QUÍMICA ANALÍTICA III. SEM. 2020-1 **26.09.19**
EXAMEN: ACIDEZ CONDICIONAL.
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Trazar sendos DLTE para los sistemas indicados para la siguiente entidad química HB^0, MM = 130:

$$K_{HB}^{H} = 10^{4}; K_{H_2B+}^{2H} = 10^{14}$$

1.0 DLTES iónica: pKs $H_2BClO_4\downarrow$ = 10; (n_0/V_0) = 0.1 mol/L, $pClO_4$ = 0.

2.0 DLTES molecular: S_{max} = 0.13 mg/L; (n_0/V_0) = 0.1 mol/L.

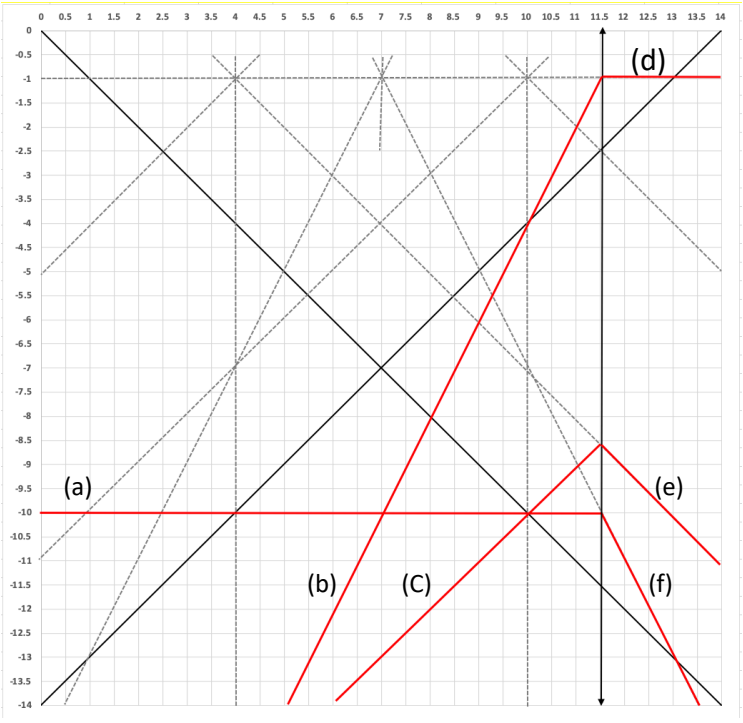
3.0 DLTED: log K_D = 2.0, (pVo/Va) = 0. (n_0/V_0) = 0.01 mol/L

4.0 DLTEII: R-H, C_I = 5 mmol/g; $K_I = K_H^{H_2B^+}$ = 20; p(m/V) = 0; (n_0/V_0) = 0.01 mol/L.

Entregar sendos diagramas en tinta, en papel milimetrado, fechado, QAIII, Apellido con MAYUSCULAS Y LETRA DE MOLDE. Limpio. Con sendos títulos de cada recta.

RESOLUCION BREVE (Borrador 1)

1,0 DLTESI: diagrama logarítmico de transisión de estado de solubilidad iónica.



En medio heterogéneo a $pClO_4 = 0$:

(a) $H_2BClO_4 \downarrow \rightleftharpoons H_2B^+ + ClO_4^-$

$Ks = [H_2B^+]\left(1\frac{mol}{L}\right) = 10^{-10}$

$\boldsymbol{log[H_2B^+] = -10}$

(b) $H_2BClO_4 \downarrow \rightleftharpoons H_2B^+ + ClO_4^-$ $\quad Ks = 10^{-10}$

$H_2B^+ \rightleftharpoons B^- + 2H^+$ $\quad K_{2H}^{H_2B} = 10^{-14}$

$H_2BClO_4 \downarrow \rightleftharpoons B^- + 2H^+ + ClO_4^-$ $\quad K_{sgbl} = 10^{-24}$

$K_{gbl} = 10^{-24} = [B][H^+]^2\left(1\frac{mol}{L}\right)$

$\boldsymbol{log[B^-] = 12 - 2pH}$

(c) $H_2BClO_4 \downarrow \rightleftharpoons H_2B^+ + ClO_4^-$ $\quad Ks = 10^{-10}$

$H_2B^+ \rightleftharpoons HB + H^+$ $\quad K_{HB}^{H} = 10^{-10}$

$H_2BClO_4 \downarrow \rightleftharpoons BH + H^+ + ClO_4^-$ $\quad K_{sgbl} = 10^{-20}$

$K_{gbl} = 10^{-20} = [HB][H^+]\left(1\frac{mol}{L}\right)$

$\boldsymbol{log[HB] = 20 - pH}$

En medio homogéneo:

(d) $\boldsymbol{log[B^-] = log\,Co - log[1 + 10^{4-pH} + 10^{14-2pH}] \approx log\,Co}$

$\boldsymbol{log[B^-] \approx log\,Co}$

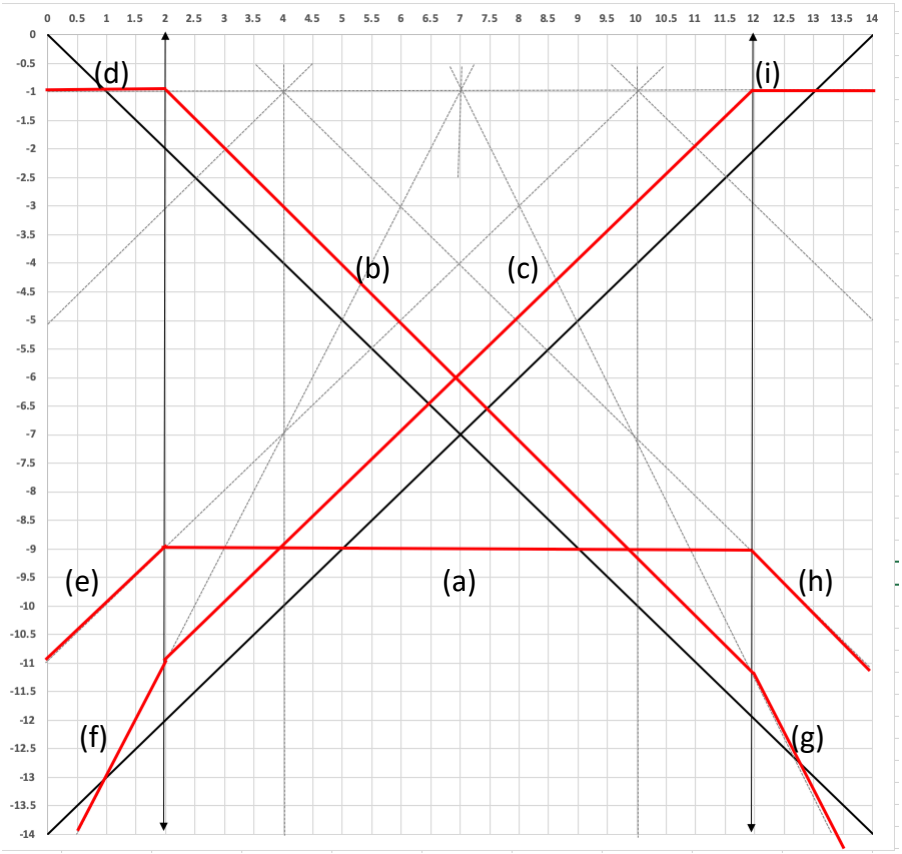
(e) $\boldsymbol{log[HB] = log\,Co - log[1 + 10^{4-pH} + 10^{14-2pH}] + log(10^{4-pH})}$

$\boldsymbol{log[HB] \approx log\,Co + 4 - pH}$

(f) $\boldsymbol{log[H_2B^+] = log\,Co - log[1 + 10^{4-pH} + 10^{14-2pH}] + log(10^{14-2pH})}$

$\boldsymbol{log[H_2B^+] \approx log\,Co + 14 - 2pH}$

2,0 DLTESM: Diagrama logarítmico de transición de estado molecular.



En medio heterogéneo a $p(n_0/V_0) = 1$:

(a) $S_{max} = 1\,x\,10^{-6}\,\frac{mol}{L} = [H_2B^+] + [HB] + [B] \approx \frac{S_{max}}{2} + 10^{-9} + \frac{S_{max}}{2}$

$S_o = 10^{-9}\,mol/L$

$HB\downarrow \rightleftharpoons HB \qquad K = S_o$

$\boldsymbol{log\,S_o = -9}$

(b) $HB\downarrow \rightleftharpoons HB \qquad K = S_o = 10^{-9}$

$HB + H^+ \rightleftharpoons H_2B^+ \qquad K^H_{H_2B^+} = 10^{10}$

$HB\downarrow + H^+ \rightleftharpoons H_2B^+ \qquad K_{sgbl} = 10^1$

$K_{sgbl} = \frac{[H_2B^+]}{[H^+]} = \frac{[H_2B^+]}{10^{-pH}}$

$\boldsymbol{log[H_2B^+] = 1 - pH}$

(c) $HB \downarrow \rightleftharpoons HB \qquad K = S_o = 10^{-9}$

$HB \rightleftharpoons B^- + H^+ \qquad K_H^{HB} = 10^{-4}$

$HB \downarrow \rightleftharpoons B^- + H^+ \qquad K_{sgbl} = 10^{-13}$

$$K_{sgbl} = [B^-][H^+] = [B^-]10^{-pH}$$

$$\boldsymbol{log[B^-] = -13 + pH}$$

En medio homogéneo a $p(n_0/V_0) = 1$:

(d) $$\boldsymbol{log[H_2B^+] = log\ Co - log\left[1 + 10^{4-pH} + 10^{14-2pH}\right] + log\left(10^{14-2pH}\right)}$$

$$\boldsymbol{log[H_2B^+] \approx log\ Co}$$

(e) $$\boldsymbol{log[HB] = log\ Co - log[1 + 10^{4-pH} + 10^{14-2pH}] + log(10^{4-pH})}$$

$$\boldsymbol{log[HB] \approx log\ Co - 10 + pH}$$

(f) $$\boldsymbol{log[B^-] = log\ Co - log[1 + 10^{4-pH} + 10^{14-2pH}]}$$

$$\boldsymbol{log[B^-] = log\ Co - 14 + 2pH}$$

(g) $$\boldsymbol{log[H_2B^+] = log\ Co - log\left[1 + 10^{4-pH} + 10^{14-2pH}\right] + log\left(10^{14-2pH}\right)}$$

$$\boldsymbol{log[H_2B^+] = log\ Co + 14 - 2pH}$$

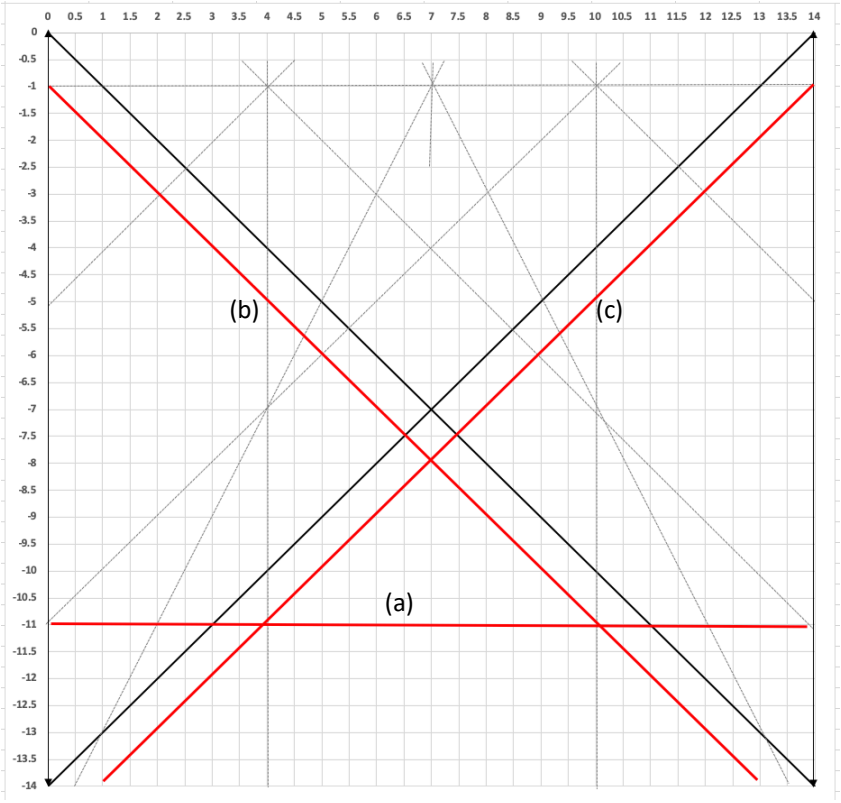
(h) $$\boldsymbol{log[HB] = log\ Co - log[1 + 10^{4-pH} + 10^{14-2pH}] + log(10^{4-pH})}$$

$$\boldsymbol{log[HB] = log\ Co + 4 - pH}$$

(i) $$\boldsymbol{log[B^-] = log\ Co - log[1 + 10^{4-pH} + 10^{14-2pH}]}$$

$$\boldsymbol{log[B^-] \approx log\ Co}$$

3,0 DLTED: Diagrama logarítmico de transición de estado de distribuión.



En medio heterogéneo a p(V_{org}/V_{ac}) = 0:

(a) $HB \rightleftarrows (HB)_{org}$ $\qquad K_D = \frac{[HB]_{org}}{[HB]} = 10^2$

$K_D = \frac{[HB]_{org}}{[HB]} = 10^2 = \frac{10^{-9}}{[HB]}$

$$\boldsymbol{log[HB] = -11}$$

(b) $HB \rightleftarrows (HB)_{org}$ $\qquad K_D = 10^2$

$H_2B^+ \rightleftharpoons HB + H^+$ $\qquad K_H^{H_2B^+} = 10^{-10}$

$H_2B^+ \rightleftharpoons (HB)_{org} + H^+$ $\qquad K_{Dgbl} = 10^{-8}$

$K_{Dgbl} = 10^{-8} = \frac{[HB]_{org}[H^+]}{[H_2B^+]} = \frac{10^{-9}[10^{-pH}]}{[H_2B^+]}$

$$\boldsymbol{log[H_2B^+] = -1 - pH}$$

(c) $HB \rightleftarrows (HB)_{org}$ $\quad K_D = 10^2$

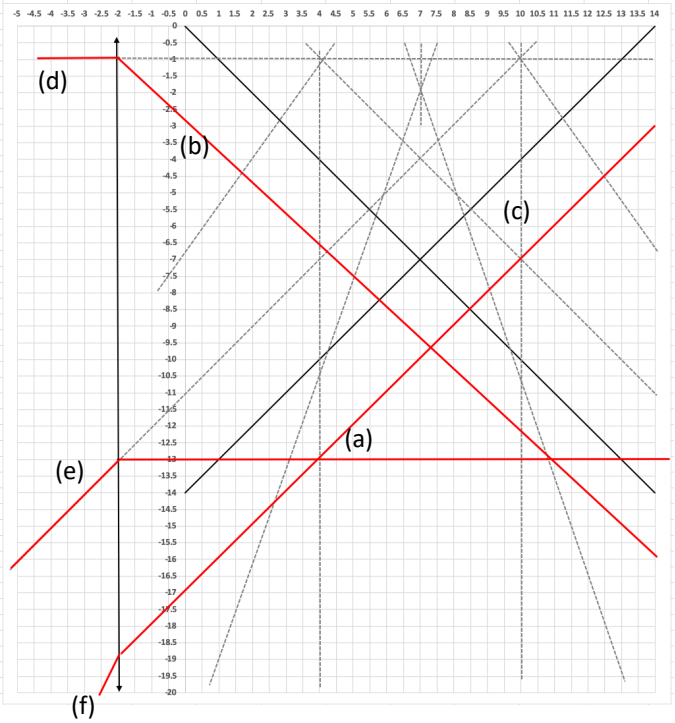
$B^- + H^+ \rightleftharpoons HB$ $\quad K_H^{HB} = 10^4$

$B^- + H^+ \rightleftarrows (HB)_{org}$ $\quad K_{Dgbl} = 10^6$

$$K_{Dgbl} = 10^6 = \frac{[HB]_{org}}{[B^-][H^+]} = \frac{10^{-9}}{[B^-][10^{-pH}]}$$

$$\boldsymbol{log[B^-] = -15 + pH}$$

4.0 DLTEII: Diagrama logarítmico de transición de estado de intercambio iónico.



En medio heterogéneo a p(V_0/m) = 0, C_I = 5 mmol/g:

(a)

$H_2B^+ + (H^+)_r \rightleftharpoons (H_2B^+)_r + H^+$ $\quad K_I = 10^{1.3}$

$HB + H^+ \rightleftharpoons H_2B^+$ $\quad K_{H_2B^+}^H = 10^{10}$

$HB + (H^+)_r \rightleftharpoons (H_2B^+)_r$ $\quad K_{Igbl} = 10^{11.3}$

$$K_{Igbl} = \frac{[H_2B^+]_r}{[HB][H^+]_r} = \frac{Co}{[HB]C_I} = 10^{11.3}$$

$$\boldsymbol{log[HB] = -13}$$

(b) $H_2B^+ + (H^+)_r \rightleftharpoons (H_2B^+)_r + H^+$ $\quad K_I = 10^{1.3}$

$$K_I = \frac{[H_2B^+]_r\,[H^+]}{[H_2B^+][H^+]_r} = \frac{Co10^{-pH}}{[H_2B^+]C_I} = 10^{1.3}$$

$$\boldsymbol{log[H_2B^+] = -3 - pH}$$

(c)

$$\begin{array}{ll} H_2B^+ + (H^+)_r \rightleftharpoons (H_2B^+)_r + H^+ & K_I = 10^{1.3} \\ B^- + 2H^+ \rightleftharpoons H_2B^+ & K^{2H}_{H_2B^+} = 10^{14} \\ \hline B^- + (H^+)_r + H^+ \rightleftharpoons (H_2B^+)_r & K_{Igbl} = 10^{15.3} \end{array}$$

$$K_{Igbl} = \frac{[H_2B^+]_r}{[B^-][H^+][H^+]_r} = \frac{Co}{[B^-]C_I10^{-pH}} = 10^{15.3}$$

$$\boldsymbol{log[B^-] = -17 + pH}$$

En medio homogéneo a $p(n_0/V_0) = 1$:

(d) $\boldsymbol{log[H_2B^+] \approx log\ Co}$

(e) $\boldsymbol{log[HB] \approx log\ Co - 10 + pH}$

(f) $\boldsymbol{log[B^-] \approx log\ Co - 14 + 2pH}$
