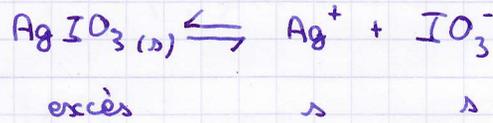
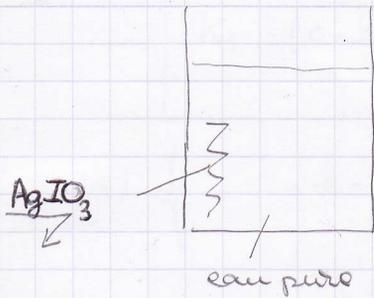


SA3. Equilibres de précipitation

Ex SA3_4:

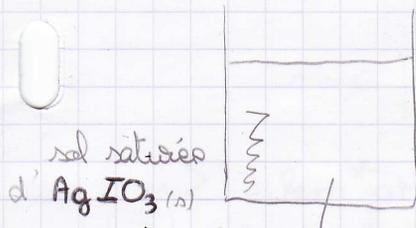
1) a-



$$K_s = [\text{Ag}^+][\text{IO}_3^-] \quad K_s = s^2$$

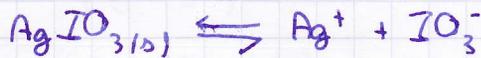
$$s = \sqrt{K_s} = \sqrt{10^{-8} K_s} \quad s = \underline{1,8 \times 10^{-4} \text{ mol} \cdot \text{L}^{-1}}$$

b-



iodate de potassium
 $\text{K}^+_{(aq)}, \text{IO}_3^-_{(aq)}, C_0$

$C_0 = 3,5 \times 10^{-7}$



excès 0 C_0
 excès s' $C_0 + s'$

Hyp: $s' < s \ll C_0$

$\rightarrow C_0 + s' \approx C_0$

$\rightarrow K_s = [\text{Ag}^+][\text{IO}_3^-] \approx s' \cdot C_0$

$\rightarrow s' = \frac{K_s}{C_0} = \underline{9 \cdot 10^{-8} \text{ mol} \cdot \text{L}^{-1}} < s$ Hyp vérifiée

$C_0 = 1,0 \times 10^{-4} \text{ mol} \cdot \text{L}^{-1}$ s n'est plus négligeable devant C_0 .

Hyp précédente fautive.

$\rightarrow K_s = [\text{Ag}^+][\text{IO}_3^-] = s'' (C_0 + s'')$

$\rightarrow s''^2 + C_0 s'' - K_s = 0$

$\rightarrow \underline{s'' = 1,3 \cdot 10^{-4} \text{ mol} \cdot \text{L}^{-1}}$ on vérifie que $s'' < s$

2)

$[\text{F}^-] = 6,5 \times 10^{-3} \text{ mol} \cdot \text{L}^{-1}$

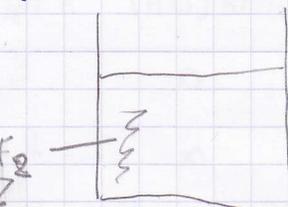


excès s $2s$

$K_s = [\text{Ba}^{2+}][\text{F}^-]^2 \quad K_s = s \cdot (2s)^2 \quad K_s = 4s^3$

$[\text{F}^-] = 2s \Leftrightarrow s = \frac{[\text{F}^-]}{2}$

$\rightarrow K_s = \frac{[\text{F}^-]}{2} \cdot [\text{F}^-]^2 = \frac{[\text{F}^-]^3}{2}$



solution saturés en fluorure de Baryum

$$pK_s = -\log\left(\frac{[F^-]^3}{2}\right)$$

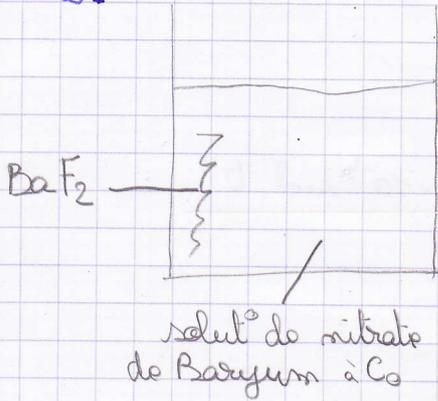
$$= -3\log[F^-] + \log 2$$

$$pK_s = 6,9$$

$$K_s = 1,4 \times 10^{-7} = 4s^3$$

$$s = \left(\frac{K_s}{4}\right)^{1/3} \quad \text{d'où } \underline{s = 3,25 \cdot 10^{-3} \text{ mol} \cdot \text{L}^{-1}}$$

b.



$$K_s = [\text{Ba}^{2+}][\text{F}^-]^2$$

$$K_s = (Co+s') \cdot (4s')^2$$

α) Co = 2,4 · 10⁻¹ mol · L⁻¹ >> s > s'

$$\rightarrow K_s = 4s'^2 Co \quad s' = \sqrt{\frac{K_s}{4Co}} = 3,8 \cdot 10^{-4} \text{ mol} \cdot \text{L}^{-1} < s$$

Hyp vérifiées

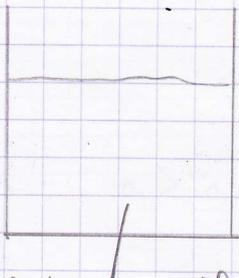
β) Co = 4 · 10⁻⁴ mol · L⁻¹

$$\rightarrow K_s = 4s'^2 Co + 4s'^3 \quad \text{d'où } 4s'^3 + 4s'^2 Co - K_s = 0$$

→ 1 seule racine > 0 et < s

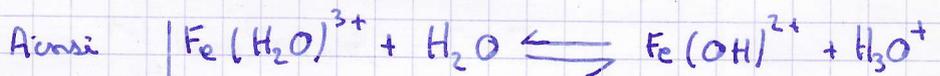
$$\underline{s'' = 3,1 \cdot 10^{-3} \text{ mol} \cdot \text{L}^{-1}}$$

Ex SA3-S:



$$K_a = \frac{[\text{Fe}(\text{HO})^{2+}][\text{H}_3\text{O}^+]}{[\text{Fe}(\text{H}_2\text{O})^{3+}]}$$

$$pK_s(\text{Fe}(\text{HO})_3) = 3,8$$



t=i	C	excès	0	E
t=éq	C-x	excès	x	h

(H1) autoprotolyse de l'eau négligée x ≈ h

(H2) réaction peu avancée à priori non envisageable car pKa est faible
 $\rightarrow C - x \approx C - h$

Fe³⁺, 3Cl⁻

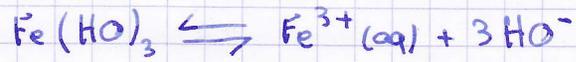
concentration C

$$pK_a(\text{Fe}_{(aq)}^{3+} / \text{Fe}(\text{HO})^{2+}) = 2,2$$

$$\rightarrow \boxed{K_a = \frac{h^2}{c-h}} \quad (*)$$

↑
(H1)

Supposons qu'on soit à la limite d'apparition des précipités: \exists dans l'équilibre



$$K_s = [\text{Fe}^{3+}][\text{HO}^-]^3 = (c-h) \cdot \left(\frac{K_e}{h}\right)^3$$

$$\boxed{K_s = (c-h) \frac{K_e^3}{h^3}} \quad (**)$$

$$(*) \quad \left\{ \begin{array}{l} c-h = \frac{h^2}{K_a} \end{array} \right.$$

$$K_s = \frac{h^2}{K_a} \cdot \frac{K_e^3}{h^3} = \frac{K_e^3}{K_a \cdot h} \rightarrow \boxed{h = \frac{K_e^3}{K_a K_s}}$$

ainsi $\boxed{\text{pH} = 3\text{p}K_e - \text{p}K_a - \text{p}K_s = 1,8}$

$$(*) \rightarrow c-h = \frac{h^2}{K_a} \quad c = \frac{h^2}{K_a} + h = \frac{(10^{-\text{pH}})^2}{K_a} + 10^{-\text{pH}}$$

$$\boxed{c = 5,6 \cdot 10^{-2} \text{ mol} \cdot \text{L}^{-1}}$$