Chapter 15

Acids & Basis

* Acids :\\
- Have a sour taste.
- React with certain metals to Produce H_2

$$2HCl + Mg \longrightarrow MgCl_2 + H_{2(g)}$$

- React with Carbonate & bicarbonates to Produce carbon dioxide. CO_2

$$2HCl + CaCO_3 \longrightarrow CaCl_2 + CO_2 + H_2O.$$

* Basis :\\
- Have a bitter taste.
- Feel slippery. "ملمس زلق"

* Definition of Acids & Basis :\\

[1] Arrhenius :\\

a. Acid : something that Produce a H^+ in an aqueous solution.

b. Base : something that Produce a OH^- in an aqueous solution.

CamScanner المسوحة ضوئيا بـ

2 Bronsted-lowry:

a. Acid: A substance that can donate a Proton (H^+).

b. Base: A substance that can accept a Proton (H^+)

$$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-_{(aq)}$$

* NH_3: Arrhenius base because adding it to water produces OH^-.

* NH_3: Bronsted-lowry base because it accepts a Proton from H_2O.

*** The Limitation of Bronsted-lowry definition:**
To be Bronsted-lowry Acid, A substance must have a hydrogen atom.

*** Amphoteric substances:** "Amphiprotic"
Some substances can act like an acid in one reaction & like a base in another reaction.

$$HCl + H_2O \longrightarrow Cl^- + H_3O^+$$

H_2O ↓

*** Bronsted lowry base ***

$$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$$

H_2O ↓

*** Bronsted-lowry acid ***

\# Conjugate Acid-Base Pairs

$$HX_{(aq)} + H_2O_{(L)} \rightleftharpoons X^-_{(aq)} + H_3O^+_{(aq)}$$

* From the equation :\\

→ H_3O^+ is the conjugate acid of H_2O.

→ X^- is the conjugate base of HX.

\# ملاحظة :// الفرق بين الحمض وقاعدته المرافقة أو القاعدة وحمضها المرافق هو بروتون واحد فقط.

Add H^+

$$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$$

* Base | * Acid | * Conjugate acid | * Conjugate base.

Remove H^+

* Question: What is the Conjugate base of each of the following?

$HClO_4 \rightarrow ClO_4^-$ * $H_2S \rightarrow HS^-$

$PH_4^+ \rightarrow PH_3$ * $HCO_3^- \rightarrow CO_3^{2-}$

* Question: What is the Conjugate acid for each of the following?

* $CN^- \rightarrow HCN$ * $SO_4^{2-} \rightarrow HSO_4^-$

* $H_2O \rightarrow H_3O^+$ * $HCO_3^- \rightarrow H_2CO_3$

* The stronger an acid, the weaker its Conjugate base.

* Strong acids: Completely transfer their Proton
  - No undissolved molecules in solution.
  - Conjugate basis have a negligible tendency to attract H^+

* يتم منح كامل للبروتونات ، بضلش جزيئات غير ذائبة من الحمض في المحلول ، القاعدة المرافقة معندهاش قابلية لجذب البروتون من عشان هيك التفاعل بكون باتجاه واحد.

Weak acids:\

* only Partially dissociate in water.
* exist in solution as a mixture of acid molecules & their Constituent ions.
* Conjugate basis show slight ability to attract the proton H^+.

* ذوبانها غير كامل في الماء ، بتكون من المحلول على شكل خليط من الحمض وقاعدته المرافقة

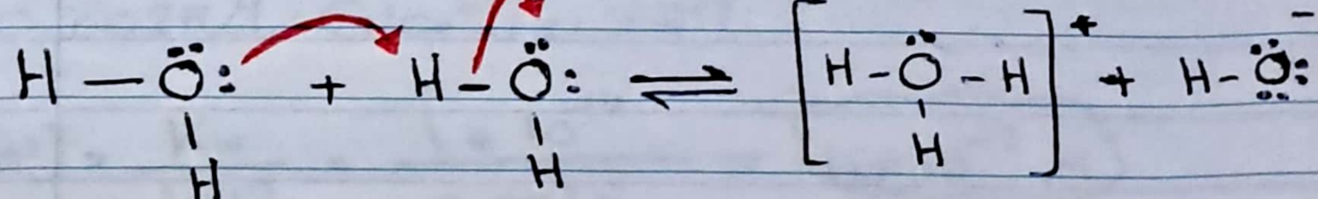
Negligible acids "Strong base"

↳ Don't act like acids in water.

* Autoionization of water

$$H_2O + H_2O \rightleftharpoons H_3\overset{+}{O} + OH^-$$

* التأين الذاتي للماء ← يعني انه أحد جزيئات الماء بتصرف كحمض ويمنح بروتون ، بينما جزيء آخر يتصرف كقاعدة ويستقبل بروتون ،



* The ion Product of Water

$$H_2O_{(l)} \rightleftharpoons H^+_{(aq)} + OH^-_{(aq)}$$

$$K_c = \frac{[H^+][OH^-]}{[H_2O]}$$

[H₂O] ثابت.

$$K_c\,[H_2O] = K_w = [H^+][OH^-]$$

* The ion-Product Constant (K_w): is the Product of the molar Concentration of H^+ & OH^- ions at a particular temperature.

At 25°C → $K_w = [H^+][OH^-] = 1 * 10^{-14}$

$[H^+] = [OH^-]$ → Neutral solution.
$[H^+] > [OH^-]$ → Acidic solution.
$[OH^-] > [H^+]$ → Basic solution.

Question: The Concentration of OH^- ions in a certain household ammonia cleaning solution is 0.0025M. Calculate $[H^+]$

$$[H^+] = \frac{K_w}{[OH^-]} = \frac{1 * 10^{-14}}{0.0025} = 4 * 10^{-12}\ M$$

#

* PH - A measure of Acidity

PH = Power of H^+ = $-\log[H^+]$

* Neutral solution :\

$[H^+] = [OH^-]$

At 25°c → $[H^+] = 1 * 10^{-7}$
→ $PH = 7$

* Acidic solution :\

$[H^+] > [OH^-]$

At 25°c → $[H^+] > 1 * 10^{-7}$
→ $PH < 7$

* Basic solution :\

$[H^+] < [OH^-]$

At 25°c → $[H^+] < 1 * 10^{-7}$
→ $PH > 7$

$\therefore PH \propto \frac{1}{[H^+]}$

∴ قيمة ال PH تتناسب تناسباً عكسياً مع
تركيز ال H^+

* POH = Power of OH^- = $-Log[OH^-]$

* $\left([H^+][OH^-] = K_w = 1 * 10^{-14}\right) * \underline{-Log}$

$\hookrightarrow -Log[H^+] - Log[OH^-] = 14$

$\therefore PH + POH = 14$

* يتم قياس قيمة ال PH باستخدام PH Meter.

*** Question:** The Concentration of H^+ ions in a solution is $3.2 * 10^{-4}$ M. The solution was left for a while, it was found that the hydrogen ion Concentration equal to $1 * 10^{-3}$ M. Calculate the PH of the solution on the two occasions.

$[H^+]_1 = 3.2 * 10^{-4}$ M

$PH_1 = -Log(3.2 * 10^{-4}) = \boxed{3.49}$ ※

$[H^+]_2 = 1 * 10^{-3}$ M

$PH_2 = -Log(1 * 10^{-3}) = \boxed{3}$ ※

لسه في أمل ♡

Question: The PH of rainwater collected in a certain region of the northeastern United States on a particular day was 4.82. Calculate the [H⁺] of the rainwater.

$$PH = -\log[H^+] = 4.82$$

$$\therefore [H^+] = 10^{-PH} = 10^{(-4.82)} = 1.5 * 10^{-5} M$$

#

Question: In a NaOH solution, [OH⁻] is $2.9 * 10^{-4} M$, Calculate PH of the solution

$$POH = -\log(2.9 * 10^{-4}) = 3.54$$

$$\because PH + POH = 14$$

$$\therefore PH = 14 - POH$$

$$= 14 - 3.54 = 10.46$$

#

* Another way:

$$[H^+] = \frac{K_w}{[OH^-]} = \frac{1 * 10^{-14}}{2.9 * 10^{-4}} = 3.45 * 10^{-11} M$$

$$PH = -\log(3.45 * 10^{-11}) = 10.46$$

#

Strength of Acids & Basis

~ Types of substances ~

Strong electrolyte

* 100% dissociation
* one arrow.

Weak electrolyte

* Not Completely dissociated.
* two arrow.

* Strong Acids → strong electrolytes.

→ HCl , HNO_3 , $HClO_4$, H_2SO_4, HBr, HI

ex: $HCl + H_2O \longrightarrow H_3O^+ + Cl^-$

* Weak Acids → weak electrolytes.

→ HF , HNO_2 , HSO_4^- , H_2O, HCN, $CHOOH$

ex: $CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$

* Strong Basis → strong electrolytes

→ $NaOH$, $Ca(OH)_2$, KOH , $Ba(OH)_2$, $Mg(OH)_2$

ex: $Ba(OH)_2 \xrightarrow{H_2O} Ba^{2+} + 2OH^-$

* Weak Basis → weak electrolytes

→ F^- , NO_2^- , NH_3

ex: $F^- + H_2O \rightleftharpoons OH^- + HF$

* The conjugate base of a strong acid has no measurable strength.

* القاعدة المرافقة للحمض القوي ملهاش قوة ملحوظة أو بتدخل في الحسابات.

* Calculating the PH of strong acid solution:

1 Monoprotic Acids:

ex: $HCl + H_2O \rightleftharpoons H^+ + Cl^-$

$[H^+] = [HCl]$

$\therefore PH = -Log[H^+] = -Log[HCl]$

2 Diprotic Acids:

ex: $H_2SO_4 + H_2O \longrightarrow 2H^+ + SO_4^{2-}$

$[H^+] = 2 * [H_2SO_4]$

$\therefore PH = -Log[H^+] = -Log(2 * [H_2SO_4])$

* Calculating the PH in strong Base Solutions:\

1 Monohydroxy Base.

ex: $NaOH \xrightarrow{H_2O} Na^+ + OH^-$

$$[OH^-] = [NaOH]$$

$$PH = -\log[H^+] = -\log\left(\frac{1*10^{-14}}{[OH^-]}\right) = -\log\left(\frac{1*10^{-14}}{[NaOH]}\right)$$

2 Dihydroxy Base.

ex: $Ba(OH)_2 \xrightarrow{H_2O} Ba^{2+} + 2OH^-$

$$[OH^-] = 2 * [Ba(OH)_2]$$

$$PH = -\log[H^+] = -\log\left(\frac{1*10^{-14}}{[OH^-]}\right) = -\log\left(\frac{1*10^{-4}}{2*[Ba(OH)_2]}\right)$$

Good → things
take → time ...

Question: What is the PH of $2*10^{-3}M$ of HNO_3 solution?

$\because HNO_3 \rightarrow$ Monoprotic strong acid

$\therefore [H^+] = [HNO_3] = 2*10^{-3}\ M$

$\therefore PH = -Log[H^+] = -Log(2*10^{-3})$

$\therefore PH = 2.7$ #

Question: What is the PH of $2.5*10^{-3}M$ of $Ca(OH)_2$?

$\because Ca(OH)_2 \rightarrow$ ~~Mono~~ Dihydroxy strong Base

$\therefore [OH^-] = 2 * [Ca(OH)_2]$

$\therefore [OH^-] = 2*(2.5*10^{-3}) = 5*10^{-3}\ M$

$$[H^+] = \frac{1*10^{-14}}{[OH^-]} = \frac{1*10^{-14}}{5*10^{-3}} = 2*10^{-12}\ M$$

$PH = -Log(2*10^{-12}) = 11.7$ #

Weak Acids & Acid ionization Constant

* HA :⇒ Weak acid.

$$HA_{(aq)} \underset{}{\overset{H_2O}{\rightleftharpoons}} H^+ + A^-$$

$$K_a = \frac{[H^+][A^-]}{[HA]}$$

* Acid ionization Constant *

* $K_a \propto$ Weak acid strength *

Weak Bases & Base ionization Constant

* B :⇒ Weak Base

$$B_{(aq)} + H_2O \rightleftharpoons BH^+ + OH^-$$

$$K_b = \frac{[BH^+][OH^-]}{[B]}$$

* Base ionization Constant *

* $K_b \propto$ weak base strength *

Ionization Constants of Conjugate Acid-Base

* $HA_{(aq)} \rightleftharpoons H^+ + A^- \rightarrow K_a$

* $A^- + H_2O \rightleftharpoons OH^- + HA \rightarrow K_b$

$H_2O \rightleftharpoons H^+ + OH^- \rightarrow K_w$

$$\therefore \quad K_w = K_a K_b$$

Percent ionization

$$\text{Percent ionization} = \frac{\text{Ionized acid Concentration at equili.}}{\text{Initial Concentration}} \times 100\%$$

* For a monoprotic Acid $\boxed{HA}$

$$\text{Percent ionization} = \frac{[H^+]}{[HA]_0} * 100\%$$

$[HA]_0 \rightarrow$ Initial Concentration of Acid

$$\therefore \text{Percent ionization} = \frac{x}{[\ ]_0} * 100\%$$

In Som Cases, The Value of (x) is very Small...... that we can deal with its Value as a neglegible one.

* إنه في بعض الحالات بقدر أتجاهل قيمة الـ x لأنها بتكون صغيرة جداً بالنسبة للتركيز الأولي.

5% Rule → $= \frac{x}{[\,]_0} * 100\%$

* إذا كانت نسبة الـ x أقل من 5% بقدر أعمل approximation.
* إذا كانت نسبة الـ x أكبر من 5% ممنوع أعمل approximation.

Question: What is the PH of a 0.5M HF solution (At 25°C)

$HF \rightleftharpoons H^+ + F^-$ / $K_a = \frac{[H^+][F^-]}{[HF]} = 7.1*10^{-4}$

	HF ⇌	H^+ +	F^-
Initial	0.5	0	0
Change	$-x$	$+x$	$+x$
equilibrium	$0.5-x$	x	x

$$K_a = \frac{x^2}{0.5-x} = 7.1 * 10^{-4}$$

$\because K_a <<< 1$
بقدر أتجاهل x
$\therefore 0.5 - x \approx 0.5$

$$K_a = \frac{x^2}{0.5} = 7.1 * 10^{-4}$$

$$\therefore x = \sqrt{0.5 * 7.1 * 10^{-4}} = \boxed{0.019}$$

$[H^+] = [F^-] = x = 0.019\,M$

$\therefore PH = -\log(0.019) = 1.72$ #

* Question: Calculate the PH of a 0.036 M nitrous acid (HNO_2) solution:
$K_a = 4.5 * 10^{-4}$

$$HNO_2 \rightleftharpoons H^+ + NO_2^-$$

* solution:

	HNO_2	H^+	NO_2^-
Initial	0.036	0	0
Change	$-x$	$+x$	$+x$
Equilibrium	$0.036-x$	x	x

$$K_a = \frac{[H^+][NO_2^-]}{[HNO_2]} = \frac{x^2}{0.036 - x} = 4.5 * 10^{-4}$$

* Applying the approximation –

$$4.5 * 10^{-4} = \frac{x^2}{0.036}$$

$$\therefore x = \sqrt{0.036 * 4.5 * 10^{-4}} = 4 * 10^{-3} M$$

* Testing the approximation :)

$$\frac{4 * 10^{-3}}{0.036} * 100\% = 11\% > 5\%$$

$\therefore$ our approximation is not valid.

* عشان نسبة ال x > 5% بنقدرش أتجاهلها –

$$\therefore 4.5 * 10^{-4} = \frac{x^2}{0.036 - x}$$

$$x^2 + (4.5 * 10^{-4} x) - (1.62 * 10^{-5}) = 0$$

$$x = \frac{(-4.5 * 10^{-4}) \pm \sqrt{(4.5 * 10^{-4})^2 - (4 * -1.62 * 10^{-5})}}{2 * 1}$$

$x = 3.8 * 10^{-3} M$ / $\cancel{x = -4.3 * 10^{-3} M}$

will be neglected

$\therefore x = 3.8 * 10^{-3} \rightarrow [H^+] = 3.8 * 10^{-3}\ M$

$PH = -\log(3.8 * 10^{-3}) = \boxed{2.42}$

Question: The PH of a 0.1 M solution of formic acid (HCOOH) is 2.39, What is the Ka of the acid.?

$[H^+] = 10^{-PH} = 10^{-2.39} = 4.1 * 10^{-3}\ M$

$\therefore x = 4.1 * 10^{-3}$

$$K_a = \frac{[H^+][HCOO^-]}{[HCOOH]} = \frac{x^2}{[HCOOH]_0 - x}$$

$$= \frac{(4.1 * 10^{-3})^2}{0.1 - (4.1 * 10^{-3})}$$

$$\boxed{\therefore K_a = 1.8 * 10^{-4}}$$

Diprotic & Triprotic Acids:

* An ionization Constant expression can be written for each ionization stage.
* They lose one proton at a time.

$H_2CO_3 \rightleftharpoons H^+ + HCO_3^- \rightarrow K_{a1}$

$HCO_3^- \rightleftharpoons H^+ + CO_3^{2-} \rightarrow K_{a2}$

* **Question:** Oxalic acid ($H_2C_2O_4$) is a Poisonous substance that used chiefly as a bleaching & Cleansing agent. Calculate the Concentrations of all the species present at equilibrium in a 0.1 M solution.

$$H_2C_2O_4 \rightleftharpoons H^+ + HC_2O_4^-$$

	$H_2C_2O_4$	H^+	$HC_2O_4^-$
Initial	0.1	0	0
Change	$-x$	$+x$	$+x$
equilibrium	$0.1-x$	x	x

$$K_a = \frac{x^2}{0.1-x} = \frac{x^2}{0.1} = 6.5 * 10^{-2}$$

$$\therefore x = \sqrt{0.1 * (6.5 * 10^{-2})} = 8.1 * 10^{-2}\ M$$

* Testing the approximation:

$$\frac{8.1 * 10^{-2}}{0.1} * 100\% = 81\% \ggg 5\%$$

$\therefore$ The approximation is not Valid

مضطر أحل معادلة تربيعية.

$$6.5 * 10^{-2} = \frac{x^2}{0.1 - x}$$

$$x^2 + (6.5 * 10^{-2})x - (6.5 * 10^{-3}) = 0$$

* باستخدام القانون العام

$$x = 0.054\ M$$

$\therefore$ $[H^+] = [HC_2O_4^-] = x = 0.054\ M$ #

$[H_2C_2O_4] = (0.1 - x)$

$= (0.1 - 0.054) = 0.046\ M$ #

ب- الحمض diprotic يعني في كمان خطوة تفكك

← بكرر فيها نفس الخطوات مع المعطيات الجديدة.

	$HC_2O_4^- \rightleftharpoons$	H^+	$+ C_2O_4^{2-}$
Initial	0.054	0.054	0
Change	$-W$	$+W$	$+W$
equilibrium	$0.054 - W$	$0.054 + W$	W

$$Ka = 6.1 * 10^{-5} = \frac{(0.054 + W) * W}{(0.054 - W)}$$

* Applying the approximation:

$$6.1 \times 10^{-5} = \frac{(0.054) \times w}{0.054}$$

$\therefore$ $w = 6.1 \times 10^{-5}$

* Testing the approximation:

$$\frac{6.1 \times 10^{-5}}{0.054} \times 100\% = 0.11\% < 5\%$$

$\therefore$ The approximation is valid. ✓

$\therefore$ $[C_2O_4^{2-}] = 6.1 \times 10^{-5}\ M$

#

* Question: What is the PH of a 0.4 M ammonia solution? "$K_b = 1.8 \times 10^{-5}$"

$$NH_3 \xrightleftharpoons{H_2O} NH_4^+ + OH^-$$

	NH_3	NH_4^+	OH^-
Initial	0.4	0	0
Change	$-x$	$+x$	$+x$
equilibrium.	$0.4 - x$	x	x

$$K_b = \frac{[NH_4^+][OH^-]}{[NH_3]}$$

$$1.8 * 10^{-5} = \frac{x^2}{0.4 - x}$$

* Applying the approximation:\

$$1.8 * 10^{-5} = \frac{x^2}{0.4}$$

$$\therefore x = \sqrt{0.4 * 1.8 * 10^{-5}} = 2.7 * 10^{-3}\ M$$

* Testing the approximation:\

$$\frac{2.7 * 10^{-3}\ M}{0.4\ M} * 100\% = 0.68\% < 5\%$$

$\therefore$ The approximation is Valid.

$$\therefore [OH^-] = x = 2.7 * 10^{-3}\ M$$

$$[H^+] = \frac{K_w}{[OH^-]} = \frac{1 * 10^{-14}}{2.7 * 10^{-3}} = 3.7 * 10^{-12}\ M$$

$$PH = -\log(3.7 * 10^{-12}) = 11.43$$

#

IF Not Now Then when ?!

Question: Calculate K_a and PH of a 0.4 ammonia solution if the ionization Percent is 0.68% ?

$$\text{ioniza\%} = \frac{x}{[\ ]_0} * 100\%$$

$$\therefore x = \frac{\text{ioniz.\%} * [\ ]_0}{100\%}$$

$$x = \frac{0.68 * 0.4}{100\%} = 2.7 * 10^{-3}$$

$$x = [OH^-] = 2.7 * 10^{-3} M$$

$$K_b = \frac{[OH^-][NH_4^+]}{[NH_3]}$$

$$= \frac{(2.7 * 10^{-3})^2}{0.4 - (2.7 * 10^{-3})} = 1.83 * 10^{-5}$$

$$K_a = \frac{K_w}{K_b} = \frac{1 * 10^{-14}}{1.83 * 10^{-5}} = 5.45 * 10^{-10}$$ #

$$\rightarrow [OH^-] = x = 2.7 * 10^{-3}$$

$$[H^+] = \frac{K_w}{[OH^-]} = \frac{1 * 10^{-14}}{2.7 * 10^{-3}} = 3.7 * 10^{-12}$$

$$PH = -\log(3.7 * 10^{-12}) = 11.43$$ #

Molecular structure & Acid strength

$$H{-}x \longrightarrow H^{+} + x^{-}$$

* The stronger the bond → The weaker the acid

* كلما زادت الرابطة في الحمض ← تقل قوة الحمض بسبب قلة عدد البروتونات الناتجة من التحلل الجزئي للحمض.

* عشان هيك بعتبر HF حمض ضعيف، بسبب قوة الرابطة.

$$HI > HBr > HCl > HF$$

* strength of Acid *

* oxoacid strength:

* Oxoacid: Acids that contain oxygen.

ex: - Carbonic Acid: H_2CO_3
- Nitrous Acid: HNO_2
- sulfuric Acid: H_2SO_4

The O-H bond will be more Polar and easier to break if:

1. Z is very electronegative.
2. Z is in high oxidation state.

$$>Z-\overset{\delta^-}{O}-\overset{\delta^+}{H} \longrightarrow >Z-O^- + H^+$$

Comparison between oxoacids:

1. First situation: Oxoacids having different central atoms that are from the same group and that have the same oxidation number.

ex: $HClO_3$ / $HBrO_3$

* لاحظ : عندهم نفس العدد من ذرات الأكسجين لكن الاختلاف في الذرة المركزية (Z).

$HClO_3 > HBrO_3$

Because Cl more electronegative than Br.

2 Second situation :\

Oxoacids having the same Central atom but different numbers of attached groubs.

* Acid strength increases as the oxidation number of Z increases.

ex: - HOCl "Hypochlorous acid"
↳ oxidatio number of Cl = +1

- HO_2Cl "Chlorous acid"
↳ oxidation number of Cl = +3

- HO_3Cl "Chloric acid"
↳ oxidation number of Cl = +5

- HO_4Cl "Perchloric acid"
↳ oxidation number of Cl = +7

* The more number of oxygen atoms, the stronger the acid.

يعني كل مازال عدد ذرات الأكسجين بتزيد قوة الحمض.

$HClO_4 > HClO_3 > HClO_2 > HClO$

* Acid-Base Properties of salts

* Types of salts solutions:\

1 Neutral solutions:\

salts containing an alkali metal or alkaline earth metal ion "except Be^{2+}" and the conjugate base of a strong acid.

* المحاليل المتعادلة ← بتكون الملح من أحد عناصر المجموعة الأولى أو الثانية من الجدول الدوري ما عدا Be^{2+} مع أحد القواعد الملازمة للأحماض القوية.

ex: $\underbrace{NaCl} \xrightarrow{H_2O} Na^+ + Cl^-$

* Na: Alkali meta
* Cl: Conjugate base of a strong acid "HCl"

2 Basic solutions:\

Salts derived from a strong base & weak acid

ex: $\underbrace{CH_3COONa} \xrightarrow{H_2O} CH_3COO^- + Na^+$

NaOH: strong base / CH_3COOH: weak acid

$CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + OH^-$

$Na^+ + H_2O \longrightarrow$ No reaction

→ Basic solution *

3 Acid solutions:

Salts derived from a strong acid & weak base

ex: $\underbrace{NH_4Cl}$ $\xrightarrow{H_2O}$ $NH_4^+ + Cl^-$

NH_3: weak base / HCl: strong acid.

* $NH_4^+ + H_2O \rightleftharpoons NH_3 + H^+$
* $Cl^- + H_2O \longrightarrow$ No reaction.

→ Acidic solution

4 Solutions in which both the cation and the anion hydrolyze:

* salt derived from a weak acid & weak base
* There are three conditions in this case:

- $K_b > K_a$ → Basic solution.
- $K_a > K_b$ → Acidic solution.
- $K_a \approx K_b$ → Neutral solution.

K_b → for the anion
K_a → for the cation
→ Note

* The end of

General chemistry

Course.....

Thank you ...

WK

30/12/2022