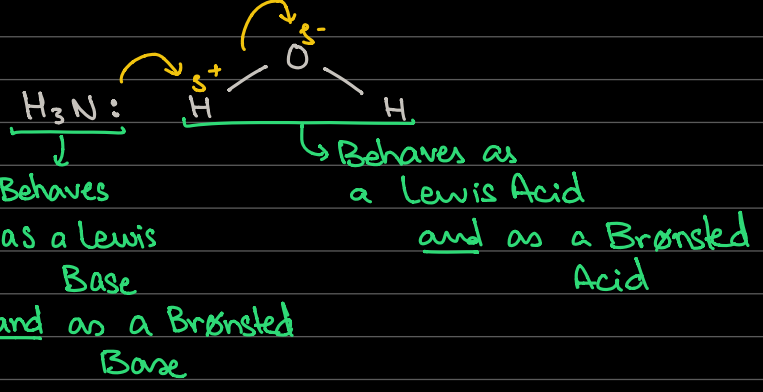
CONJUGATE ACIDS & BASES : REVERSIBLE REACTIONS

Arrhenius acid dissociates to form H^+ (aq) in water ($CH_3COOH \rightleftharpoons CH_3COO^- + H^+$)
Arrhenius base dissociates to form OH^- (aq) in water ($NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$)

Brønsted-Lowry Acid is a proton donor ($CH_3COOH \rightleftharpoons CH_3COO^- + H^+$)
Brønsted-Lowry Base is a proton acceptor ($CH_3\ddot{N}H_2 + H^+ \longrightarrow CH_3\overset{+}{N}H_3$)
↳ Most important

Lewis acid is an electron pair acceptor
Lewis base is an electron pair donor



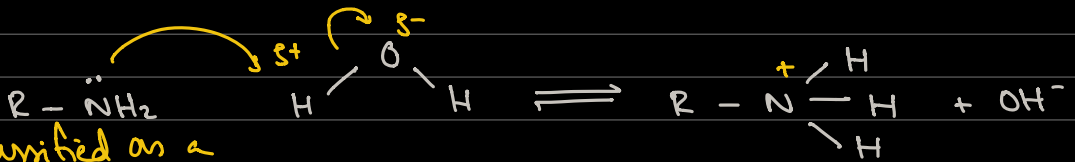
WEAK vs. STRONG acids & bases

- A weak acid dissociates partially in water to form H^+ ions or hydronium ions

$$CH_3COOH \rightleftharpoons H^+ + CH_3COO^-$$

- A weak base dissociates partially in water to form hydroxide ions (OH^-)

↳ Amines are weak bases



This is classified as a base because N, due to its lone pair, attracts and accepts protons

CONJUGATE Acids + Bases

Every acid has a conjugate base and every base has a conjugate acid

Example: $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

Weak Acid — Strong Conjugate Base

Example 2: $HCl + H_2O \longrightarrow H_3O^+ + Cl^-$

Strong Acid — Base — Conjugate Acid — Weak Conjugate Base

- The species formed when an acid gives up / donates a proton is it's conjugate base

Acid $\longrightarrow H^+$ + Conjugate base

- The species formed when a base accepts its proton is its conjugate acid

Base + $H^+ \longrightarrow$ Conjugate Acid

	ACID	CONJUGATE BASE	
strongest *	H_2SO_4	HSO_4^-	weakest *
	HCl	Cl^-	
	CH_3COOH	CH_3COO^-	
	H_2CO_3	HCO_3^-	
weakest *	H_2O	OH^-	strongest *

acid strength is decreasing ↓

Conjugate base strength is increasing ↓

*: in this list

Example: $H_2CO_3 + OH^- \rightleftharpoons HCO_3^- + H_2O$

Base — Conjugate Acid

Acid — Conjugate Base

Example: $HCO_3^- + S^{2-} \rightleftharpoons HS^- + CO_3^{2-}$

Acid — Conjugate Base

Base — Conjugate Acid

Example: $H_2O + H_2O \rightleftharpoons H_3O^+ + OH^-$

Acid — Base — Conjugate Acid — Conjugate Base

BASICITY OF ACIDS

Monobasic or monoprotic acids: dissociate to provide 1 H^+ ion

ie. $HCl \longrightarrow H^+ + Cl^-$

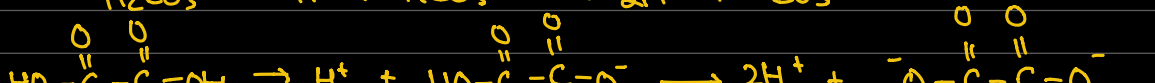
$HNO_3 \longrightarrow H^+ + NO_3^-$

$CH_3COOH \longrightarrow H^+ + CH_3COO^-$

Dibasic or diprotic acid: can lose 2 H^+ per molecule

$H_2SO_4 \longrightarrow H^+ + HSO_4^- \longrightarrow 2H^+ + SO_4^{2-}$

$H_2CO_3 \longrightarrow H^+ + HCO_3^- \longrightarrow 2H^+ + CO_3^{2-}$



ethanedioate ion

Tribasic or triprotic acids: can lose up to $3H^+$ per molecule

ie. H_3PO_4 Same concept applies

pH values

· Generally...

Strong Acid	0 - 2
Weak Acid	2.5 - 5
Neutral	7
Weak base	8 - 11
Strong base	13 - 14