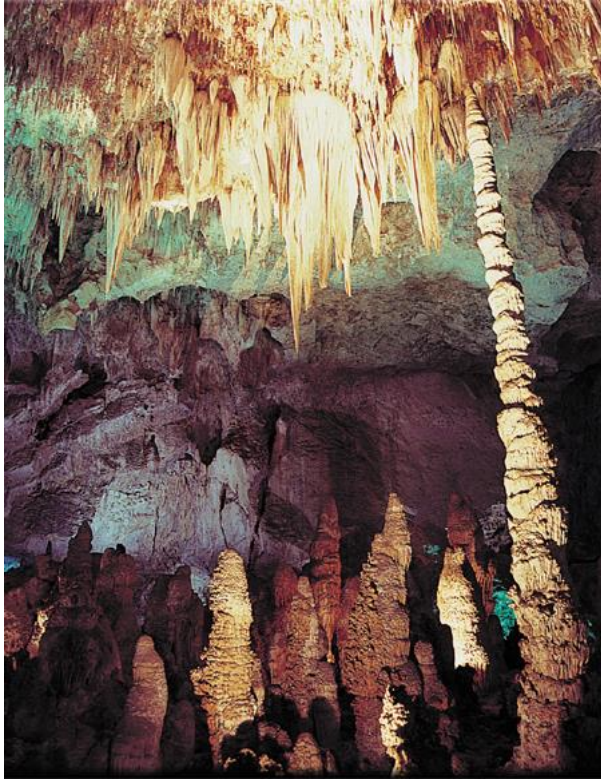
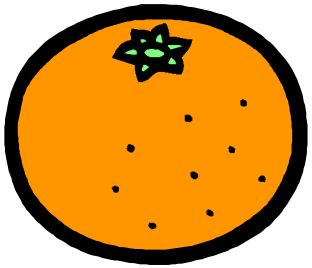
Ketika tablet Alka-Seltzer dilarutkan dalam air, ion bikarbonat dari natrium bicarbonat di dalamnya bereaksi dengan komponen asam dalam tablet yaitu asam sitrat menghasilkan gas karbon dioksida.



Asam dan Basa

Bab 15



Asam

Berasa asam. Cuka berasa asam asetat. Jeruk mengandung asam sitrat.

Bereaksi dengan logam menghasilkan gas hidrogen.

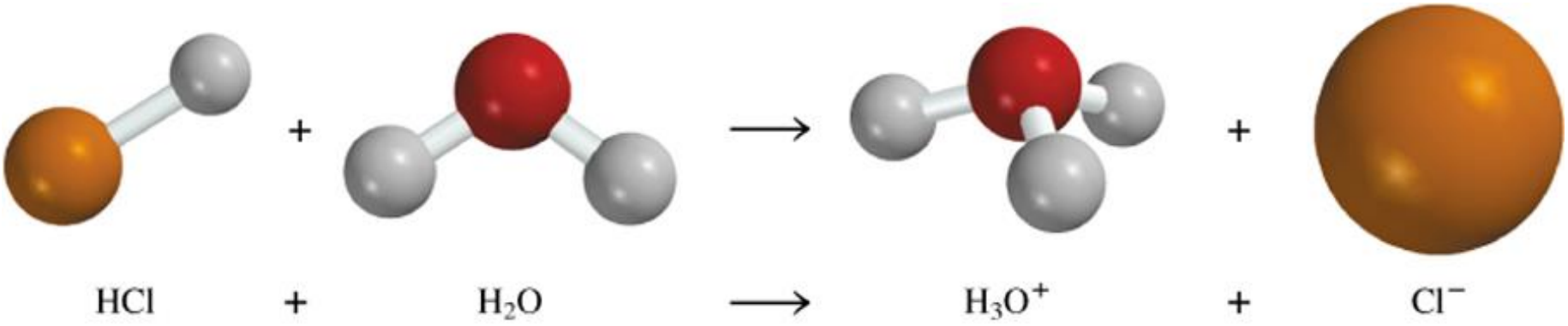
Bereaksi dengan karbonat atau bikarbonat menghasilkan gas karbondioksida.

Basa

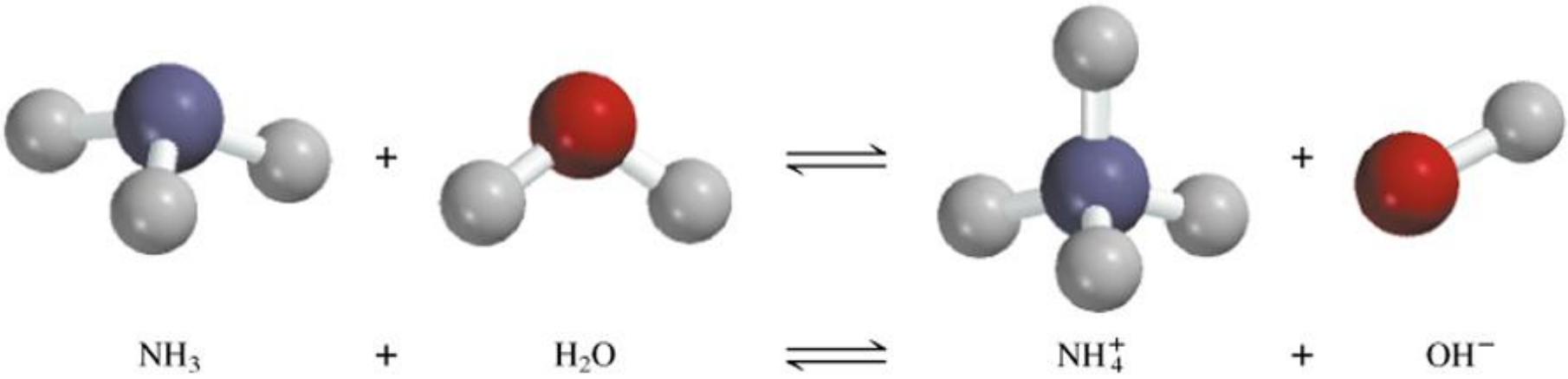
Berasa pahit.

Terasa licin. Sabun mengandung basa.

Asam Arrhenius adalah zat yang menghasilkan H^+ (H_3O^+) di dalam air

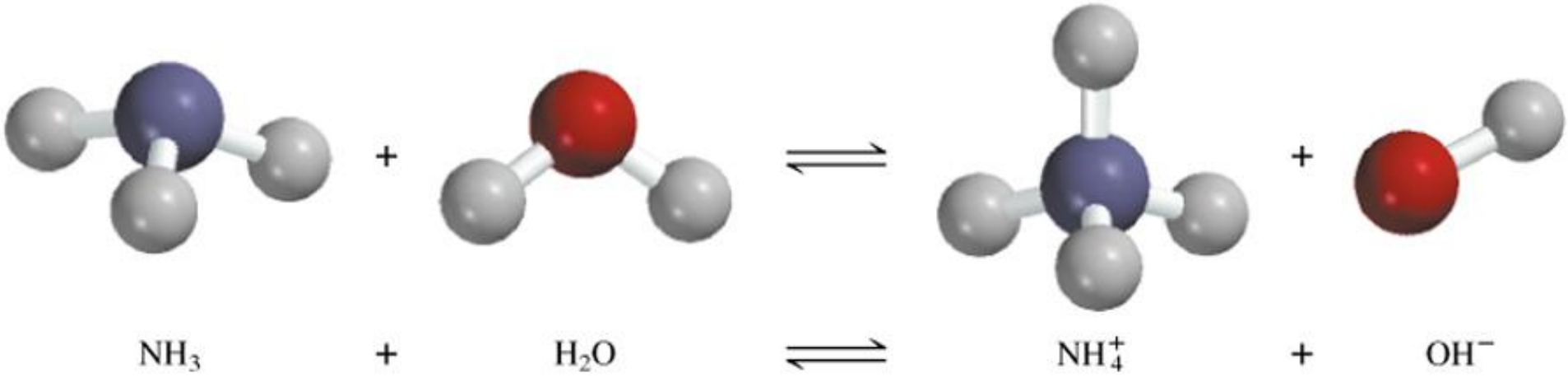


Basa Arrhenius adalah zat yang menghasilkan OH^- di dalam air



Asam Brønsted merupakan pendonor proton

Basa Brønsted adalah akseptor/penerima proton



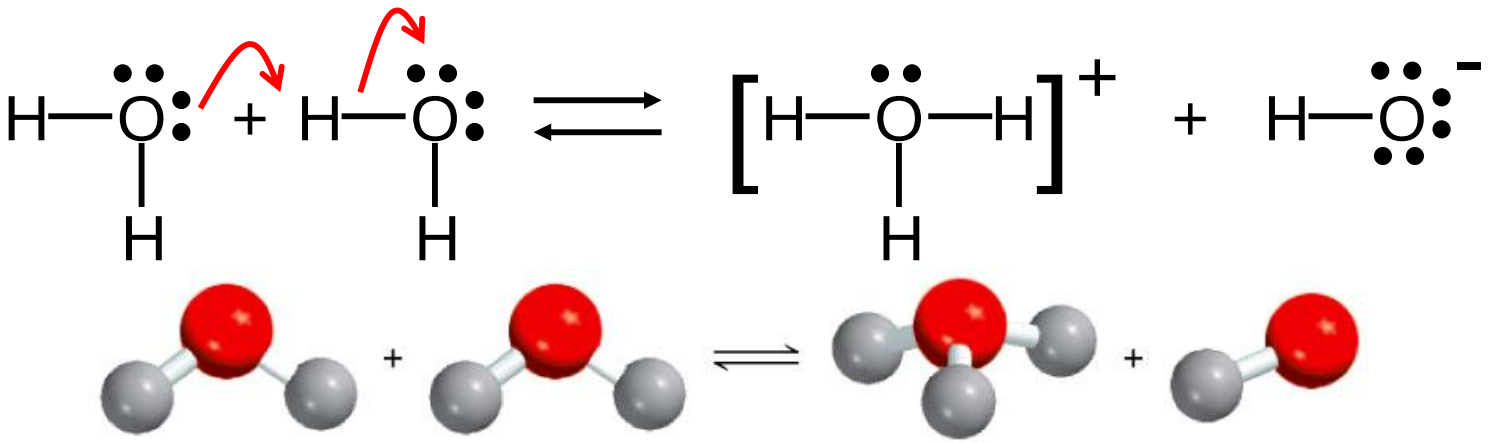
NH_3 + H_2O $\rightleftharpoons$ NH_4^+ + OH^-

basa	asam	asam	basa
basa	asam	asam konjugat	basa konjugat

Sifat-sifat Asam-Basa Air

$$H_2O\ (l) \rightleftharpoons H^+\ (aq) + OH^-\ (aq)$$

autoionisasi air



basa

asam konjugat

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

asam

basa konjugat

Hasil Kali Ion-ion Air

$H_2O\ (l) \rightleftharpoons H^+\ (aq) + OH^-\ (aq)$ $\quad K_c = \dfrac{[H^+][OH^-]}{[H_2O]}$ $\quad [H_2O] = \text{constant}$

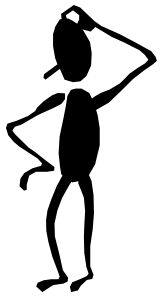
$$K_c[H_2O] = K_w = [H^+][OH^-]$$

Konstanta hasil kali ion (***K*_w***) adalah hasil kali konsentrasi-konsentrasi molar ion-ion H^+ dan OH^- **pada suhu tertentu.**

At 25°C

$K_w = [H^+][OH^-] = 1.0 \times 10^{-14}$

	Solution is
$[H^+] = [OH^-]$	neutral
$[H^+] > [OH^-]$	acidic
$[H^+] < [OH^-]$	basic

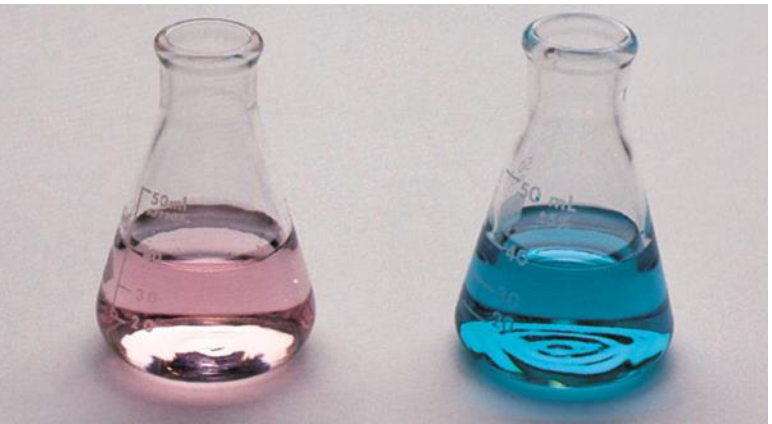


What is the concentration of OH^- ions in a HCl solution whose hydrogen ion concentration is 1.3 *M*?

$$K_w = [H^+][OH^-] = 1.0 \times 10^{-14}$$

$$[H^+] = 1.3\ M$$

$$[OH^-] = \frac{K_w}{[H^+]} = \frac{1 \times 10^{-14}}{1.3} = 7.7 \times 10^{-15}\ M$$



pH – Ukuran Keasaman

$$pH = -\log [H^+]$$

Solution Is		**At 25°C**	
neutral	$[H^+] = [OH^-]$	$[H^+] = 1 \times 10^{-7}$	pH = 7
acidic	$[H^+] > [OH^-]$	$[H^+] > 1 \times 10^{-7}$	pH < 7
basic	$[H^+] < [OH^-]$	$[H^+] < 1 \times 10^{-7}$	pH > 7

pH ↑ $[H^+]$ ↓

TABLE 15.1

The pHs of Some Common Fluids

Sample	pH Value
Gastric juice in the stomach	1.0–2.0
Lemon juice	2.4
Vinegar	3.0
Grapefruit juice	3.2
Orange juice	3.5
Urine	4.8–7.5
Water exposed to air*	5.5
Saliva	6.4–6.9
Milk	6.5
Pure water	7.0
Blood	7.35–7.45
Tears	7.4
Milk of magnesia	10.6
Household ammonia	11.5

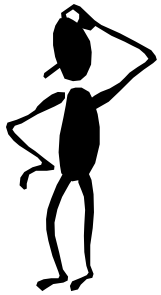
*Water exposed to air for a long period of time absorbs atmospheric CO_2 to form carbonic acid, H_2CO_3.

$$pOH = -\log [OH^-]$$

$$[H^+][OH^-] = K_w = 1.0 \times 10^{-14}$$

$$-\log [H^+] - \log [OH^-] = 14.00$$

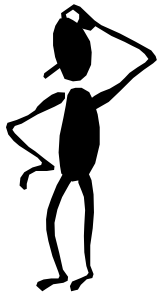
$$pH + pOH = 14.00$$



The pH of rainwater collected in a certain region of the northeastern United States on a particular day was 4.82. What is the H^+ ion concentration of the rainwater?

$$pH = -\log [H^+]$$

$$[H^+] = 10^{-pH} = 10^{-4.82} = 1.5 \times 10^{-5}\ M$$



The OH^- ion concentration of a blood sample is $2.5 \times 10^{-7}\ M$. What is the pH of the blood?

$$pH + pOH = 14.00$$

$$pOH = -\log [OH^-] = -\log (2.5 \times 10^{-7}) = 6.60$$

$$pH = 14.00 - pOH = 14.00 - 6.60 = 7.40$$

Strong Electrolyte – 100% dissociation

$$NaCl\ (s) \xrightarrow{H_2O} Na^+\ (aq) + Cl^-\ (aq)$$

Weak Electrolyte – not completely dissociated

$$CH_3COOH \rightleftharpoons CH_3COO^-\ (aq) + H^+\ (aq)$$

Strong Acids are strong electrolytes

$$HCl\ (aq) + H_2O\ (l) \longrightarrow H_3O^+\ (aq) + Cl^-\ (aq)$$

$$HNO_3\ (aq) + H_2O\ (l) \longrightarrow H_3O^+\ (aq) + NO_3^-\ (aq)$$

$$HClO_4\ (aq) + H_2O\ (l) \longrightarrow H_3O^+\ (aq) + ClO_4^-\ (aq)$$

$$H_2SO_4\ (aq) + H_2O\ (l) \longrightarrow H_3O^+\ (aq) + HSO_4^-\ (aq)$$

Weak Acids are weak electrolytes

$HF\ (aq) + H_2O\ (l) \rightleftharpoons H_3O^+\ (aq) + F^-\ (aq)$

$HNO_2\ (aq) + H_2O\ (l) \rightleftharpoons H_3O^+\ (aq) + NO_2^-\ (aq)$

$HSO_4^-\ (aq) + H_2O\ (l) \rightleftharpoons H_3O^+\ (aq) + SO_4^{2-}\ (aq)$

$H_2O\ (l) + H_2O\ (l) \rightleftharpoons H_3O^+\ (aq) + OH^-\ (aq)$

Strong Bases are strong electrolytes

$NaOH\ (s) \xrightarrow{H_2O} Na^+\ (aq) + OH^-\ (aq)$

$KOH\ (s) \xrightarrow{H_2O} K^+\ (aq) + OH^-\ (aq)$

$Ba(OH)_2\ (s) \xrightarrow{H_2O} Ba^{2+}\ (aq) + 2OH^-\ (aq)$

Weak Bases are weak electrolytes

F^- (*aq*) + H_2O (*l*) $\rightleftharpoons$ OH^- (*aq*) + HF (*aq*)

NO_2^- (*aq*) + H_2O (*l*) $\rightleftharpoons$ OH^- (*aq*) + HNO_2 (*aq*)

Pasangan asam-basa konjugat:

- Basa konjugat suatu asam kuat tidak mempunyai kekuatan yang dapat diukur.
- H_3O^+ adalah asam terkuat yang ada dalam larutan air.
- OH^- adalah basa terkuat yang ada dalam larutan air.

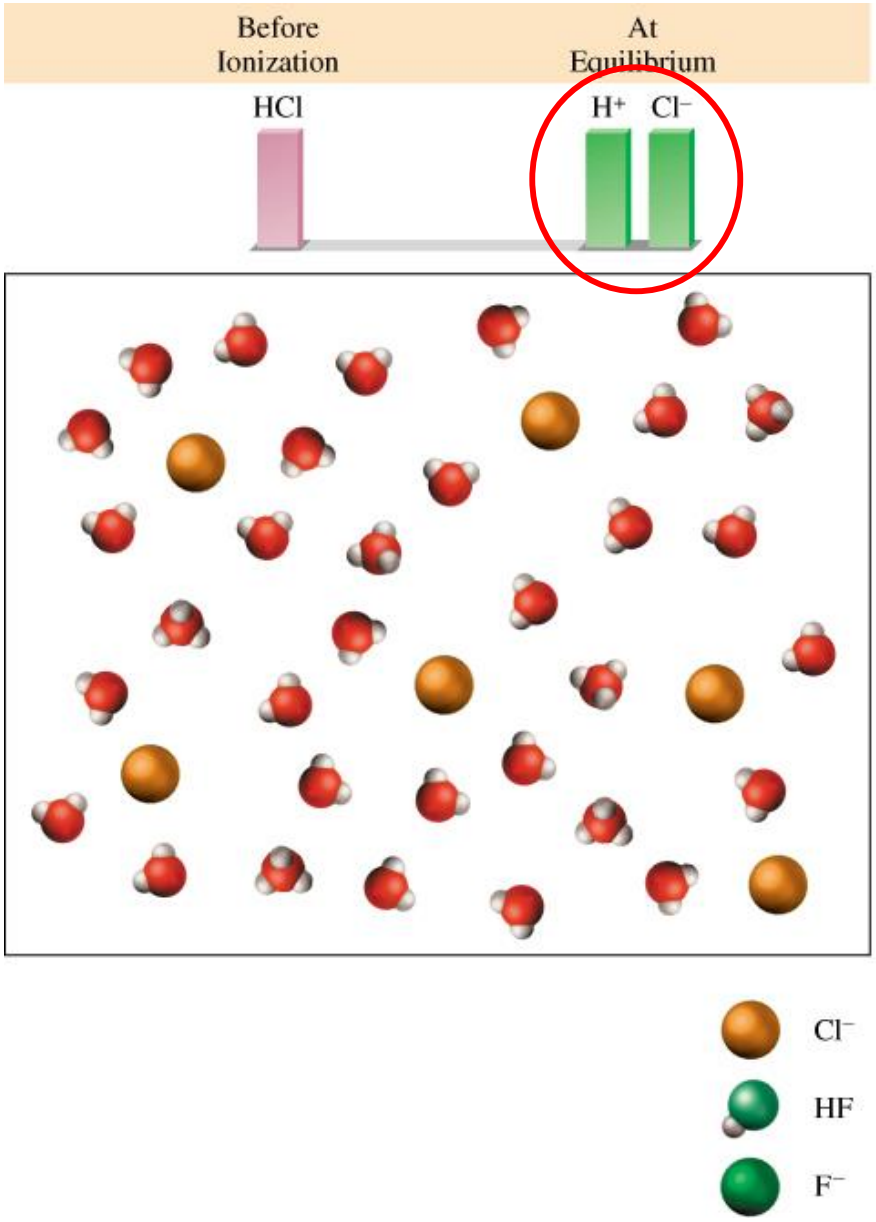
TABLE 15.2 Relative Strengths of Conjugate Acid-Base Pairs

	Acid	Conjugate Base
Strong acids	$HClO_4$ (perchloric acid)	ClO_4^- (perchlorate ion)
	HI (hydroiodic acid)	I^- (iodide ion)
	HBr (hydrobromic acid)	Br^- (bromide ion)
	HCl (hydrochloric acid)	Cl^- (chloride ion)
	H_2SO_4 (sulfuric acid)	HSO_4^- (hydrogen sulfate ion)
	HNO_3 (nitric acid)	NO_3^- (nitrate ion)
	H_3O^+ (hydronium ion)	H_2O (water)
Weak acids	HSO_4^- (hydrogen sulfate ion)	SO_4^{2-} (sulfate ion)
	HF (hydrofluoric acid)	F^- (fluoride ion)
	HNO_2 (nitrous acid)	NO_2^- (nitrite ion)
	HCOOH (formic acid)	$HCOO^-$ (formate ion)
	CH_3COOH (acetic acid)	CH_3COO^- (acetate ion)
	NH_4^+ (ammonium ion)	NH_3 (ammonia)
	HCN (hydrocyanic acid)	CN^- (cyanide ion)
	H_2O (water)	OH^- (hydroxide ion)
	NH_3 (ammonia)	NH_2^- (amide ion)

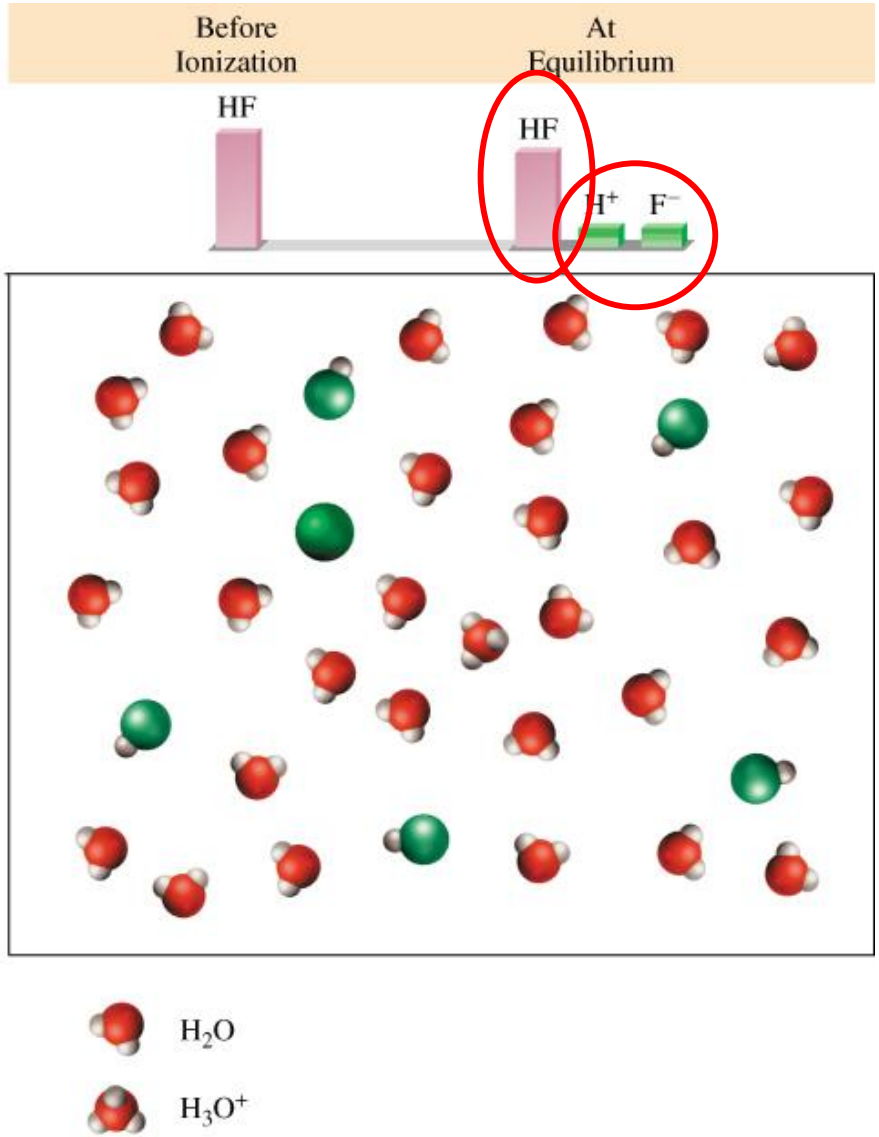
Acid strength increases ↑

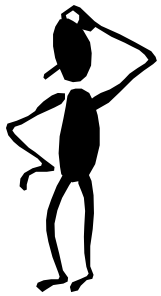
Base strength increases ↓

Asam Kuat



Asam Lemah



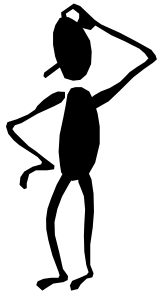


What is the pH of a 2 x 10^{-3} *M* HNO_3 solution?

HNO_3 is a strong acid – 100% dissociation.

Start	0.002 *M*	0.0 *M*	0.0 *M*
	HNO_3 (*aq*) + H_2O (*l*) ⟶	H_3O^+ (*aq*) +	NO_3^- (*aq*)
End	0.0 *M*	0.002 *M*	0.002 *M*

$pH = -\log [H^+] = -\log [H_3O^+] = -\log(0.002) = 2.7$



What is the pH of a 1.8 x 10^{-2} *M* $Ba(OH)_2$ solution?

$Ba(OH)_2$ is a strong base – 100% dissociation.

Start	0.018 *M*	0.0 *M*	0.0 *M*
	$Ba(OH)_2$ (*s*) ⟶	Ba^{2+} (*aq*) +	$2OH^-$ (*aq*)
End	0.0 *M*	0.018 *M*	0.036 *M*

$pH = 14.00 - pOH = 14.00 + \log(0.036) = 12.6$

Asam Lemah (HA) dan Konstanta Ionisasi Asam

$$HA\,(aq) + H_2O\,(l) \rightleftharpoons H_3O^+\,(aq) + A^-\,(aq)$$

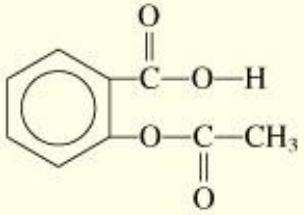
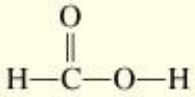
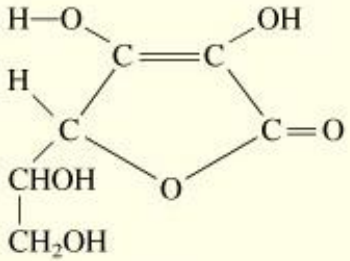
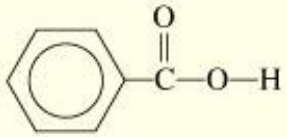
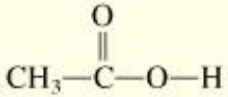
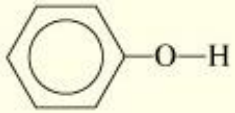
$$HA\,(aq) \rightleftharpoons H^+\,(aq) + A^-\,(aq)$$

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

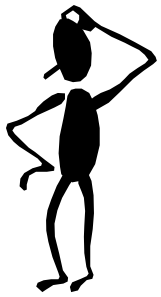
K_a adalah ***konstanta ionisasi asam***

K_a ↑ Kekuatan asam lemah ↑

TABLE 15.3 Ionization Constants of Some Weak Acids and Their Conjugate Bases at 25°C

Name of Acid	Formula	Structure	K_a	Conjugate Base	K_b
Hydrofluoric acid	HF	H—F	7.1×10^{-4}	F^-	1.4×10^{-11}
Nitrous acid	HNO_2	O=N—O—H	4.5×10^{-4}	NO_2^-	2.2×10^{-11}
Acetylsalicylic acid (aspirin)	$C_9H_8O_4$		3.0×10^{-4}	$C_9H_7O_4^-$	3.3×10^{-11}
Formic acid	HCOOH		1.7×10^{-4}	$HCOO^-$	5.9×10^{-11}
Ascorbic acid*	$C_6H_8O_6$		8.0×10^{-5}	$C_6H_7O_6^-$	1.3×10^{-10}
Benzoic acid	C_6H_5COOH		6.5×10^{-5}	$C_6H_5COO^-$	1.5×10^{-10}
Acetic acid	CH_3COOH		1.8×10^{-5}	CH_3COO^-	5.6×10^{-10}
Hydrocyanic acid	HCN	H—C≡N	4.9×10^{-10}	CN^-	2.0×10^{-5}
Phenol	C_6H_5OH		1.3×10^{-10}	$C_6H_5O^-$	7.7×10^{-5}

*For ascorbic acid it is the upper left hydroxyl group that is associated with this ionization constant.



What is the pH of a 0.5 *M* HF solution (at 25^0C)?

$$HF\ (aq) \rightleftharpoons H^+\ (aq) + F^-\ (aq) \qquad K_a = \frac{[H^+][F^-]}{[HF]} = 7.1 \times 10^{-4}$$

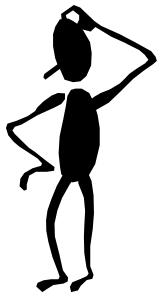
	$HF\ (aq) \rightleftharpoons$	$H^+\ (aq)$	$+\ F^-\ (aq)$
Initial (*M*)	0.50	0.00	0.00
Change (*M*)	$-x$	$+x$	$+x$
Equilibrium (*M*)	$0.50 - x$	x	x

$$K_a = \frac{x^2}{0.50 - x} = 7.1 \times 10^{-4} \qquad K_a << 1 \qquad 0.50 - x \approx 0.50$$

$$K_a \approx \frac{x^2}{0.50} = 7.1 \times 10^{-4} \qquad x^2 = 3.55 \times 10^{-4} \qquad x = 0.019\ M$$

$[H^+] = [F^-] = 0.019\ M$ $\qquad$ $pH = -\log [H^+] = 1.72$

$[HF] = 0.50 - x = 0.48\ M$



When can I use the approximation?

$K_a << 1 \quad 0.50 - x \approx 0.50$

When x is less than 5% of the value from which it is subtracted.

$x = 0.019 \qquad \frac{0.019\ M}{0.50\ M} \times 100\% = 3.8\%$

Less than 5%

Approximation ok.

What is the pH of a 0.05 *M* HF solution (at 25^0C)?

$$K_a \approx \frac{x^2}{0.05} = 7.1 \times 10^{-4} \qquad x = 0.006\ M$$

$\frac{0.006\ M}{0.05\ M} \times 100\% = 12\%$

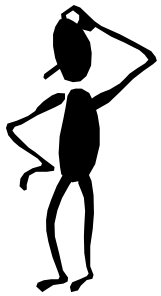
More than 5%

Approximation **not** ok.

Harus menyelesaikan x secara eksak menggunakan persamaan kuadrat atau metode pendekatan tertentu.

Memecahkan masalah ionisasi **asam lemah**:

1. Identifikasi spesi utama yang dapat mempengaruhi pH.
   - Dalam kebanyakan kasus, autoionisasi air dapat diabaikan.
   - Abaikan [OH^-] karena ditentukan oleh [H^+].
2. Gunakan ICE untuk menyatakan konsentrasi kesetimbangan dalam simbol tunggal *x* yang tidak diketahui.
3. Tulis K_a untuk konsentrasi kesetimbangan. Selesaikan *x* dengan metode perkiraan/*approximation method*. Jika perkiraan tidak valid, selesaikan *x* dengan tepat.
4. Hitung konsentrasi semua spesi dan/atau pH larutan.



What is the pH of a 0.122 *M* monoprotic acid whose K_a is 5.7×10^{-4}?

$$HA\ (aq) \rightleftharpoons H^+\ (aq) + A^-\ (aq)$$

	HA	H^+	A^-
Initial (*M*)	0.122	0.00	0.00
Change (*M*)	$-x$	$+x$	$+x$
Equilibrium (*M*)	$0.122 - x$	x	x

$$K_a = \frac{x^2}{0.122 - x} = 5.7 \times 10^{-4} \qquad K_a << 1 \qquad 0.122 - x \approx 0.122$$

$$K_a \approx \frac{x^2}{0.122} = 5.7 \times 10^{-4} \qquad x^2 = 6.95 \times 10^{-5} \qquad x = 0.0083\ M$$

$$\frac{0.0083\ M}{0.122\ M} \times 100\% = 6.8\%$$

More than 5%

Approximation **not** ok.

$$K_a = \frac{x^2}{0.122 - x} = 5.7 \times 10^{-4} \qquad x^2 + 0.00057x - 6.95 \times 10^{-5} = 0$$

$$ax^2 + bx + c = 0 \qquad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = 0.0081 \qquad x = -0.0081$$

$$HA\,(aq) \rightleftharpoons H^+\,(aq) + A^-\,(aq)$$

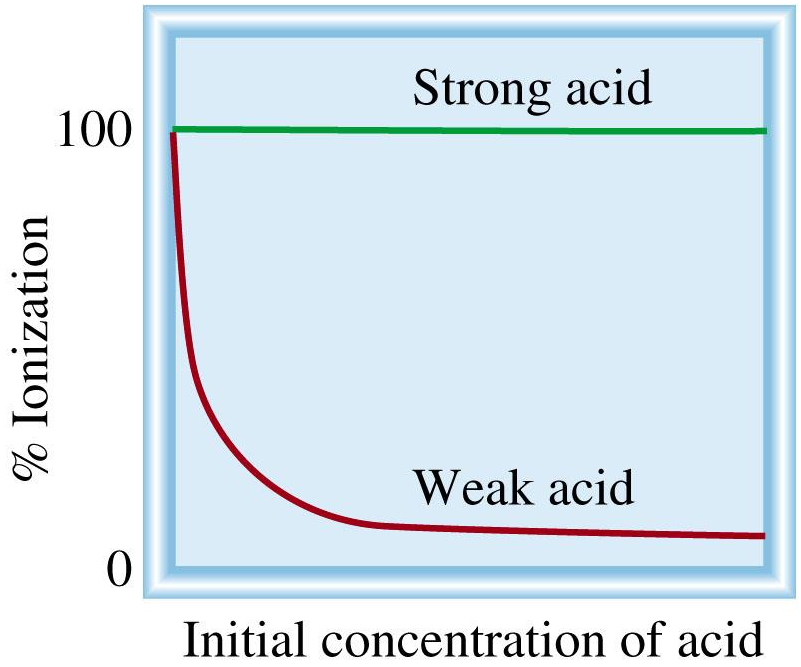
Initial (*M*)	0.122	0.00	0.00
Change (*M*)	$-x$	$+x$	$+x$
Equilibrium (*M*)	$0.122 - x$	x	x

$$[H^+] = x = 0.0081\ M \qquad pH = -\log[H^+] = 2.09$$

Persen ionisasi = $\frac{\text{Konsentrasi asam terionisasi pada kesetimbangan}}{\text{Konsentrasi awal asam}}$ x 100%

Untuk asam monoprotik HA

Persen ionisasi = $\frac{[H^+]}{[HA]_0}$ x 100% $[HA]_0$ = konsentrasi awal



Basa Lemah dan Konstanta Ionisasi Basa

$$NH_3\,(aq) + H_2O\,(l) \rightleftharpoons NH_4^+\,(aq) + OH^-\,(aq)$$

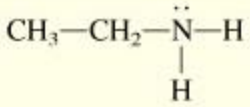
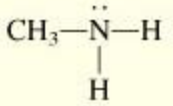
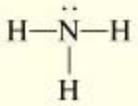
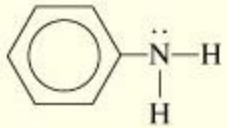
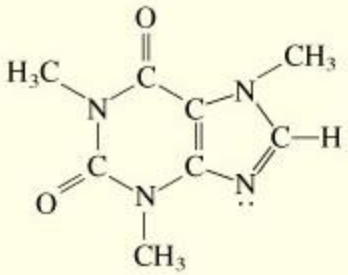
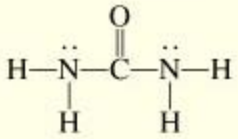
$$K_b = \frac{[NH_4^+][OH^-]}{[NH_3]}$$

K_b adalah **konstanta ionisasi basa**

K_b ↑ kekuatan basa lemah ↑

Selesaikan soal basa lemah seperti asam lemah ***kecuali*** $[OH^-]$ menggantikan $[H^+]$.

TABLE 15.4 Ionization Constants of Some Weak Bases and Their Conjugate Acids at 25°C

Name of Base	Formula	Structure	K_b*	Conjugate Acid	K_a
Ethylamine	$C_2H_5NH_2$		5.6×10^{-4}	$C_2H_5\overset{+}{N}H_3$	1.8×10^{-11}
Methylamine	CH_3NH_2		4.4×10^{-4}	$CH_3\overset{+}{N}H_3$	2.3×10^{-11}
Ammonia	NH_3		1.8×10^{-5}	NH_4^+	5.6×10^{-10}
Pyridine	C_5H_5N		1.7×10^{-9}	$C_5H_5\overset{+}{N}H$	5.9×10^{-6}
Aniline	$C_6H_5NH_2$		3.8×10^{-10}	$C_6H_5\overset{+}{N}H_3$	2.6×10^{-5}
Caffeine	$C_8H_{10}N_4O_2$		5.3×10^{-14}	$C_8H_{11}\overset{+}{N}_4O_2$	0.19
Urea	$(NH_2)_2CO$		1.5×10^{-14}	$H_2NCO\overset{+}{N}H_3$	0.67

*The nitrogen atom with the lone pair accounts for each compound's basicity. In the case of urea, K_b can be associated with either nitrogen atom.

Konstanta Ionisasi Pasangan Asam-Basa Konjugat

$$HA\,(aq) \rightleftharpoons H^+\,(aq) + A^-\,(aq) \qquad K_a$$

$$A^-\,(aq) + H_2O\,(l) \rightleftharpoons OH^-\,(aq) + HA\,(aq) \qquad K_b$$

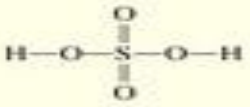
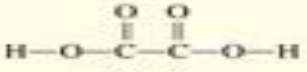
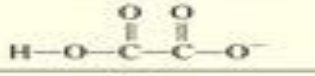
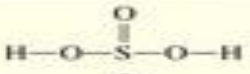
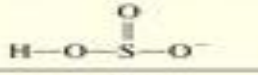
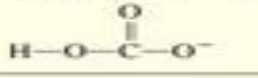
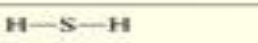
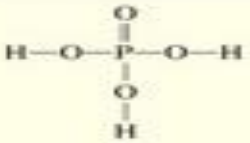
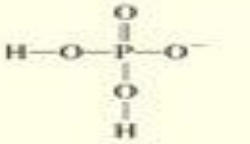
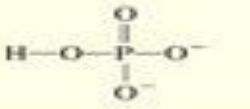
$$H_2O\,(l) \rightleftharpoons H^+\,(aq) + OH^-\,(aq) \qquad K_w$$

$$K_aK_b = K_w$$

Asam Lemah dan Basa Konjugatnya

$$K_a = \frac{K_w}{K_b} \qquad K_b = \frac{K_w}{K_a}$$

TABLE 15.5 Ionization Constants of Some Diprotic Acids and a Polyprotic Acid and Their Conjugate Bases at 25°C

Name of Acid	Formula	Structure	K_a	Conjugate Base	K_b
Sulfuric acid	H_2SO_4		very large	HSO_4^-	very small
Hydrogen sulfate ion	HSO_4^-		1.3×10^{-2}	SO_4^{2-}	7.7×10^{-13}
Oxalic acid	$C_2H_2O_4$		6.5×10^{-2}	$C_2HO_4^-$	1.5×10^{-13}
Hydrogen oxalate ion	$C_2HO_4^-$		6.1×10^{-5}	$C_2O_4^{2-}$	1.6×10^{-10}
Sulfurous acid*	H_2SO_3		1.3×10^{-2}	HSO_3^-	7.7×10^{-13}
Hydrogen sulfite ion	HSO_3^-		6.3×10^{-8}	SO_3^{2-}	1.6×10^{-7}
Carbonic acid	H_2CO_3		4.2×10^{-7}	HCO_3^-	2.4×10^{-8}
Hydrogen carbonate ion	HCO_3^-		4.8×10^{-11}	CO_3^{2-}	2.1×10^{-4}
Hydrosulfuric acid	H_2S		9.5×10^{-8}	HS^-	1.1×10^{-7}
Hydrogen sulfide ion*	HS^-		1×10^{-19}	S^{2-}	1×10^{5}
Phosphoric acid	H_3PO_4		7.5×10^{-3}	$H_2PO_4^-$	1.3×10^{-12}
Dihydrogen phosphate ion	$H_2PO_4^-$		6.2×10^{-8}	HPO_4^{2-}	1.6×10^{-7}
Hydrogen phosphate ion	HPO_4^{2-}		4.8×10^{-13}	PO_4^{3-}	2.1×10^{-2}

*H_2SO_3 has never been isolated and exists in only minute concentration in aqueous solution of SO_2. The K_a value here refers to the process $SO_2(g) + H_2O(l) \rightleftharpoons H^+(aq) + HSO_3^-(aq)$.
*The ionization constant of HS^- is very low and difficult to measure. The value listed here is only an estimate.

Struktur Molekul dan Kekuatan Asam

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

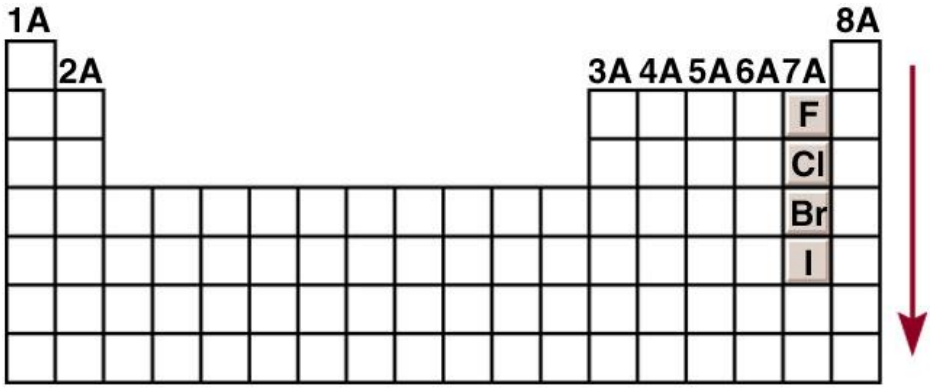
Semakin kuat ikatannya

Semakin lemah asamnya

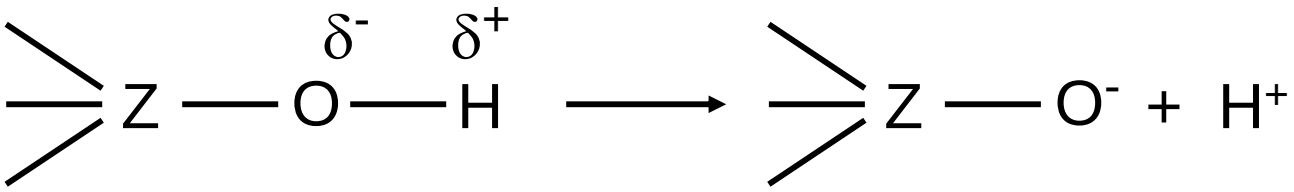
TABLE 15.6 Bond Enthalpies for Hydrogen Halides and Acid Strengths for Hydrohalic Acids

Bond	Bond Enthalpy (kJ/mol)	Acid Strength
H—F	568.2	weak
H—Cl	431.9	strong
H—Br	366.1	strong
H—I	298.3	strong

HF << HCl < HBr < HI

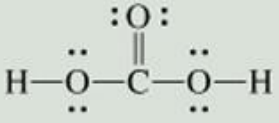


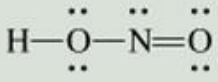
Struktur Molekul dan Kekuatan Asam

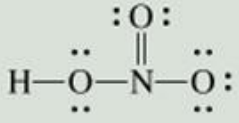


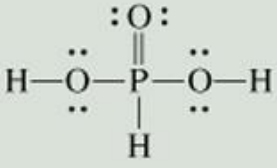
Ikatan OH akan lebih polar dan mudah putus jika:

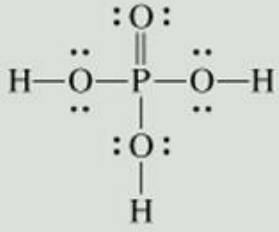
- Z sangat elektronegatif atau
- Z berada dalam bilangan oksidasi tinggi


Carbonic acid


Nitrous acid


Nitric acid


Phosphorous acid

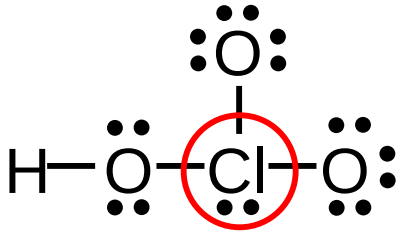

Phosphoric acid

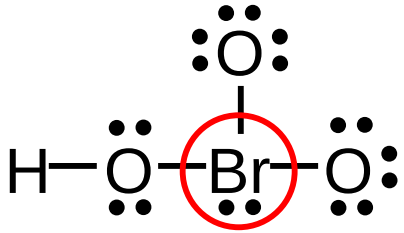

Sulfuric acid

Struktur Molekul dan Kekuatan Asam

1. Asam-asam okso yang mempunyai atom pusat **(Z) berbeda**, yang **berasal dari golongan yang sama** dan mempunyai **bilangan oksidasi yang sama**.

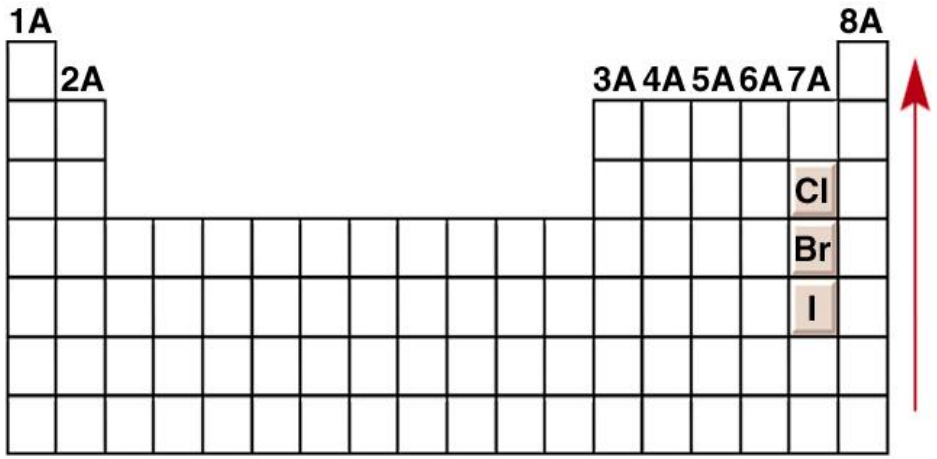
Kekuatan asam meningkat dengan meningkatnya keelektronegatifan Z





Cl lebih elektronegatif dibandingkan Br

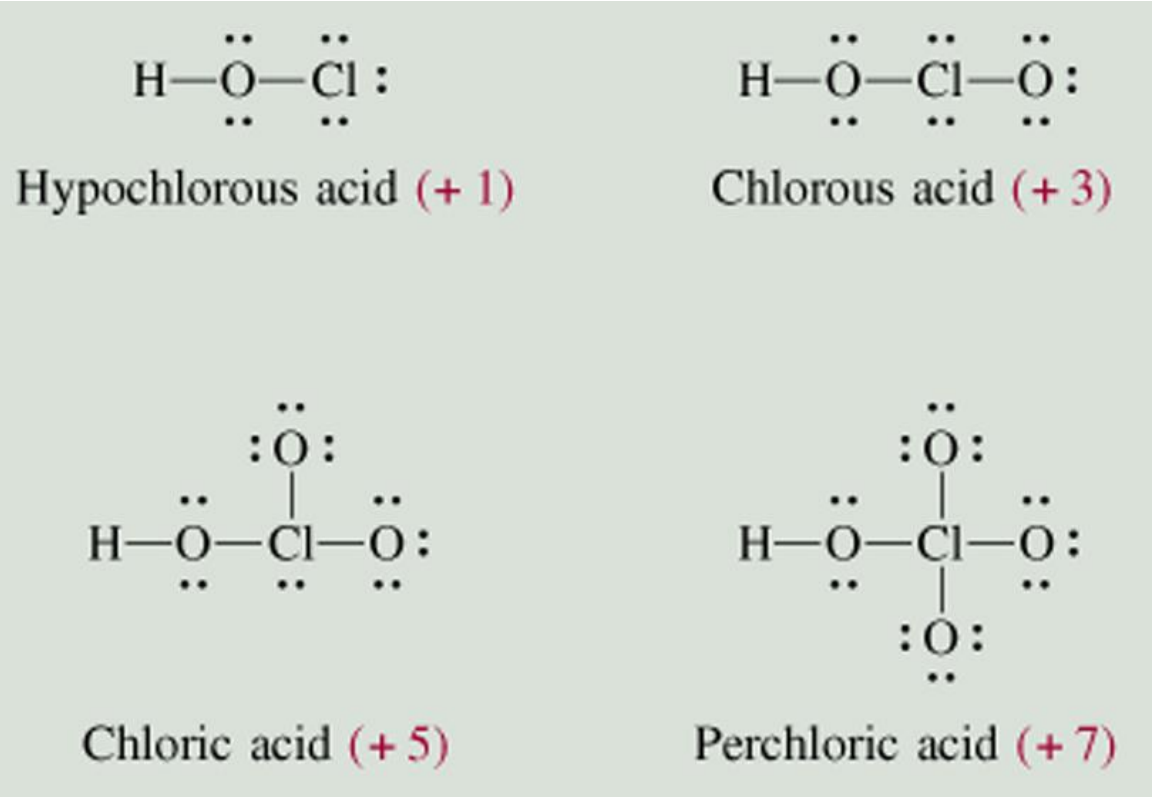
$HClO_3 > HBrO_3$



Struktur Molekul dan Kekuatan Asam

2. Asam-asam okso yang mempunyai atom pusat **(Z) yang sama** tetapi **jumlah gugus terikatnya berbeda**.

Kekuatan asam meningkat seiring dengan meningkatnya bilangan oksidasi Z.



$HClO_4 > HClO_3 > HClO_2 > HClO$

Sifat Asam-Basa Garam

Larutan Netral:

Garam yang mengandung ion logam **alkali** atau **alkali tanah** (kecuali Be^{2+}) dan **basa konjugat** dari suatu **asam kuat** (misalnya Cl^-, Br^-, dan NO_3^-).

$$NaCl\ (s) \xrightarrow{H_2O} Na^+\ (aq) + Cl^-\ (aq)$$

Larutan Basa:

Garam yang berasal dari **basa kuat** dan **asam lemah**.

$$CH_3COONa\ (s) \xrightarrow{H_2O} Na^+\ (aq) + CH_3COO^-\ (aq)$$

$$CH_3COO^-\ (aq) + H_2O\ (l) \rightleftharpoons CH_3COOH\ (aq) + OH^-\ (aq)$$

Sifat Asam-Basa Garam

Larutan Asam:

Garam berasal dari **asam kuat** dan **basa lemah**.

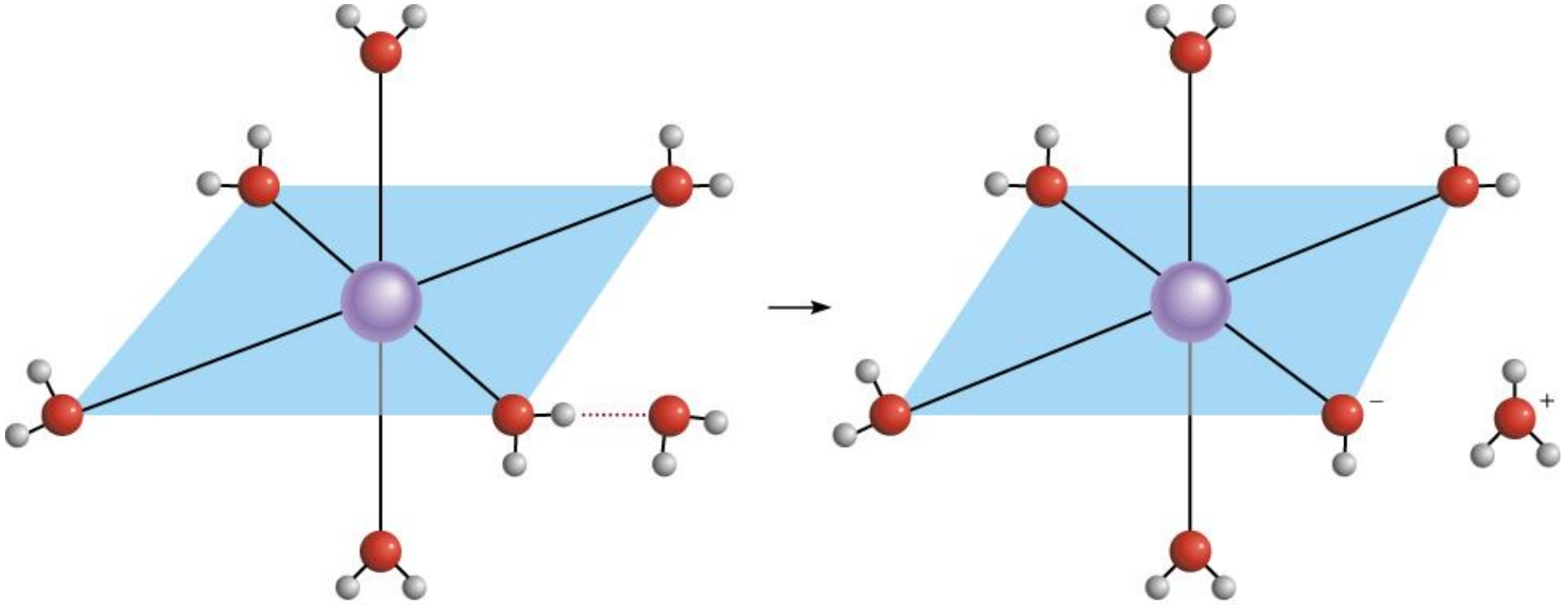
$$NH_4Cl\ (s) \xrightarrow{H_2O} NH_4^+\ (aq) + Cl^-\ (aq)$$

$$NH_4^+\ (aq) \rightleftharpoons NH_3\ (aq) + H^+\ (aq)$$

Garam dengan **kation logam kecil** dan ber**muatan tinggi** (misalnya Al^{3+}, Cr^{3+}, dan Be^{2+}) dan **basa konjugat** dari **asam kuat**.

$$Al(H_2O)_6^{3+}(aq) \rightleftharpoons Al(OH)(H_2O)_5^{2+}(aq) + H^+\ (aq)$$

Hidrolisis Asam dari Al^{3+}



Sifat Asam-Basa Garam

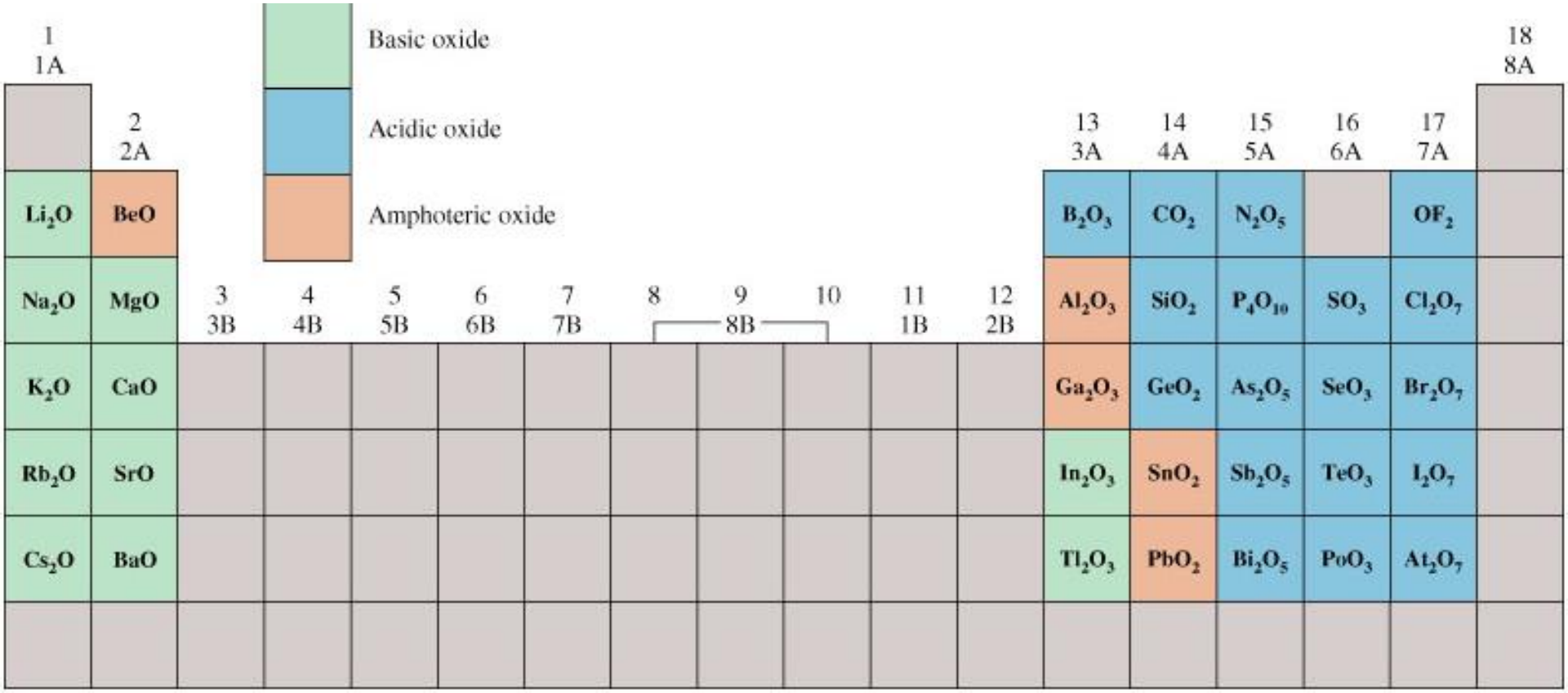
Larutan yang kedua kation maupun anionnya terhidrolisis:

- K_b untuk anion > K_a untuk kation, larutan bersifat basa
- K_b untuk anion < K_a untuk kation, larutan bersifat asam
- K_b untuk anion ≈ K_a untuk kation, larutannya netral

TABLE 15.7 Acid-Base Properties of Salts

Type of Salt	Examples	Ions That Undergo Hydrolysis	pH of Solution
Cation from strong base; anion from strong acid	NaCl, KI, KNO_3, RbBr, $BaCl_2$	None	≈ 7
Cation from strong base; anion from weak acid	CH_3COONa, KNO_2	Anion	> 7
Cation from weak base; anion from strong acid	NH_4Cl, NH_4NO_3	Cation	< 7
Cation from weak base; anion from weak acid	NH_4NO_2, CH_3COONH_4, NH_4CN	Anion and cation	< 7 if $K_b < K_a$ ≈ 7 if $K_b \approx K_a$ > 7 if $K_b > K_a$
Small, highly charged cation; anion from strong acid	$AlCl_3$, $Fe(NO_3)_3$	Hydrated cation	< 7

Oksida dari Unsur-unsur Representatif (Golongan Utama) dalam Bilangan Oksidasi Tertingginya



$$CO_2\,(g) + H_2O\,(l) \rightleftharpoons H_2CO_3\,(aq)$$

$$N_2O_5\,(g) + H_2O\,(l) \rightleftharpoons 2HNO_3\,(aq)$$

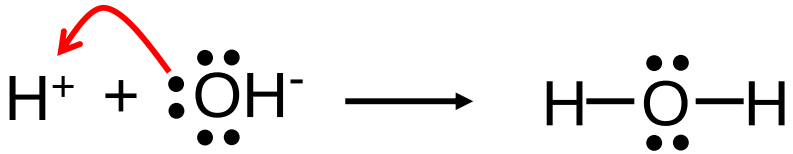
Pengertian Asam

Asam Arrhenius adalah zat yang menghasilkan H^+ (H_3O^+) di dalam air

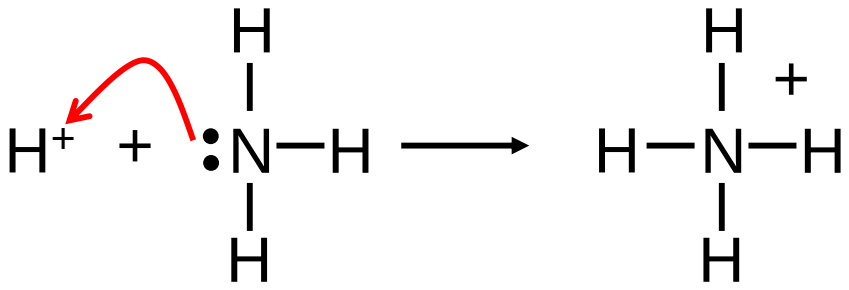
Asam Brønsted adalah pendonor proton

Asam Lewis adalah zat yang dapat menerima sepasang elektron

Basa Lewis adalah zat yang dapat mendonorkan sepasang elektron

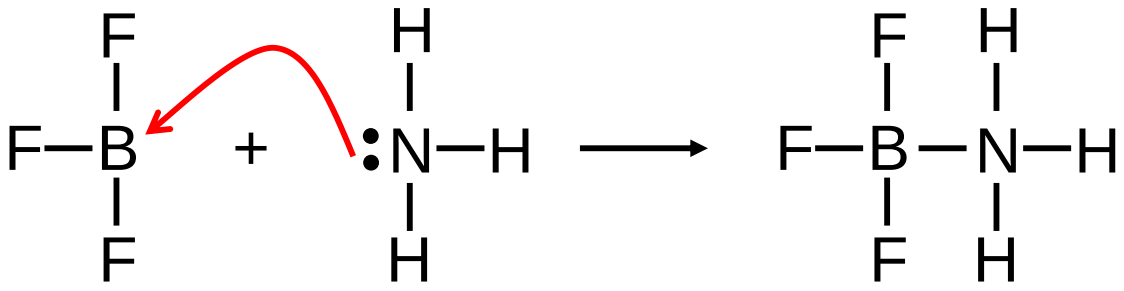


asam basa



asam basa

Asam dan Basa Lewis



asam basa

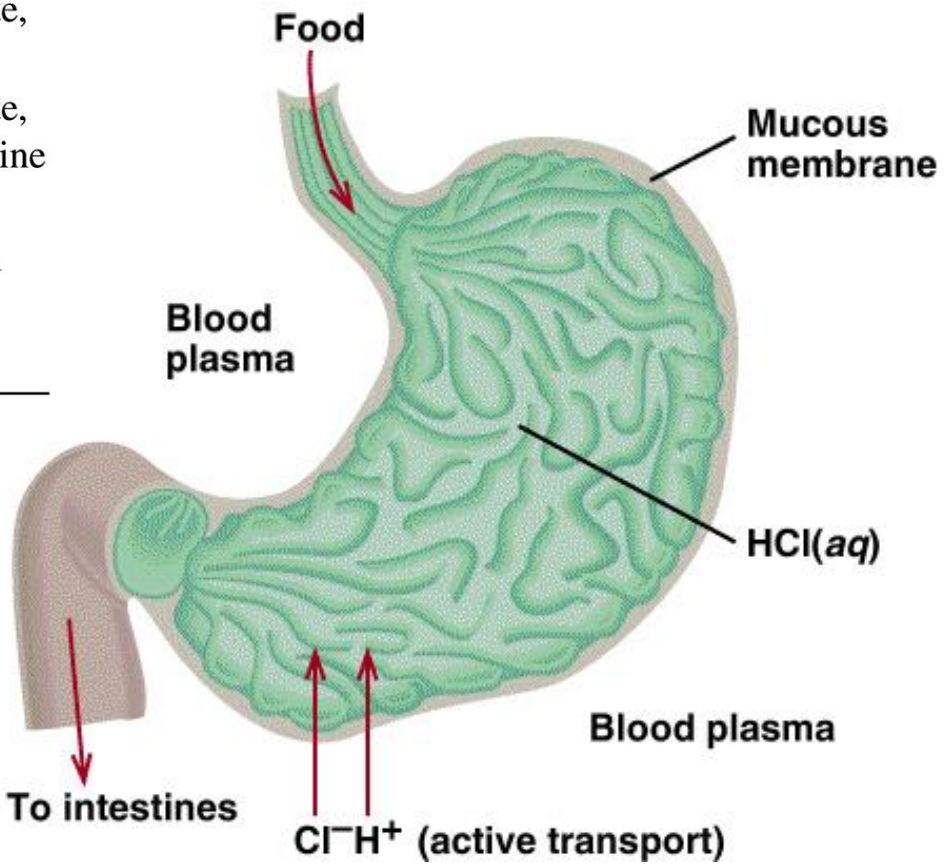
Tidak ada proton yang didonorkan atau diterima!

Kimia “in Action”: Antasida dan Keseimbangan pH Lambung

Some Common Commercial Antacid Preparations

Commercial Name	Active Ingredients
Alka-2	Calcium carbonate
Alka-Seltzer	Aspirin, sodium bicarbonate, citric acid
Bufferin	Aspirin, magnesium carbonate, aluminum glycinate
Buffered aspirin	Aspirin, magnesium carbonate, aluminum hydroxide-glycine
Milk of magnesia	Magnesium hydroxide
Rolaids	Dihydroxy aluminum sodium carbonate
Tums	Calcium carbonate

$$NaHCO_3\,(aq) + HCl\,(aq) \longrightarrow NaCl\,(aq) + H_2O\,(l) + CO_2\,(g)$$



$$Mg(OH)_2\,(s) + 2HCl\,(aq) \longrightarrow MgCl_2\,(aq) + 2H_2O\,(l)$$