

VII QUÍMICA

20

Ácido-base

• Equilibrio.

$$aA + bB \rightleftharpoons cC + dD \quad Q = \frac{\Sigma C^c \Sigma D^d}{\Sigma A^a \Sigma B^b}$$

$$K = \exp \left\{ -\frac{\Delta G^\circ}{RT} \right\}$$

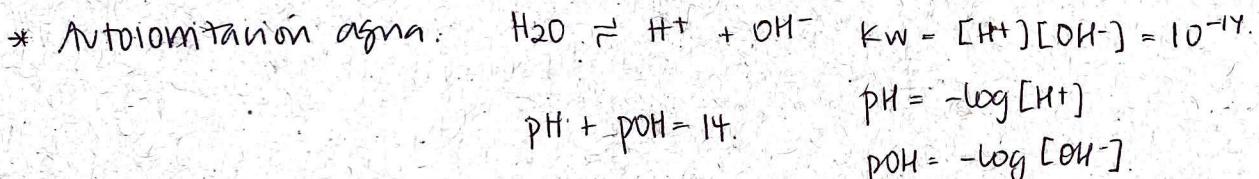
$Q/K > 1$; $\Delta G > 0$: imposible

$Q/K = 1$; $\Delta G = 0$: equilibrio.

$Q/K < 1$; $\Delta G < 0$: espontánea.

• Ácido: sust. que "cede" protones

Base: sust. que capta protones.



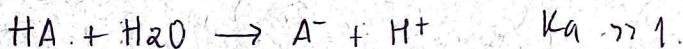
* Balances masa: conc. analítica = suma conc. equilibrio.

carga: $\sum []^+ \cdot \text{carga} = \sum []^- \cdot \text{carga}$.

protónico: $\sum [] \text{cedido prot} = \sum [] \text{captado prot}$.

• Ácidos fuertes

$$K_a \cdot K_b = K_w$$

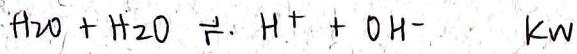
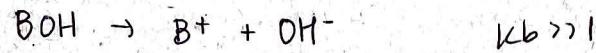


$$\text{BM: } CH_A = [A^-]$$

$$[H^+] = CH_A + \frac{K_w}{[H^+]}$$

$$\text{BC: } [H^+] = [A^-] + [OH^-] = \text{BP}$$

• Base fuerte



$$BM: C_{BOH} = [B^+]$$

$$[OH^-] = \frac{C_{BOH} + K_w}{[OH^-]}$$

$$BC: [OH^-] = [B^+] + [H^+]$$

• Ácido débil

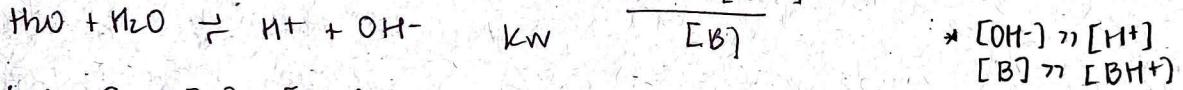
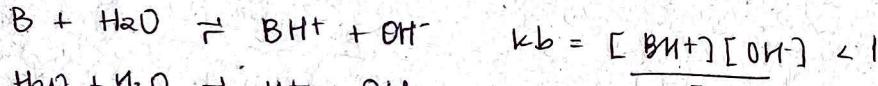


$$BM: C_{HA} = [HA] + [A^-]$$

$$[H^+] = \frac{C_{HA} \cdot K_a}{[H^+] + K_a} + \frac{K_w}{[H^+]}$$

$$BC: [H^+] = [A^-] + [OH^-]$$

• Base débil



$$BM: C_B = [B] + [BH^+]$$

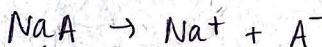
$$[OH^-] = \frac{C_B k_b}{[OH^-] + K_b} + \frac{K_w}{[OH^-]}$$

$$BC: [OH^-] = [BH^+] + [H^+]$$

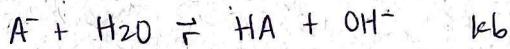
• Sales neutras: cation ion expectador B^+
 $(BA \rightarrow B^+ + A^-)$ anión ion expectador A^- .

$$pH = 7.$$

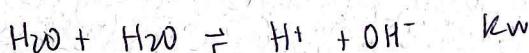
• Sales básicas cation ion exp. B^+
anión base débil



$$BM: C_{NaA} = [Na^+] = [A^-]$$



$$[A^-] = [HA] + [OH^-]$$



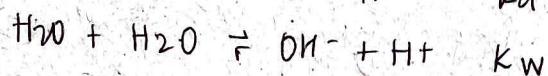
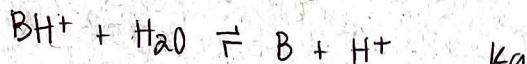
$$BC: [H^+] + [Na^+] = [A^-] + [OH^-]$$



$$BD: [OH^-] = [HA] + [H^+]. \quad BU 2020$$

• Sales ácidas

cátion ácido débil (BH^+)
amonio ion esp.



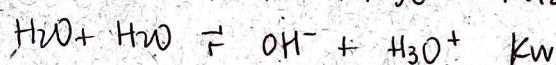
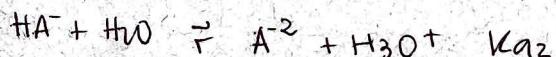
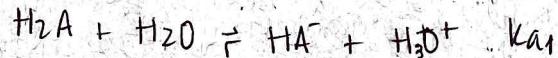
$$BM: C_{BH} = [Cl^-] = C_{BH}$$

$$C_{BH} = [BH^+] + [B]$$

$$BC: [H^+] + [BH^+] = [Cl^-] + [OH^-]$$

$$BP: [H^+] = [B] + [OH^-]$$

• Ácidos polipróticos



$$BM: C_{H_2A} = [H_2A] + [HA^-] + [A^{2-}]$$

$$BC: [H_3O^+] = [HA^-] + 2[A^{2-}] + [OH^-]$$

$$[H_2A] = \frac{C_{H_2A}}{[H_3O^+]^2 + K_{a1}[H_3O^+] + K_{a1}K_{a2}}$$

$$[HA^-] = \frac{C_{H_2A} \cdot K_{a1}[H_3O^+]}{[H_3O^+]^2 + K_{a1}[H_3O^+] + K_{a1}K_{a2}}$$

$$[A^{2-}] = \frac{C_{H_2A} \cdot K_{a1}K_{a2}}{[H_3O^+]}$$

• Buffer

A y B en cañ = [].

Mantiene pH cte.

* Ácido: ácido débil + sal base conjugada ($HA^- + NaA$)

* Básico: base débil + " ac. " ($B + BHCl$)

Henderson-Hasselbach: $pH = pK_a + \log \frac{[\text{base}]}{[\text{ácido}]}$

> Definiciones

o Molaridad: $\frac{\text{moles soluto}}{1 \text{ lit. solución}}$; $[]$; M .

* N° atómico: cant protones
N° masico: neutrones + prot.

o Molalidad: $\frac{\text{moles soluto}}{1 \text{ kg solvente}}$

o % p/p: masa soluto en 100 unidades masa solución.

o Fracción molar: $\frac{\text{moles soluto}}{1 \text{ mol solución} (\Sigma)}$

o Normalidad: $M \cdot n \left(\frac{\text{eq}}{\text{L}} \right) \quad \frac{\text{peso eq gr}}{1 \text{ litro.}}$

$$T^\circ + 273,15 = k^\circ$$

o Peso equivalente: $\frac{\text{Peso atómico (gr)}}{n \quad \text{eq.}}$

o ppm: partes soluto en 1 millón de partes de solución.

o Dureza: $[\text{Ca}^{+2}] + [\text{Mg}^{+2}] \quad \frac{\text{meq}}{\text{L}} \quad : \quad \frac{\text{mg CaCO}_3}{\text{meq}} \quad (\text{so})$

o PV = nRT.
 $R = 0,082 \frac{\text{Latm}}{\text{kmol}} \quad * \frac{760 \text{ mmHg}}{\text{atm.}} \quad 1 \text{ atm.} = 101325 \text{ Pa.}$
 $(\text{OH})_i + (\text{OH})_j + i z q_i - \text{sol.}$

> Solubilidad

amt. sólido que se puede disolver bajo cond. equilibrio.

Dep: grado ordenamiento, tamaño partículas, fuerzas intermoleculares.

nucleación ; crecimiento ; maduración.
 (supersat) (depós. iones) (precipit).

$Q < K_{sp}$ subsaturado

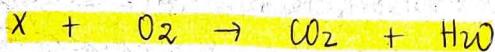
$Q > K_{sp}$ supersaturado

$Q = K_{sp}$ equilibrio.

7 Tipos enlaces

- o Iónico: metal + no metal ^{anión}
(e⁻) → (núcleo)
- o Covalentes: ≈ EN.
átomos comparten e⁻.
 - * no polar: = EN.
átomos del mismo elemento no pierden ni ganan.
NO SIMÉTRICAS.
 - * polar: ≠ EN. (+ cargas)
- o Metálico: 2 o + elementos metálicos
cación + e⁻ libres y ajenos.
red con patrones.
- o Van der Waals: mol. simétricas
atracción / repulsión entre moléculas o
interacción iones
2 dipolos permanentes:
- o Puente de hidrógeno: H + otro con mucha polaridad.
(débil) (EN)

> Combustión



$$\% \text{ rendimiento} = \frac{\text{real}}{\text{esperado}} \times 100.$$

> REDOX

Transferencia de \bar{e} .

pendida: oxidación
ganancia: reducción.

agente ox: sustrae \bar{e}
red: pierde \bar{e}

• E° OX: nivel referencia

H(+1), O(-2), N(-3).

$$\sum E\text{O}_i \times n_i = \text{carga espere.}$$

$$\text{comb. consigna} = 0 \quad (\text{N}_2, \text{O}_2)$$

* Ambientes:

red: \bar{e} disponibles

OX: pocos \bar{e} .

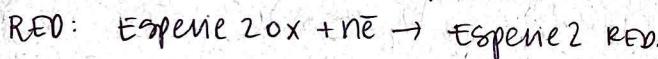
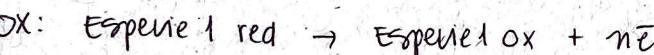
• Balance

1. n° OX, OX, red.
2. Coeficientes estquiométricos
3. Espenes
4. Oxígenos con H₂O.
5. Hidrógeno con H⁺.
6. Carga con \bar{e} .

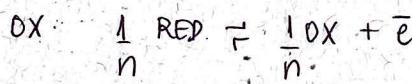
* Oxidantes: + fuerte
 $-e^\circ, +pe^\circ$

Red: + fuerte
 $+e^\circ, -pe^\circ$

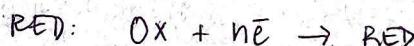
• Semirreacciones



• Constantes equilibrio



$$e^\circ = \frac{\xi_{\text{OX}}^{\text{1/m}}}{\xi_{\text{RED}}^{\text{1/m}}} : \xi \bar{e}^3$$



$$K = \frac{\xi_{\text{RED}}^3}{\xi_{\text{OX}}^3 \xi \bar{e}^{3n}}$$

$$\log K = \frac{n (pe^\circ)}{} \text{ RED} - \frac{-n (pe^\circ)}{} \text{ OX}$$

$$pe = pe^\circ + \frac{1}{n} \log \frac{\xi_{\text{OX}}^3}{\xi_{\text{RED}}^3} \quad (\text{NERNST})$$