(23) **Today**

Chap 6 Acid-Base and Donor-Acceptor Chemistry

Next Class

Test 2
Chap 4 Symmetry
Chap 5 Molecular Orbital Theory

(24) **Second Class from Today**

Chap 6 Acid-Base and Donor-Acceptor Chemistry

Third Class from Today (25)

Chap 9.1 Introduction to Coordination Chemistry amphoteric - can act as base or acid

What's the strongest Brønsted-Lowry acid that can exist in aqueous solution?

$$HCl_{(g)} + H_2O_{(l)} \rightarrow H_3O^{+}_{(aq)} + Cl^{-}_{(aq)}$$

$$HI_{(g)} + H_2O_{(l)} \rightarrow H_3O^{+}_{(aq)} + I^{-}_{(aq)}$$

What's the strongest Brønsted-Lowry base that can exist in aqueous solution?

$$\text{"base:"} + H_2O_{(l)} \rightarrow \text{"base"}:H^{+} + OH^{-}_{(aq)}$$

What's the strongest Brønsted-Lowry acid that can exist in a given solution?

The protonated solvent

You must pick your solvents carefully when working with strong acids because the solvent puts a ceiling on the strongest acid that can exist in that solution.

What's the strongest Brønsted-Lowry base that can exist in a given solution?

the deprotonated solvent

You must pick your solvents carefully when working with strong bases because the solvent puts a ceiling on the strongest base that can exist in that solution.

across a period

$LiH \quad BeH_2 \quad BH_3 \quad CH_4 \quad NH_3 \quad H_2O \quad HF$

HF ← hydrofluoric acid
weak but dangerous acid

$$H_2O + H_2O \rightleftharpoons H_3O^{\oplus} + OH^{\ominus}$$

acid strength increases from left to right

$LiH \not\rightarrow Li^{\ominus} + H^{\oplus}$ +3 nucleus

$H_2O \rightarrow HO^{\ominus} + H^{\oplus}$ +8 nucleus

$HF \rightarrow F^{\ominus} + H^{\oplus}$ +9 nucleus

increasing nuclear charge is stabilizing the e^-'s that are left when the H^+ is abstracted away

the more stable we can make this neg charge the stronger this acid will be down a family

	HF	HCl	HBr	HI
K_a	10^{-4}	10^{6}	10^{9}	10^{11}

acid strength increases as we go down a family

increase Z_{eff}

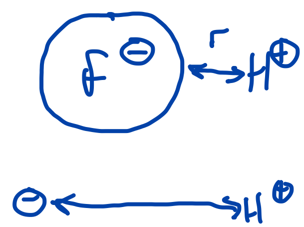
increased volume

CH_3OH CH_3SH

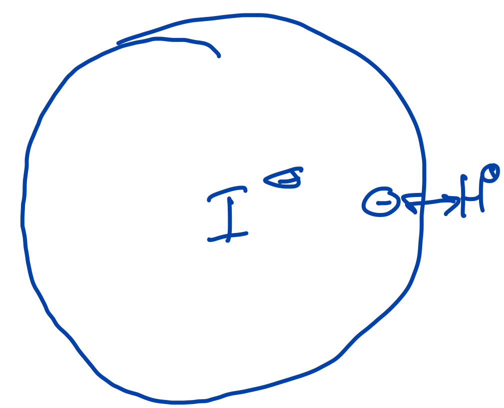
H_2O vs H_2S

↑ stronger acid

Z_{eff} is larger + e^-'s density is more diffuse



H^+ is on average closer to the e^- in $F^\ominus$



On average, H+ is farther from the (-) charge on I-

$e^\ominus$ ⟷ $H^\oplus$

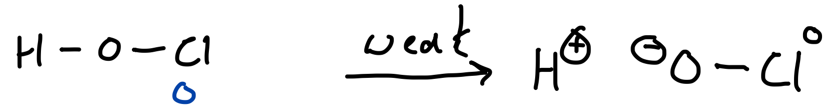
H^+ is more easily attracted to concentrated charge

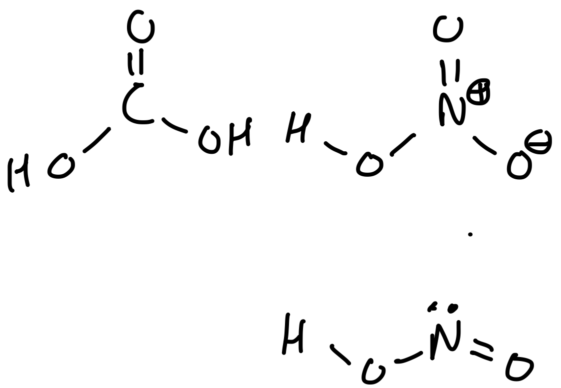
Trends in Acid Strength

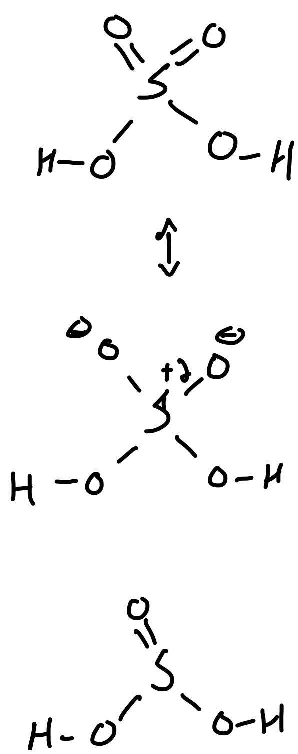
for "oxy-acids"

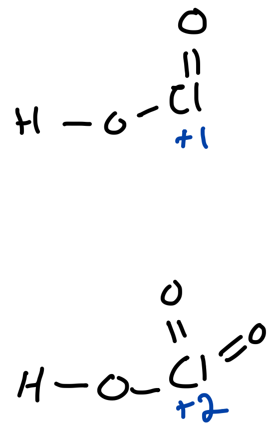
$Na^{\oplus}\ {}^{\ominus}OCl$

H_2CO_3 HNO_3, H_2SO_4, $HClO_3$



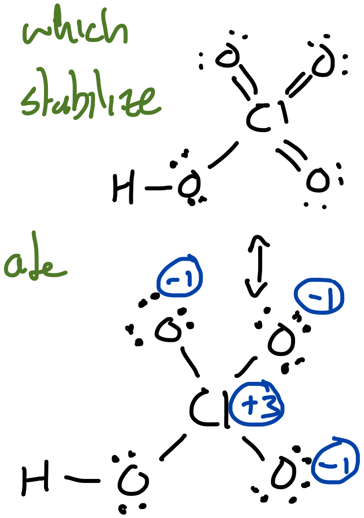


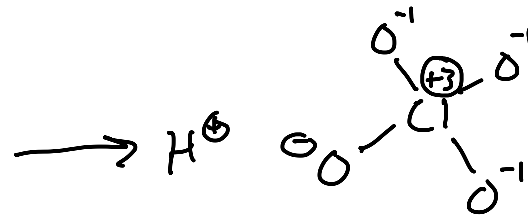




neg O next to neutral Cl ... no help stabilizing ⊖

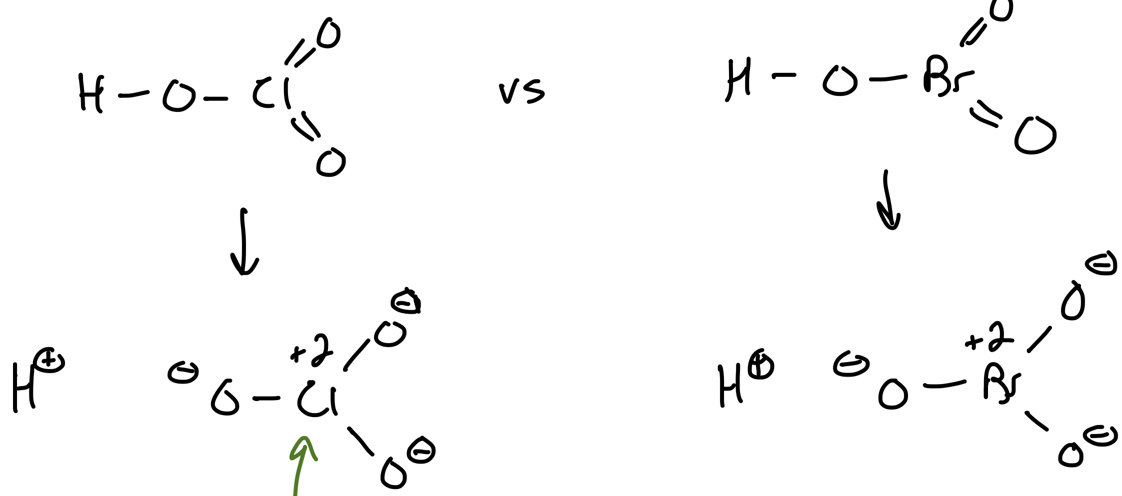
adding more O atoms increases ⊕ charge on central atom which helps stabilize the conjugate base





neg O next to a 3+ Cl which helps stabilize ⊖ on O for "oxy-acids"

stronger vs weaker



charges are the same on the central atom, but the more electronegative atom is able to stabilize the ⊖ more effectively

H − Cl

H − Br

stronger

Br^{-} more stable