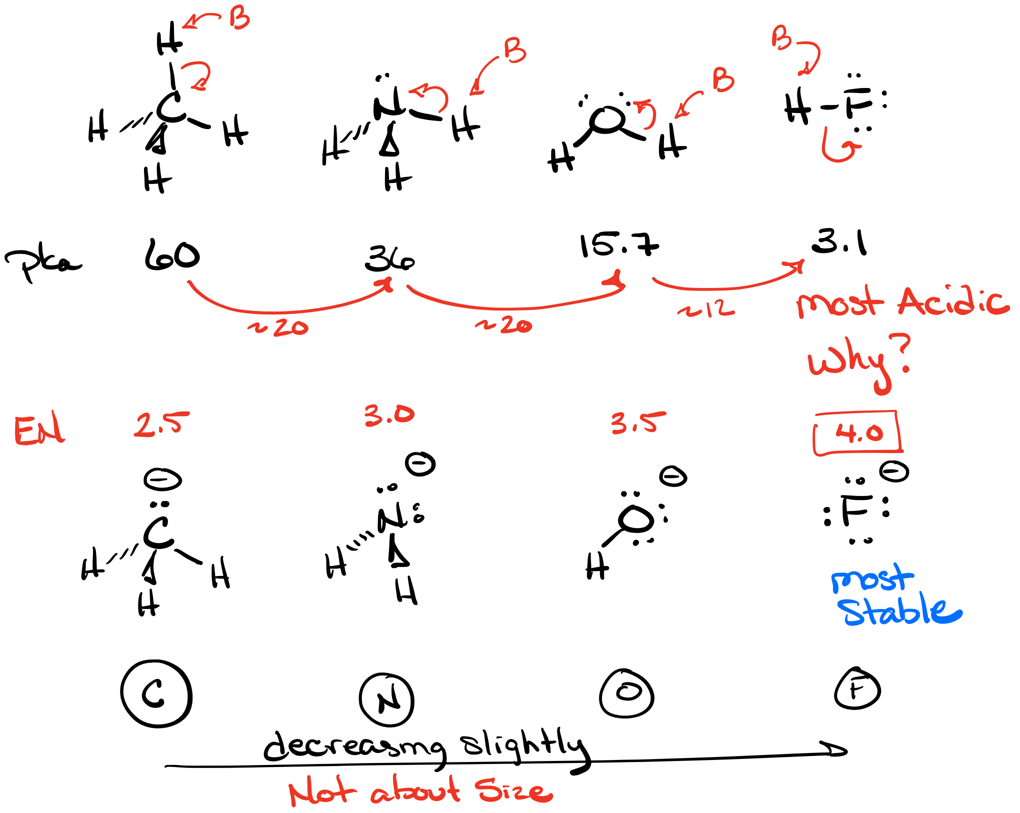
Size!

$F^{\ominus}$ is most EN
⇒ should be most stable with negative charge, but its not!

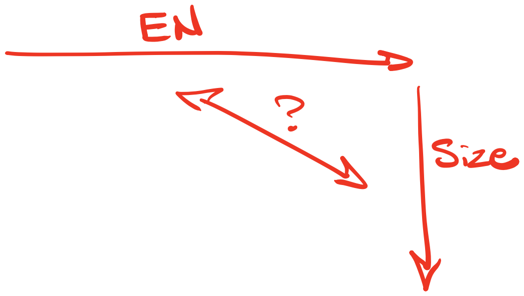
$I^{\ominus}$ is most stable!!

The more delocalized a charge, the more stable a charge becomes.

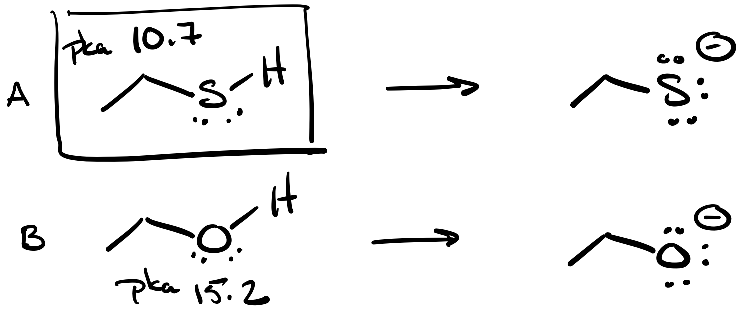
Size > EN ! when going down a Column in periodic Table

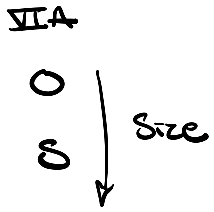


EN is a more important factor when going across the periodic table



which of these is more acidic?





Because Sulfur is larger than oxygen, the Sulfide ion is larger and more delocalized. The sulfide is thus more stable = less reactive = stronger Conj acid !

Factors

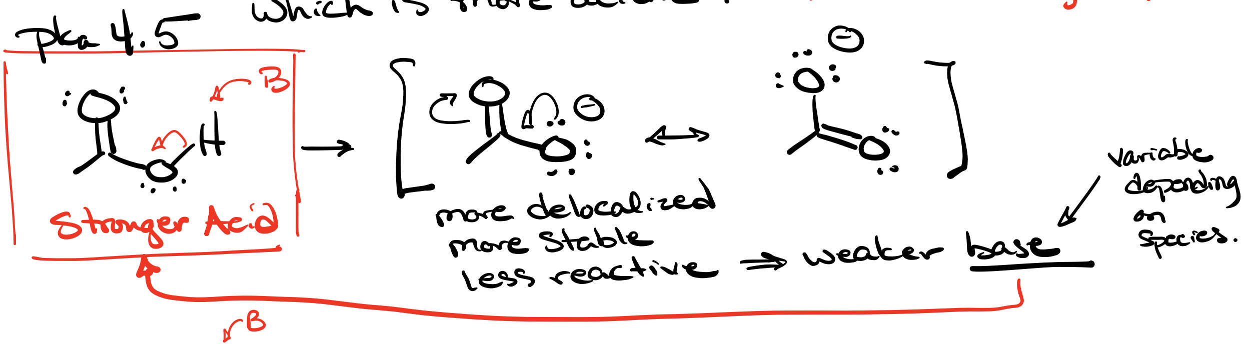
EN 12-20 pka units

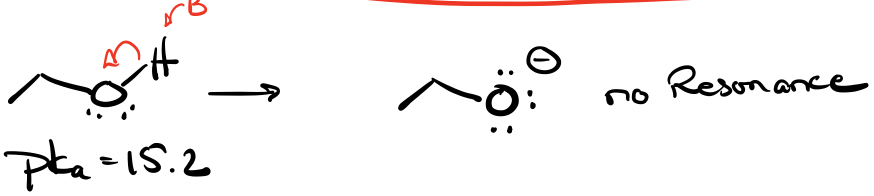
Size 2-6 pka units

Resonance ? ~10 pka units

Ranking Factors?

which is more acidic? ⇒ look at Charged Species





One more factor to look at

Induction - the pulling (or delocalization)
of e^- through EN differences