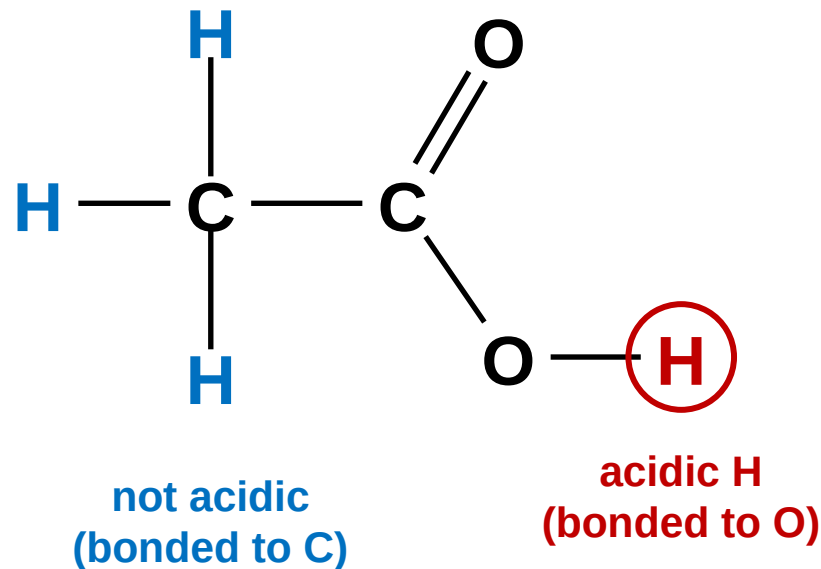


Essential Question

How does structure make an acid strong or weak?

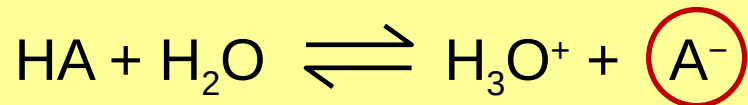
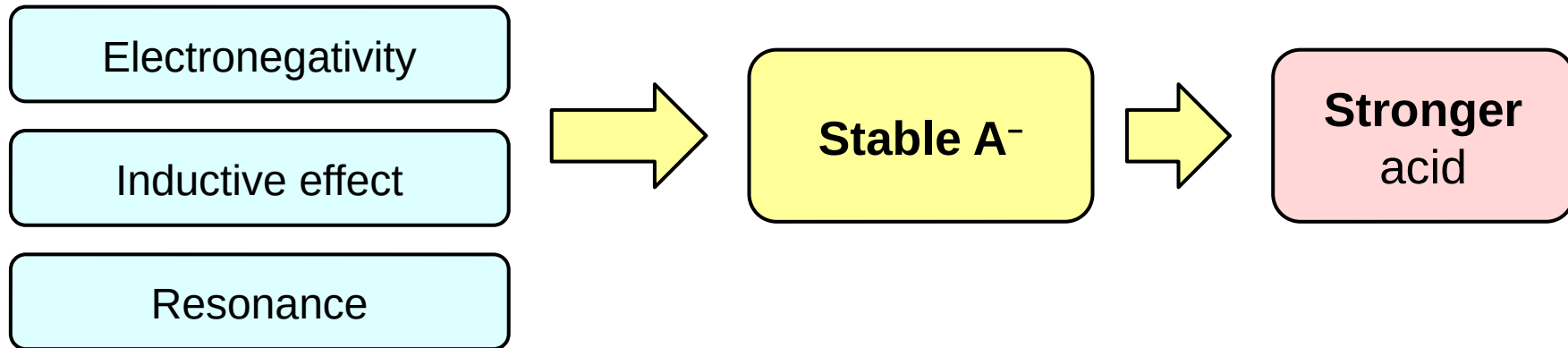
Which H Is Acidic?

- Acidic H is usually on O
- O-H bond is very polar
- H on carbon is not acidic



Stable Conjugate Base, Stronger Acid

- Acid strength depends on A^-
- More stable $A^- \rightarrow$ stronger acid



Electronegativity

- More electronegative X pulls e^-
- This stabilizes the OX^- ion
- Lower pK_a = stronger acid

Acid	EN of X	pK_a
$H - O - \overset{\text{red arrow}}{\text{Cl}}$	3.16	7.53
$H - O - \overset{\text{red arrow}}{\text{Br}}$	2.96	8.63
$H - O - \overset{\text{red arrow}}{\text{I}}$	2.66	10.64

Higher EN $\rightarrow$ lower $pK_a \rightarrow$ stronger acid

More Oxygen Atoms, Stronger Acid

- Extra O atoms pull e^- away from O-H
- Charge spreads over more O atoms



1 O

$pK_a = 7.53$



2 O

$pK_a = 1.96$



3 O

strong



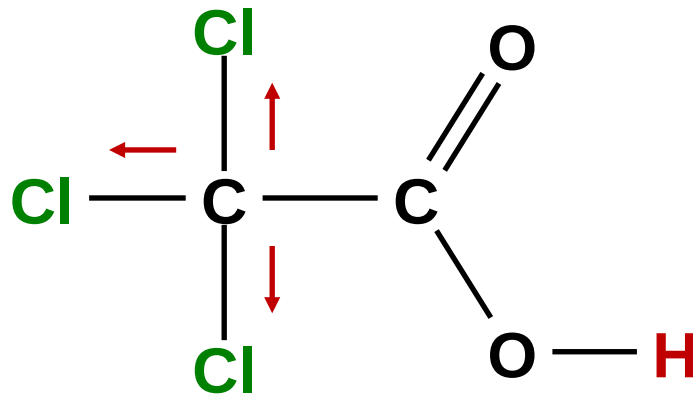
4 O

very strong

More O atoms → stronger acid

Inductive Effect

- Cl pulls e^- through bonds
- Pull spreads out the A^- charge
- More Cl atoms $\rightarrow$ stronger acid



acetic acid



$$pK_a = 4.74$$

chloroacetic acid



$$pK_a = 2.87$$

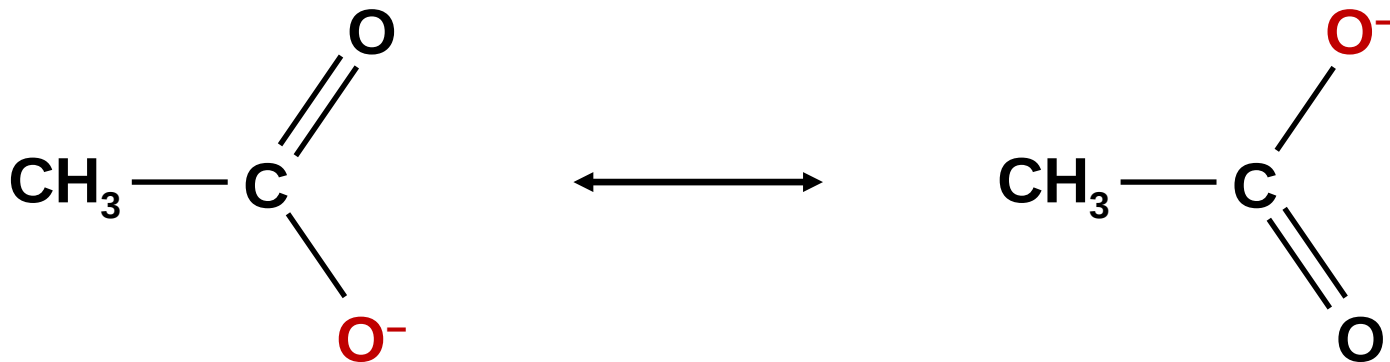
trichloroacetic acid



$$pK_a = 0.66$$

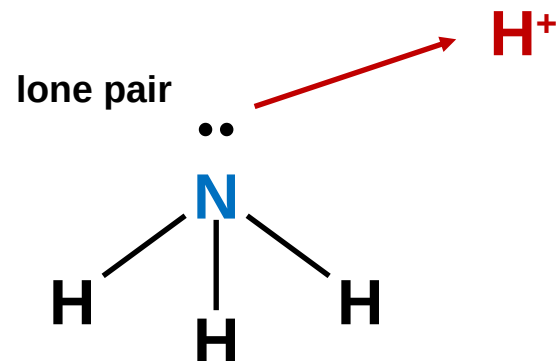
Resonance

- Acetate's charge spreads over two O atoms
- Spread-out charge = more stable A^-
- This is why carboxylic acids are acidic

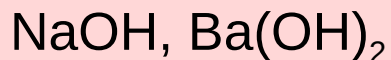


Strong and Weak Bases

- A base uses a lone pair to grab H^+
- Strong: group 1 and 2 hydroxides



Strong base



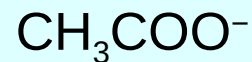
100% $\rightarrow \text{OH}^-$

Weak base



N lone pair takes H^+

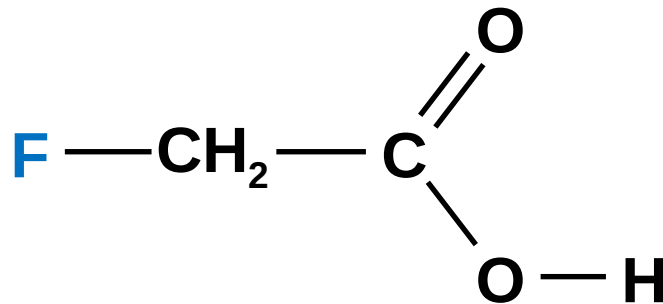
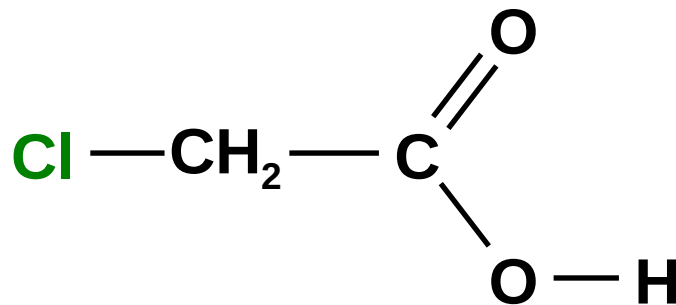
Weak base



carboxylate ion

Example: Fluoro vs. Chloro

Which is the stronger acid, fluoroacetic acid (FCH_2COOH) or chloroacetic acid (ClCH_2COOH)? Justify your answer.



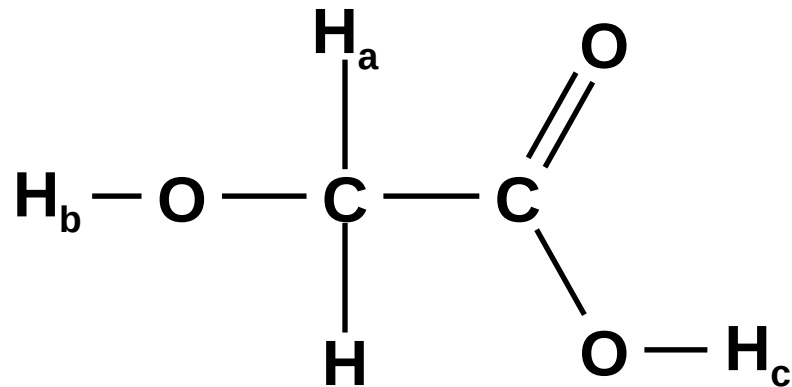
Example: Ranking Oxyacids

Rank HBrO_3 , HOI , and HIO_3 from weakest to strongest acid. Justify your ranking.



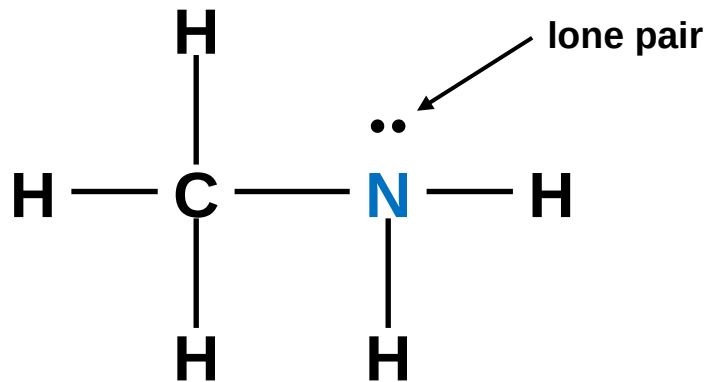
Example: Find the Acidic H

Glycolic acid is shown. Which labeled hydrogen, a, b, or c, is the most acidic? Justify your answer.



Example: Methylamine as a Base

Explain why methylamine, CH_3NH_2 , is a base.



Big Ideas

- Stable A^- $\rightarrow$ stronger acid
- Pull or spread charge: stable A^-
- Bases: lone pair on N or O^-

Electronegativity

Inductive effect

Resonance



**Stable A^-
= stronger acid**