

Clase 12 11 diciembre parte B

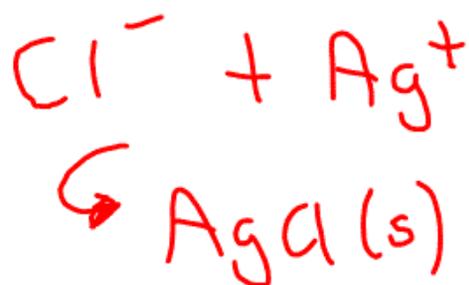
Título de la nota

11/12/2020

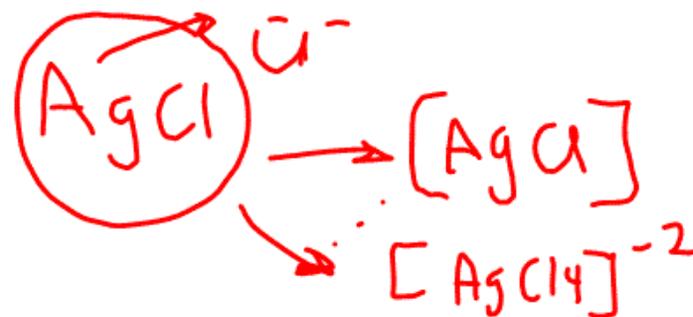
TABLA A.2d (Cont.)

Cloruro Cl^-

Ion	Fuerza iónica	Log β_1	Log β_2	Log β_3	Log β_4	Log β_5	Log β_6	Ref. núm.
Ag^+	0,2	2,9	4,7	5,0	5,9			84, 85
Ag^+	Var.	Log $[\text{Ag}_2\text{Cl}]/[\text{Ag}]^2[\text{Cl}] = 6,7$						7



$$pK_s = 9.8$$



$$K_s = 10^{-9.8}$$

$$K_s = S^2$$

$$S = \sqrt{K_s} = 10^{-9.8/2}$$

$$S = 10^{-4.9}$$

$$10^{-1}$$

$$10^{-4.9}$$

$$0.1M \leftarrow [Ag^+] = 10^{-4.9}$$

$$[a^-] = 10^{-4.9}$$

$$K_s' = [Ag^{+'}] [Cl^{-}']$$

$$\alpha_{Ag(OH)} = \frac{[Ag^{+'}]}{[Ag^{+L}]}$$

$$K_s = [Ag^{+L}] [Cl^{-}]$$

$$[Ag^{+'}] = \alpha_{Ag(OH)} [Ag^{+L}]$$

$$K_s' = \alpha_{Ag(OH)} [Ag^{+L}] \alpha_{Cl(H_3O^+)} [Cl^{-}]$$

$$K_s' = K_s \alpha_{Ag(OH)} \alpha_{Cl(H_3O^+)}$$

$$K_s' = 10^{-9.8} 10^2 = 10^{-7.8}$$

Ion metálico	Fuerza iónica	Log β_1	Log β_2	Log β_3	Log β_4	Log $K_{M_m(OH)_n}^{nOH}$
Ag ⁺	0	2,3	3,6	4,8		

$$\alpha_{Ag(OH)} = 1 + \beta_1 [OH^-] + \beta_2 [OH^-]^2 + \beta_3 [OH^-]^3$$

$$K_s = Ag(OH) = 10^{-7.6}$$

$$K_s = AgCl = 10^{-9.8}$$

7.2
 $10^{-7.2} >$ soluble
 mas soluble
 el Ag(OH)

PRECIPITACIÓN **PORTADA**

Instrucción: llenar las celdas en color amarillo, los resultados aparecen en las celdas de color verde

	Cl ⁻	+	Ag ⁺	↔	AgCl
Inicio	Co				
Agregado			xCo		
APE	Co(1-X)		~0		
PE	ECo		ECo		
DPE	~0		Co(X-1)		

Ag(OH)		HC
pKs	7.6	
β1	2.3	pKa
β2	3.6	
β3	4.8	

pH de inicio de Precipitación

Co = 0.1



pH = 7.4

Ks=	[Ag]	[OH]	=	2.51189E-08
[OH]	=	Ks	=	2.51189E-08
		[Ag]	=	0.1
			=	2.51189E-07

[OH] = 2.51189E-07

$$K_{s} = 10^{-9.8} = [Ag^{+}][Cl^{-}]$$

$$K_{s} = 10^{-7.6} = [Ag^{+}][OH^{-}]$$

$$[OH^{-}] = \frac{K_{s}}{[Ag^{+}]} = \frac{10^{-7.6}}{10^{-1}} = 10^{-6.6}$$

$$\begin{aligned} pH &= 14 + \log [B] \\ &= 14 + \log 10^{-6.6} \\ &= 14 - 6.6 = 7.4 \end{aligned}$$

$pH = 7$

$$\alpha_{Ag(OH)} = 1 + \beta_1 [OH^-] + \beta_2 [OH^-]^2 + \beta_3 [OH^-]^3$$

$$= 1 + 10^{2.3} [10^{-7}] + 10^{3.6} [10^{-7}]^2 + 10^{4.8} [10^{-7}]^3$$

$$= 1 + 10^{-4.7}$$

$$= 1.0000199$$

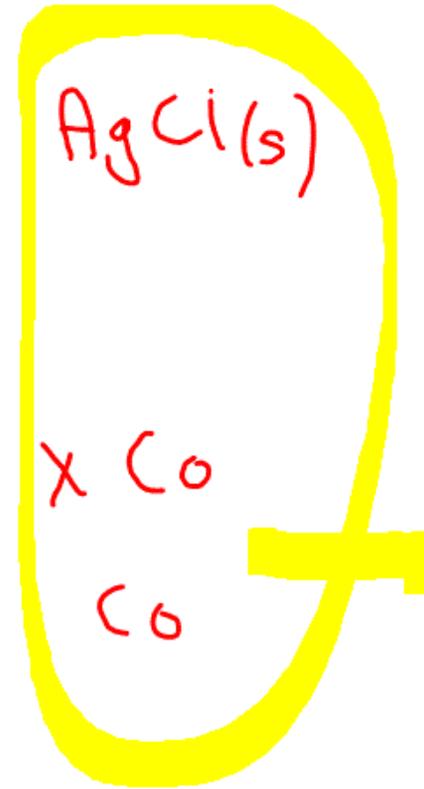
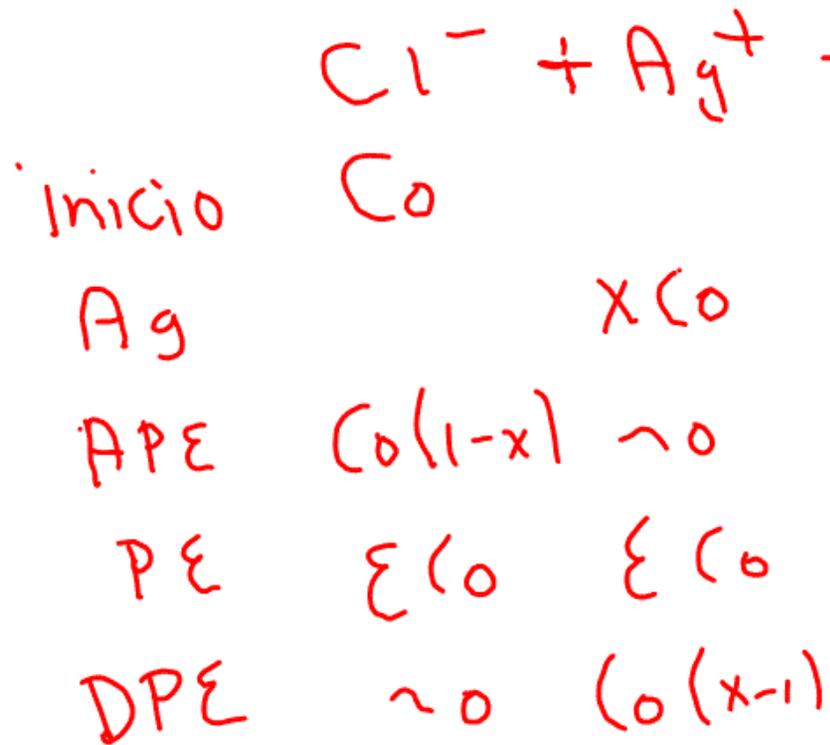
pH	=	7.00			
Ks'	=	Ks	$\alpha_{Ag(OH)}$	$\alpha_{Cl(H_3O)^+}$	
Ks'	=	1.58489E-10	1.00001995	1	
Ks'	=	1.58492E-10	LOG =	-9.8000	
			pks' =	9.8000	

$\alpha_{Ag(OH)}$	=	1	+	$\beta_1(OH)$	+	$\beta_2(OH)^2$	+	$\beta_3(OH)^3$
$\alpha_{Ag(OH)}$	=	1	+	1.99526E-05	+	3.98107E-11	+	6.30957E-17
$\alpha_{Ag(OH)}$	=	1.000019953	LOG =	8.66524E-06				

Cuantitividad	
E	= 0.01258938
%Q	= 98.74106203
No Cuantitativo	

$\alpha_{Cl(H_3O)^+}$	=	1	+	$\beta_1(H_3O)^+$
$\alpha_{Cl(H_3O)^+}$	=	1	+	6.30957E-14
$\alpha_{Cl(H_3O)^+}$	=	1	LOG =	2.73869E-14

$[] = 10^{-3}$



no se colora
en la
ecuación
por ser insoluble.

$$K_R = \frac{1}{[Ag^+][Cl^-]} \quad pH=7$$

$$\begin{aligned} K_{s'} &= K_s \alpha_{Ag(OH)} \alpha_{Cl(H_3O^+)} \\ &= 10^{-9.8} \cdot 10^0 \cdot 10^0 \\ &= 10^{-9.8} \end{aligned}$$

$$K_R = \frac{1}{[Ag^+][Cl^-]} = \frac{1}{K_s} = 10^{9.8}$$

$$10^{9.8} = \frac{1}{\epsilon \epsilon_0 \epsilon_0}$$

$$\epsilon = \sqrt{\frac{1}{k_r \epsilon_0^2}} = \sqrt{\frac{1}{10^{9.8} (10^{-1})^2}}$$

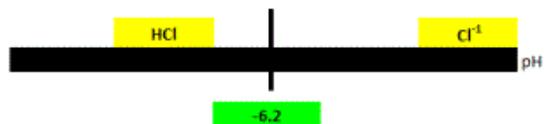
$$= \sqrt{\frac{1}{10^{7.8}}} = 10^{-7.8/2}$$

$$= 10^{-3.9}$$

$$\therefore \alpha = (1 - \epsilon) 100 = 99.98\%$$

pH = 7.00

K_s'	=	K_s	$\alpha_{Ag(OH)}$	$\alpha_{Cl(H_2O)^+}$
K_s'	=	1.58489E-10	1.00001995	1
K_s'	=	1.58492E-10	LOG =	-9.8000
			$pK_s' =$	9.8000



$\alpha_{Ag(OH)}$	=	1	+	$\beta_1(OH)$	+	$\beta_2(OH)^2$	+	$\beta_3(OH)^3$
$\alpha_{Ag(OH)}$	=	1	+	1.99526E-05	+	3.98107E-11	+	6.30957E-17
$\alpha_{Ag(OH)}$	=	1.000019953	LOG =	8.66524E-06				

$\alpha_{Cl(H_2O)^+}$	=	1	+	$\beta_1(H_2O^+)$
$\alpha_{Cl(H_2O)^+}$	=	1	+	6.30957E-14
$\alpha_{Cl(H_2O)^+}$	=	1	LOG =	2.73869E-14

Cantidad	
ϵ	= 0.000125894
$\%Q$	= 99.98741062
Cuantitativo	

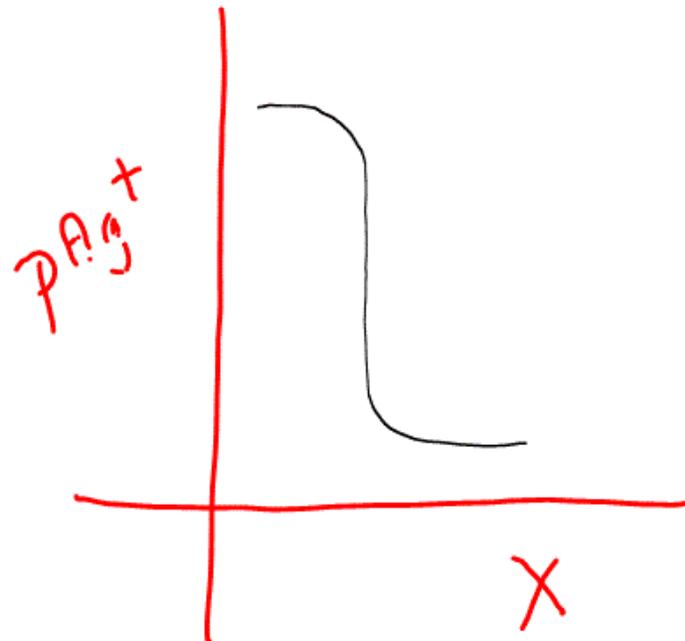
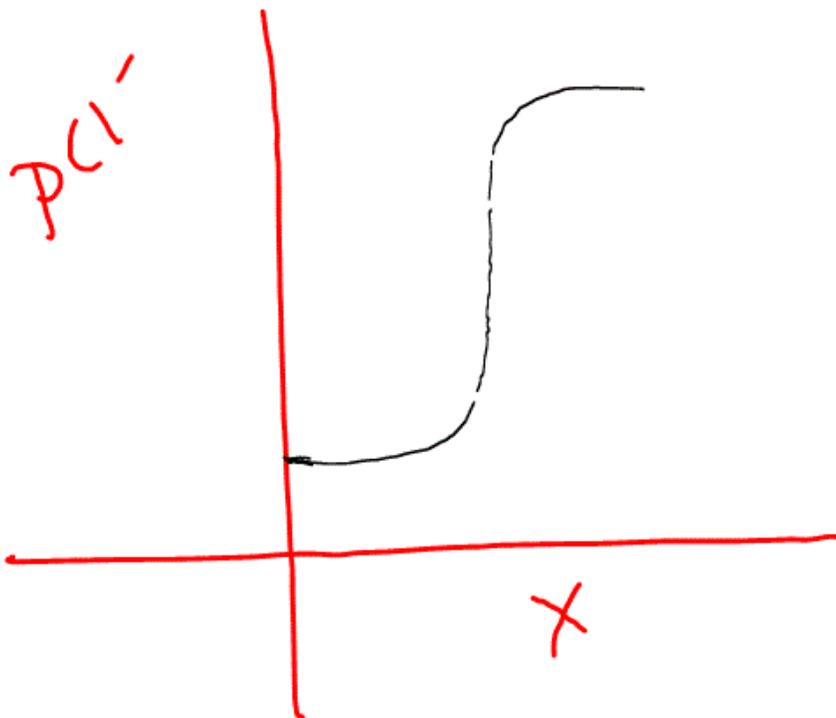


Mínimo $[] \approx 0.002 M$

$$pCl^- = -\log [Cl^-]$$

$$pAg^+ = -\log [Ag^+]$$

X	pCl ⁻	pAg ⁺
0		
0.5		
1		
1.5		
2		



$$\chi = 0$$

$$pAg^+ = \text{no calculable}$$

$$\begin{aligned} pCl^- &= -\log C_0 + \alpha_{Cl^-(H_3O^+)} \\ &= -\log 10^{-1} + \log 10^0 \\ &= 1 \end{aligned}$$

$$\chi = 0.5$$

$$\begin{aligned} pCl^- &= -\log (C_0(1-\chi)) \\ &= -\log 10^{-1}(1-0.5) \\ &= -\log 5 \times 10^{-2} = 1.3 \end{aligned}$$

$$p \text{ Ag}^+ \quad X = 0.5$$

$$K_s = K_s' = [\text{Ag}^+][\text{Cl}^-]$$

$$[\text{Ag}^+] = \frac{K_s'}{[\text{Cl}^-]} = \frac{10^{-9.8}}{C_0(1-X)}$$

$$p \text{ Ag}^+ = -\log \frac{K_s'}{[\text{Cl}^-]} = \frac{10^{-9.8}}{10^{-1}(1-0.5)}$$

$$= -\log \frac{10^{-9.8}}{10^{-1.3}} = 10^{-8.5}$$

$$= 8.5$$



$$[Ag^+]^2 = K_s$$

$$[Cl^-]^2 = K_s$$

$$pAg^+ = -\log \sqrt{K_s} = -\log 10^{-9.8/2}$$
$$= 4.9$$

$$pCl^- = -\log \sqrt{K_s} = -\log 10^{-9.8/2}$$
$$= 4.9$$

$$X = 1.5$$

pCl^-

$$[Cl^-] = \frac{Ks'}{[Ag^+]} = \frac{10^{-9.8}}{C_0(x-1)}$$

$$= \frac{10^{-9.8}}{10^{-1}(1.5-1)} = \frac{10^{-9.8}}{10^{-1.3}} = 10^{-8.5}$$

$$pCl^- = -\log 10^{-8.5}$$

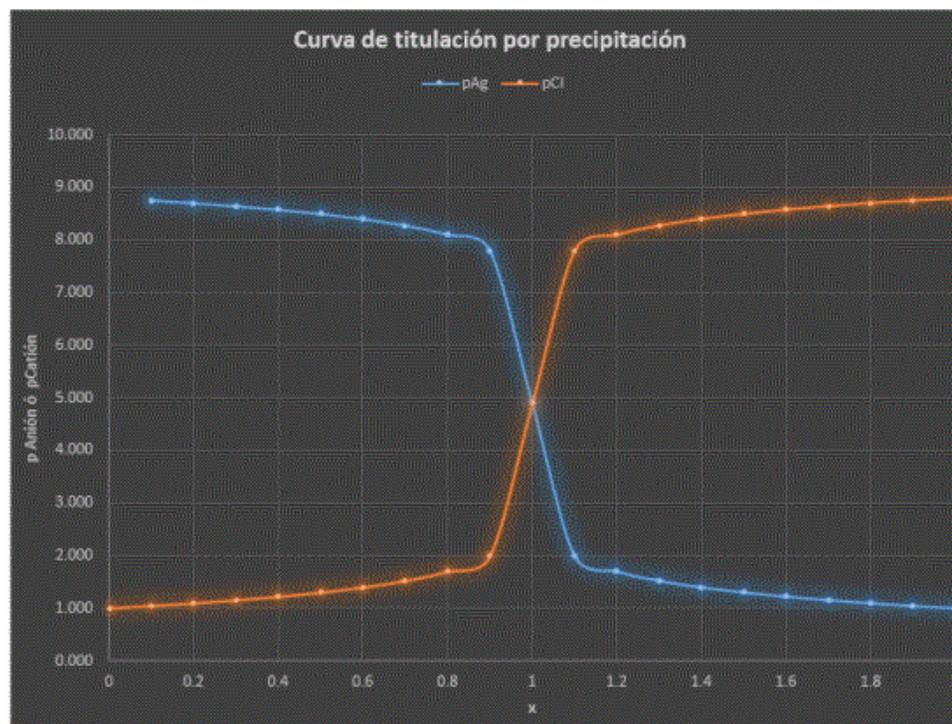
$$= 8.5$$

$$pAg^+ = -\log [Ag^+] = -\log C_0(x-1) = -\log 10^{-1}(1.5-1) = 1.3$$

$$\begin{aligned}
 \chi &= 2 \\
 pCl^- &= -\log \frac{K_s}{C_0(\chi-1)} \\
 &= -\log \frac{10^{-9.8}}{10^{-1}(2-1)} = -\log \frac{10^{-9.8}}{10^{-1}} = \\
 &= -\log 10^{-8.8} \\
 &= 8.8
 \end{aligned}$$

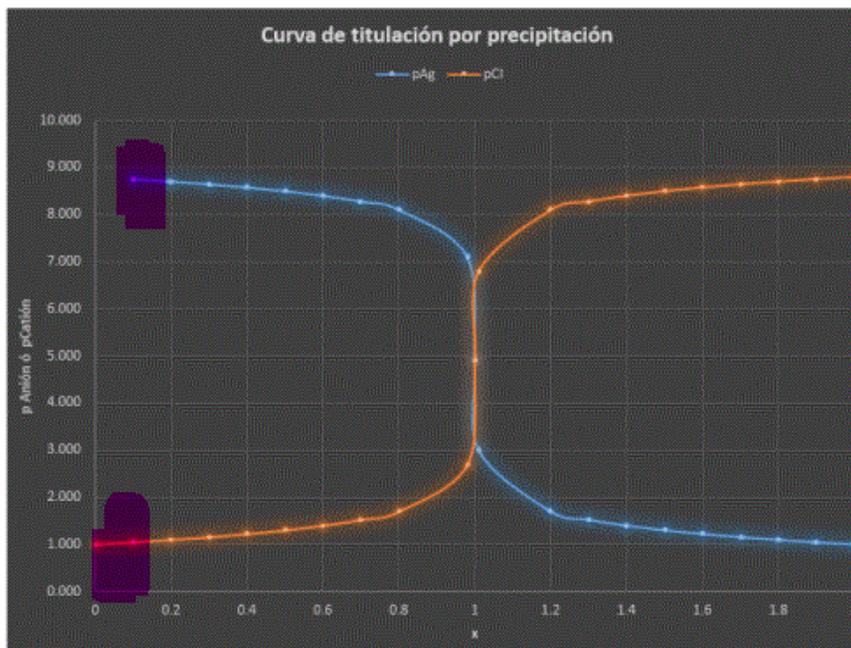
$$\begin{aligned}
 pAg^+ &= -\log [Ag^+] + \log \alpha_{Ag(OH)} \\
 &= -\log C_0(\chi-1) \\
 &= -\log 10^{-1}(2-1) = -\log 10^{-1} \\
 &= 1
 \end{aligned}$$

X	pAg	pCl
0	INCALC	1.000
0.1	8.754	1.046
0.2	8.703	1.097
0.3	8.645	1.155
0.4	8.578	1.222
0.5	8.499	1.301
0.6	8.402	1.398
0.7	8.277	1.523
0.8	8.101	1.699
0.9	7.800	2.000
1	4.900	4.900
1.1	2.000	7.800
1.2	1.699	8.101
1.3	1.523	8.277
1.4	1.398	8.402
1.5	1.301	8.499
1.6	1.222	8.578
1.7	1.155	8.645
1.8	1.097	8.703
1.9	1.046	8.754
2	1.000	8.800





X	pAg	pCl
0	INCALC	1.000
0.1	8.754	1.046
0.2	8.703	1.097
0.3	8.645	1.155
0.4	8.578	1.222
0.5	8.499	1.301
0.6	8.402	1.398
0.7	8.277	1.523
0.8	8.101	1.699
0.98	7.101	2.699
1	4.900	4.900
1.01	3.000	6.800
1.2	1.699	8.101
1.3	1.523	8.277
1.4	1.398	8.402
1.5	1.301	8.499
1.6	1.222	8.578
1.7	1.155	8.645
1.8	1.097	8.703
1.9	1.046	8.754
2	1.000	8.800

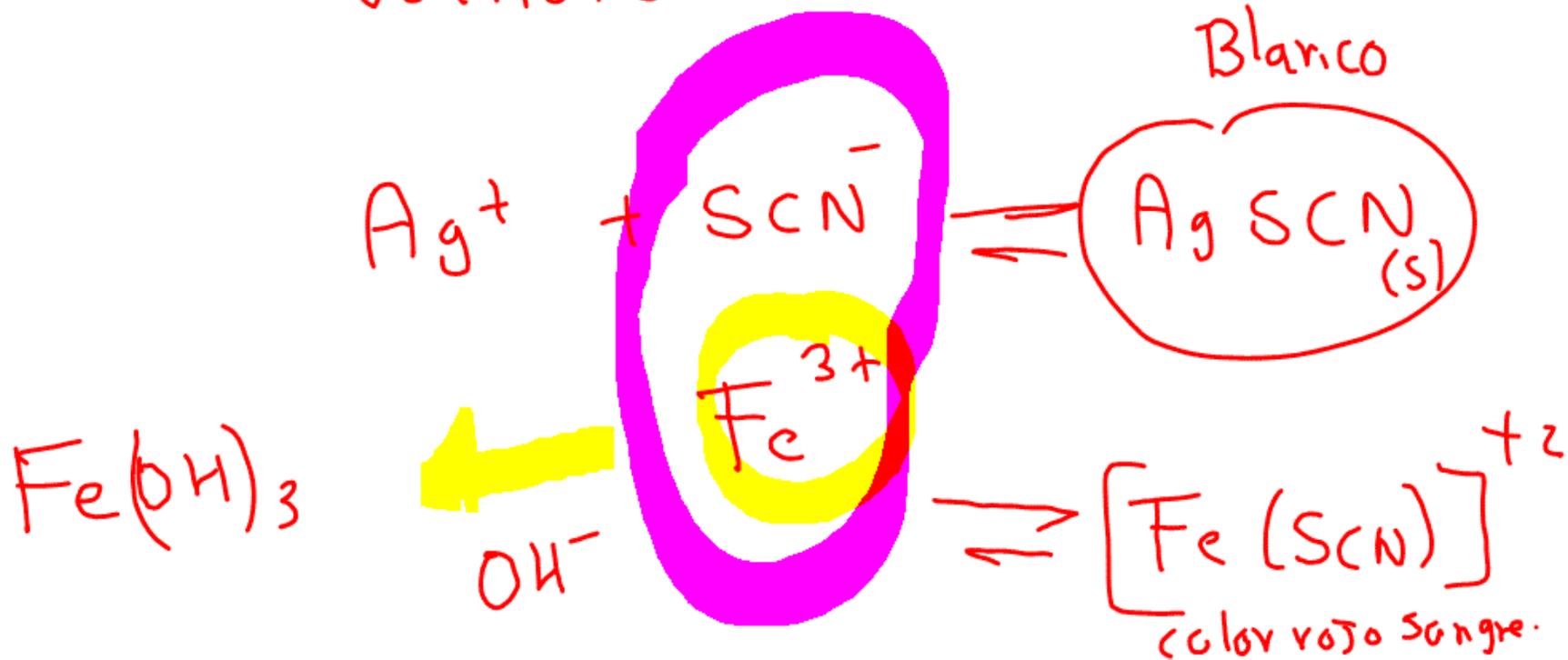


Fajans (Adsorción)

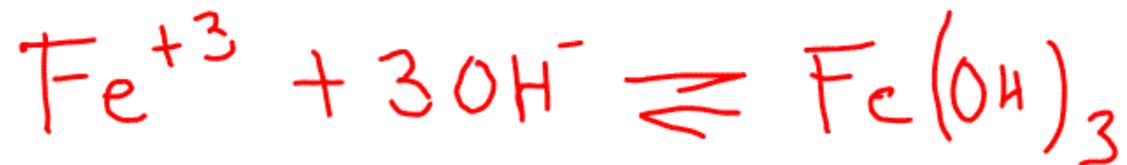
Volhard (Complejo soluble)

Mohr (precipitación de competencia)

Volhard +



$$K_s = \text{Fe}(\text{OH})_3 = 10^{-38.55}$$



$$K_s = [\text{Fe}^{3+}] [\text{OH}^-]^3$$

$$[\text{OH}^-] = \sqrt[3]{\frac{10^{-38.55}}{[\text{Fe}^{3+}]}}$$

$$[\text{Fe}^{3+}] = 10^{-3}$$

$$[\text{OH}^-] = \sqrt[3]{\frac{10^{-38.55}}{10^{-3}}} = 10^{-35.55/3}$$

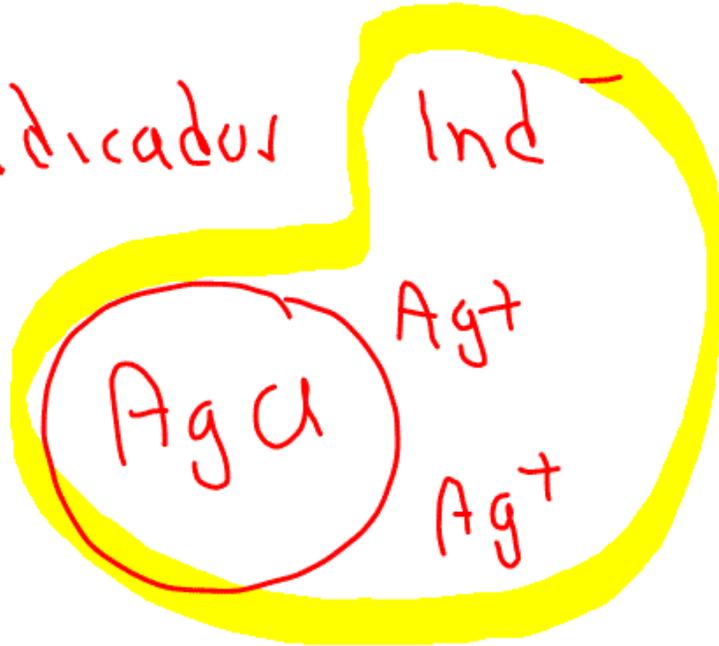
$$[\text{OH}^-] = 10^{-11.85}$$

$$\begin{aligned} \text{pH} &= 14 + \log [\text{OH}^-] \\ &= 14 + \log 10^{-11.85} \\ &= \underline{\underline{2.15}} \end{aligned}$$

Fajans Adsorción

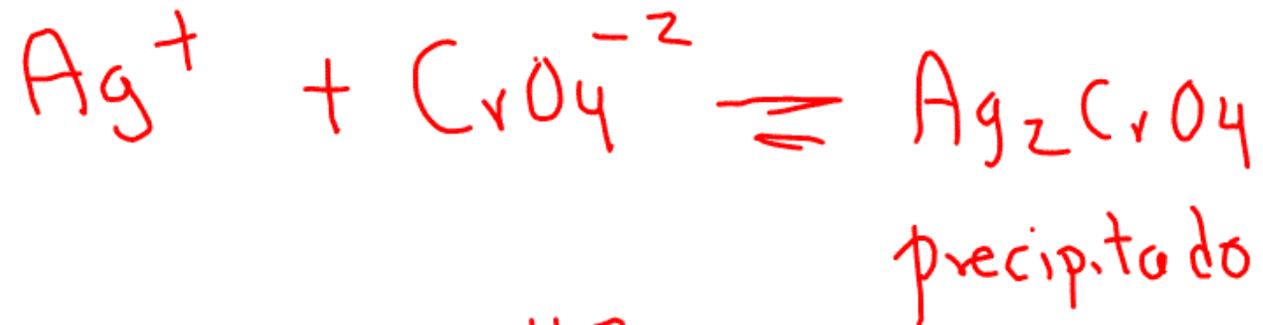
Indicador

Ind⁻



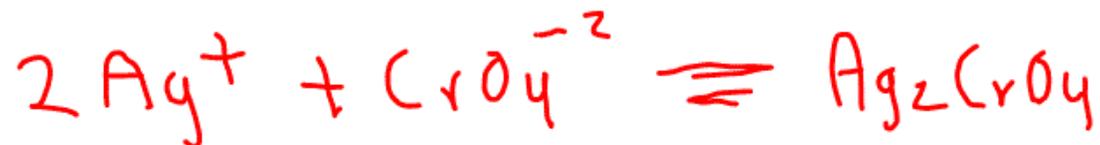
Rosa
intenso

Mohr



$$K_s \text{ Ag}_2\text{CrO}_4 = 10^{-11.3}$$

$$\text{AgCl} = 10^{-9.8} \quad s = \sqrt{K_s} = 10^{-4.9}$$



$$2s \quad s$$

$$4s^3 = K_s$$

$$V_s = 4s^3$$

$$s = \sqrt[3]{\frac{V_s}{4}} = \sqrt[3]{\frac{10^{-11.3}}{10^{0.6}}} = 10^{-11.9/3}$$

$$s = 10^{-3.96}$$

