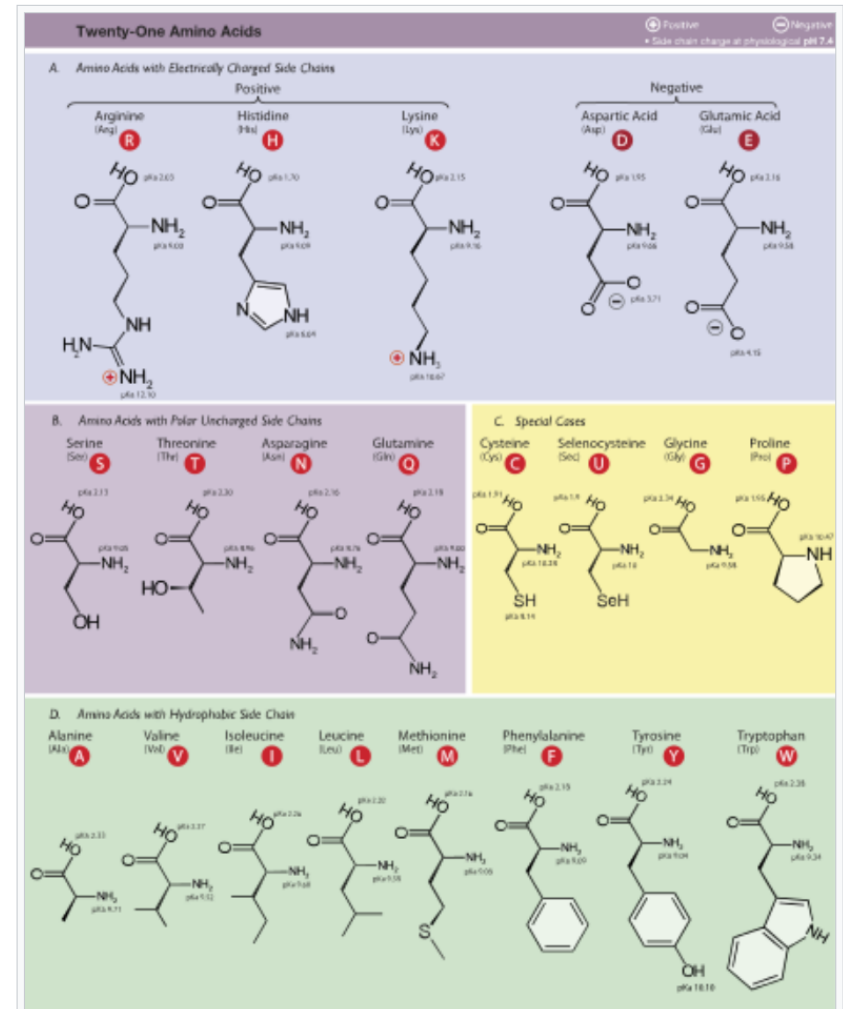


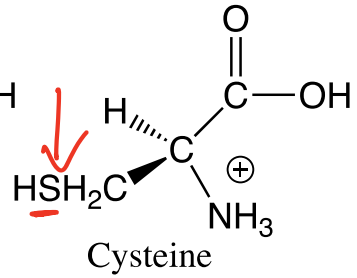
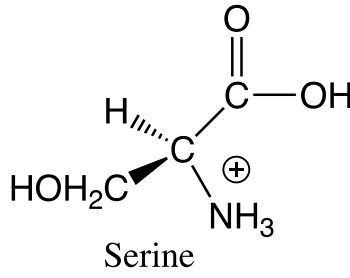
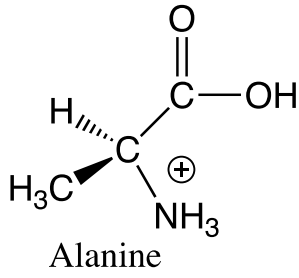
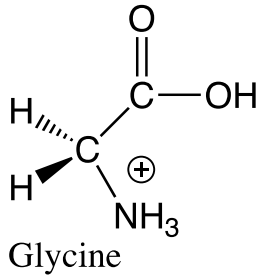
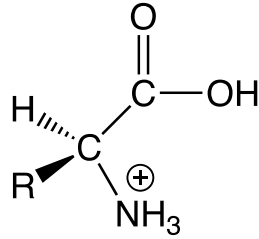
General structure [\[edit \]](#)

In the structure shown at the top of the page, **R** represents a [side chain](#) specific to each amino acid. The [carbon](#) atom next to the [carboxyl group](#) (which is therefore numbered 2 in the [carbon chain](#) starting from that functional group) is called the α -carbon. Amino acids containing an [amino group](#) bonded directly to the alpha carbon are referred to as *alpha amino acids*.^[34] These include amino acids such as [proline](#) which contain [secondary amines](#), which used to be often referred to as "imino acids".^{[35][36][37]}

Isomerism [\[edit \]](#)

The alpha amino acids are the most common form found in nature, but only when occurring in the L-isomer. The alpha carbon is a [chiral](#) carbon atom, with the exception of [glycine](#) which has two indistinguishable hydrogen atoms on the alpha carbon.^[38] Therefore, all alpha amino acids but [glycine](#) can exist in either of two [enantiomers](#), called L or D amino acids, which are mirror images of each other (*see also* [Chirality](#)). While L-amino acids represent all of the amino acids found in [proteins](#) during translation in the ribosome, D-amino acids are found in some proteins produced by enzyme [posttranslational modifications](#) after [translation](#) and [translocation](#) to the [endoplasmic reticulum](#), as in exotic sea-dwelling organisms such as [cone snails](#).^[39] They are also abundant components of the [peptidoglycan cell walls](#) of bacteria,^[40] and D-serine may act as a [neurotransmitter](#) in the brain.^[41] D-amino acids are used in [racemic crystallography](#) to create centrosymmetric crystals, which (depending on the protein) may allow for easier and more robust protein structure determination.^[42]





X

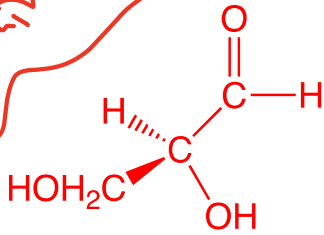
S

S

R

IUPAC

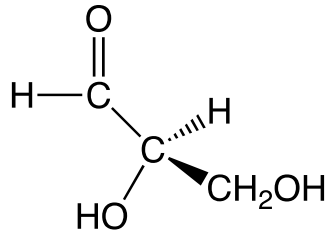
Can be used to synthesize all 19 chiral amino acids



(L)-(-)-Glyceraldehyde

Levorotatory

Another word for "-"
Rotates the plane of plane polarized light counter-clockwise



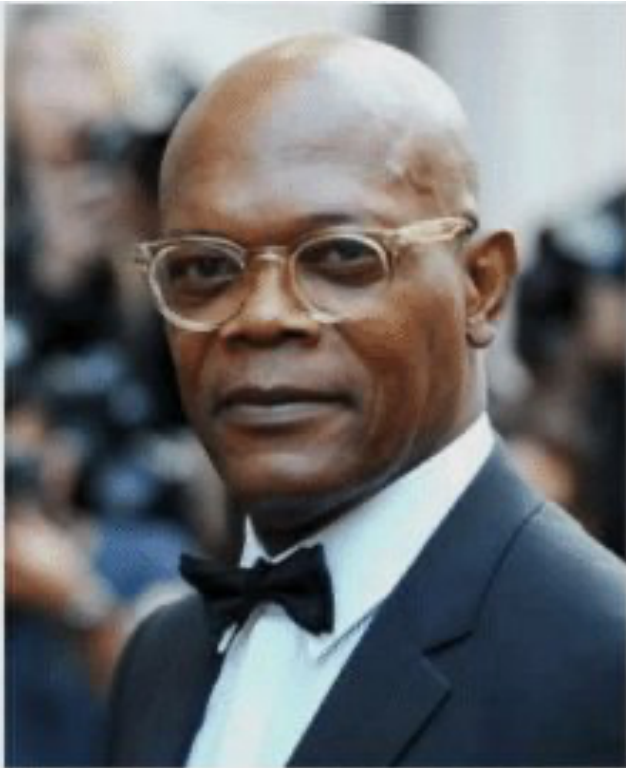
(D)-(+)-Glyceraldehyde

Dextrorotatory

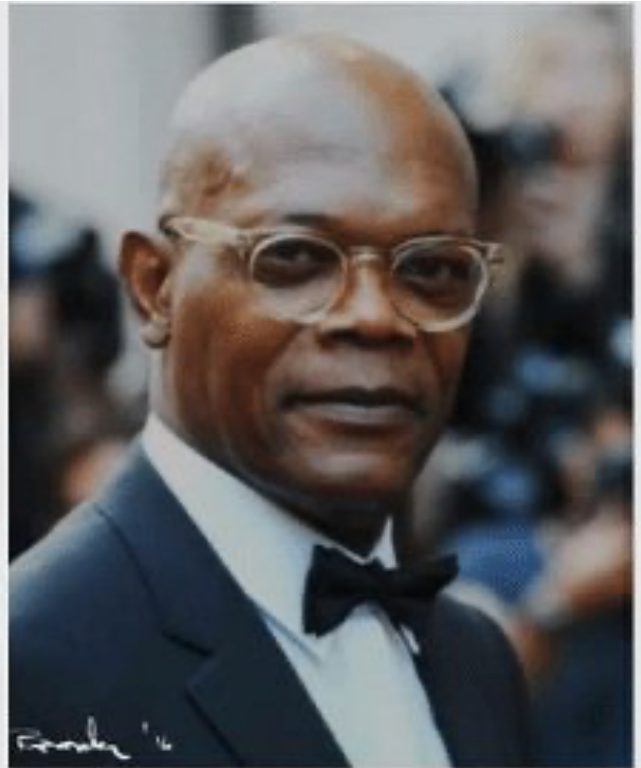
Another word for "+"
Rotates the plane of plane polarized light clockwise

The 19 chiral common amino acids are all "L" amino acids (even cysteine!)

The "L" designation of amino acids is based on the structural relationship to (L)-(-)-glyceraldehyde

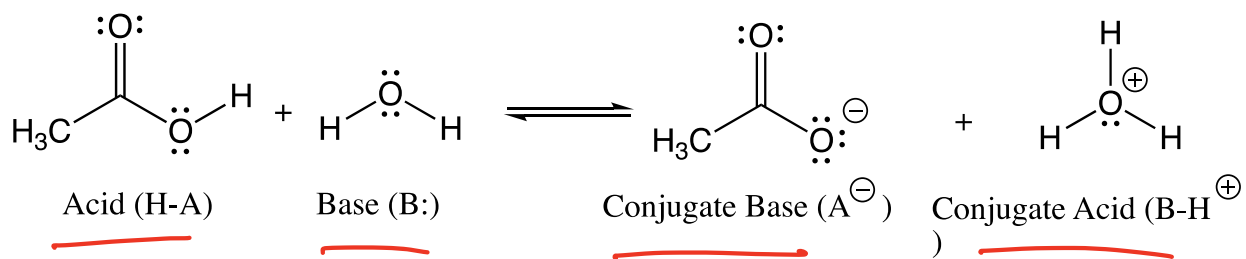


Samuel-L-Jackson



Samuel-D-Jackson

I hope this goes chiral



At equilibrium: $K_{\text{equilibrium}} = \frac{[\text{Products}]}{[\text{Reactants}]} = \frac{[\text{CH}_3\text{CO}_2^\ominus][\text{H}_3\text{O}^\oplus]}{[\text{CH}_3\text{CO}_2\text{H}][\text{H}_2\text{O}]}$

Equilibrium Constant \uparrow

Assume: $[\text{H}_2\text{O}] = 55 \text{ M}$ and does not change

Acid Constant \rightarrow

$$K_a = K_{\text{equilibrium}} [\text{H}_2\text{O}] = K_{\text{equilibrium}} [55 \text{ M}]$$

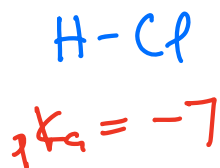
$$K_a = \frac{[\text{CH}_3\text{CO}_2^\ominus][\text{H}_3\text{O}^\oplus]}{[\text{CH}_3\text{CO}_2\text{H}]} \quad \underline{pK_a = -\log K_a}$$

A stronger acid has a lower value of pK_a

A weaker acid has a higher value of pK_a

General Rule

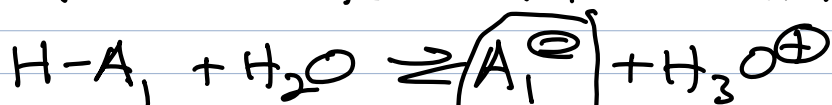
All acid-base reactions favor formation of the weaker acid



$pK_a = 15.7$
weaker acid

Favored at equilibrium

How to estimate relative acid strengths



How do you
predict anion
stability?

Compare the relative stabilities of the anions produced upon deprotonation → the more stable anion comes from the stronger acid

2 important principles for predicting anion stability

1) Negative charge (\ominus) is neutralized by nuclear \oplus charge.

2) Delocalizing negative charge (\ominus) over a larger area is better. → Golden Rule #5

Rules for anion stability -

The anion is more stable when the negative charge (\ominus) is:

a) On a more electronegative element (Principle 1)
→ Periodic Table (across a single row)

b) On a larger atom (Principle 2)
↓ Periodic Table (down a single column)

c) On an atom with more "s" character to its hybridization
($sp > sp^2 > sp^3$)
← anion stability
"s" orbitals are closer to the nucleus (Principle 1)

d) stabilized by resonance delocalization.
(Principle 2)

e) Stabilized by the inductive effect
(Principles 1 and 2)

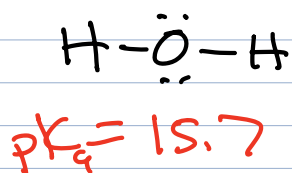
Operates through sigma bonds

nearby electronegative atoms attract \ominus charge and therefore spread the \ominus charge onto more atoms

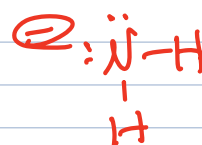
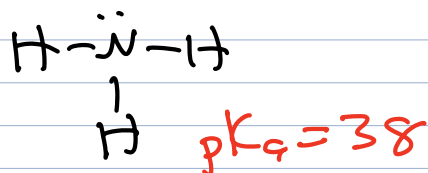
Examples

Rule a)

Ex.



more stable
anion

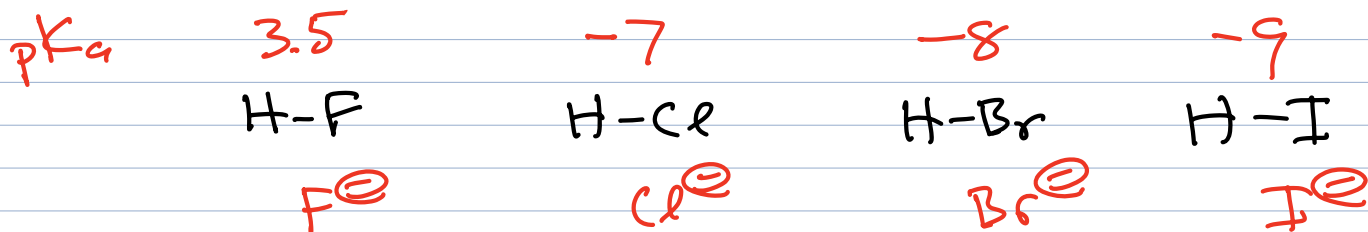


O \rightarrow more electronegative

Rule b)



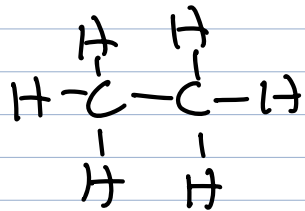
(Only compare atoms
in same column of
the Periodic Table)



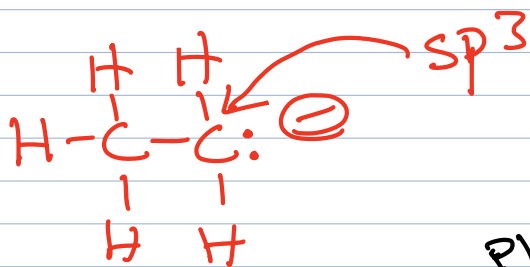
larger ion \rightarrow

acid strength \rightarrow

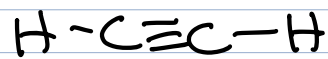
Rule c)



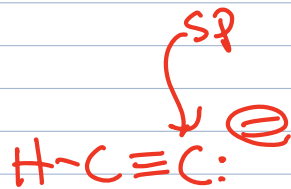
$pK_a \cong 50$



$sp^3 \rightarrow 25\% \text{ S}$
 $75\% \text{ P}$



$pK_a = 25$



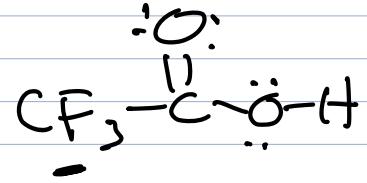
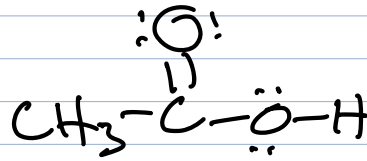
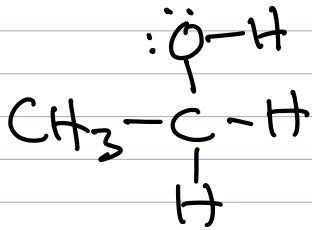
Places more
 \ominus closer
to nucleus

More "s" \rightarrow

$sp \rightarrow 50\% \text{ S}$
 $50\% \text{ P}$

max stable anion

Rules d) and e)

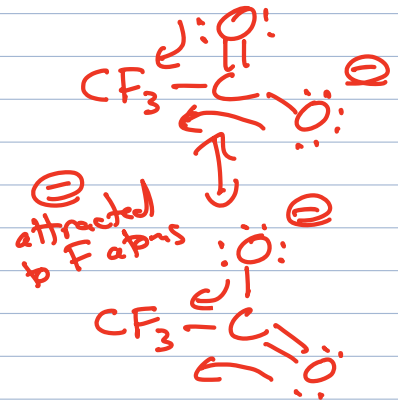
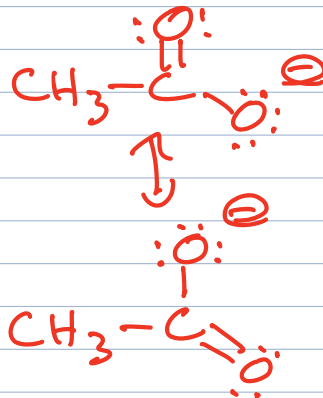
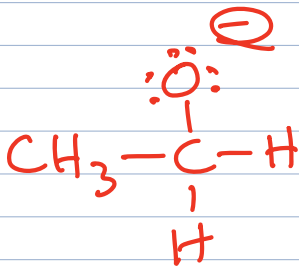
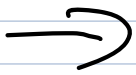


pK_a

15.9

4.8

0.1



Resonance
Delocalization
Rule d)

Inductive
Effect
Rule e)

anion stability

acid strength