

Latihan 8.3

1. Lantan CaCl_2 $0,001 \text{ M}$ sebanyak 200 mL diampur dengan 300 mL larutan Na_2CO_3 $0,001 \text{ M}$. Apakah timbul endapan pada campuran yang terjadi?

$$K_{sp} \text{ CaCO}_3 = 5 \times 10^{-9}$$

Diket

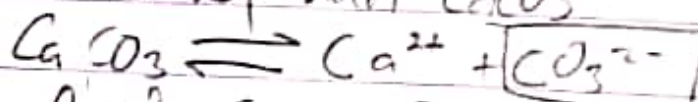
Mencari $[\text{Ca}^{2+}]$ dari CaCl_2

$$[\text{Ca}^{2+}] = \frac{n}{V_{\text{total}}} = \frac{M \cdot V}{V_1 + V_2} = \frac{0,001 \times 200}{200 + 300} = 4 \times 10^{-4} \text{ M}$$

Mencari $[\text{CO}_3^{2-}]$ dari Na_2CO_3

$$[\text{CO}_3^{2-}] = \frac{n}{V_{\text{total}}} = \frac{M \cdot V}{V_1 + V_2} = \frac{0,001 \times 300}{200 + 300} = 6 \times 10^{-4} \text{ M}$$

Mencari Q_{sp} dari CaCO_3



$$Q_{sp} = [4 \times 10^{-4}] [6 \times 10^{-4}] = 2,4 \times 10^{-7}$$

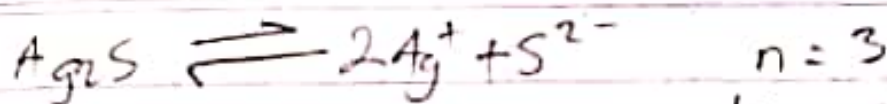
Jika dibandingkan dg $K_{sp} = 5 \times 10^{-9}$ maka

$Q_{sp} > K_{sp}$ → campuran tsb sudah mengendap

2. Diketahui $K_{sp} \text{ Ag}_2\text{S} = 1,6 \times 10^{-49}$. Jika $M_r \text{ Ag}_2\text{S} = 248$, hitunglah massa Ag_2S yang dapat larut dalam 500 mL air.

Diket

$$K_{sp} \text{ Ag}_2\text{S} = 1,6 \times 10^{-49}$$



$$K_{sp} = 4s^3$$

$$s = \sqrt[3]{\frac{K_{sp}}{4}} = \sqrt[3]{\frac{1,6 \times 10^{-4}}{4}} \rightarrow \sqrt[3]{\frac{1,6 \times 10^{-5}}{4}}$$

$$= \sqrt[3]{4 \times 10^{-5}} = 3,42 \times 10^{-2} \text{ M}$$

$$M = \frac{Gr}{Mr} \times \frac{1000}{mL}$$

$$Gr = \frac{M \times 1000 \times mL}{1000} = \frac{3,42 \times 10^{-2} \times 29,8 \times 1000}{1000} = 1,29 \text{ gr}$$

3

pH larutan jenuh $\text{Pb}(\text{OH})_2$ pada 7°C adalah $9 + \log 2$.

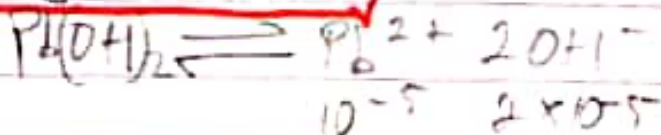
Hitunglah K_{sp} $\text{Pb}(\text{OH})_2$ pada 7°C .

$$\text{pH} = 9 + \log 2$$

$$\text{pOH} = 14 - (9 + \log 2)$$

$$= 5 - \log 2$$

$$[\text{OH}^-] = 2 \times 10^{-5}$$



$$K_{sp} = [\text{Pb}^{2+}][\text{OH}^-]^2$$

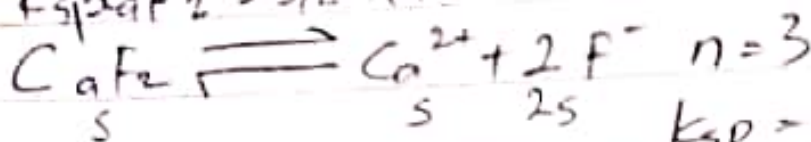
$$= [10^{-5}][2 \times 10^{-5}]^2 = 4 \times 10^{-5}$$

(Indikator, ...)

4. Jika $K_{sp} \text{CaF}_2 = 3,2 \times 10^{-11}$ dan $K_a \text{HF} = 10^{-5}$, hitunglah pH larutan jenuh MgF_2 .

Diket

$$K_{sp} \text{CaF}_2 = 3,2 \times 10^{-11}$$



$$K_{sp} = 4s^3$$

$$s = \sqrt[3]{\frac{K_{sp}}{4}} = \sqrt[3]{\frac{3,2 \times 10^{-11}}{4}} = \sqrt[3]{8 \times 10^{-12}} = 2 \times 10^{-4} \text{ M}$$

garam CaF_2 basa (dari base kuat dan asam lemah)

$$[\text{OH}^-] = \sqrt{\frac{K_{sp} \text{Mg}}{K_a}} = \sqrt{\frac{10^{-11} \cdot 2 \times 10^{-4}}{10^{-5}}} = \sqrt{2 \times 10^{-10}} = 1,41 \times 10^{-5}$$

$$p\text{OH} = 7 - \log 1,41$$

$$\begin{aligned} \text{pH} &= 14 - (7 - \log 1,41) \\ &= 7 + \log 1,41 \end{aligned}$$

5. Diket $K_{sp} \text{PbS} = 8 \times 10^{-28}$; $K_{sp} \text{CdS} = 8 \times 10^{-27}$; $K_{sp} \text{CuS} = 6,3 \times 10^{-36}$
 $K_{sp} \text{FeS} = 6,3 \times 10^{-10}$

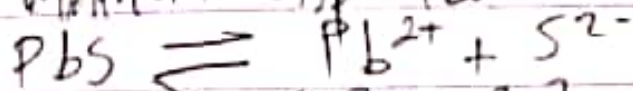
Mencari $[\text{Pb}^{2+}]$, $[\text{Fe}^{2+}]$, $[\text{Cu}^{2+}]$, $[\text{Cd}^{2+}]$

$$= \frac{n}{V_{\text{total}}} = \frac{M \cdot V}{V_1 + V_2} = \frac{10^{-4} \times 1}{1 + 1} = 5 \times 10^{-5} \text{ M}$$

Mencari $[\text{S}^{2-}]$ dari $\text{K}_{sp} \text{S}$

$$[\text{S}^{2-}] = \frac{n}{V_{\text{total}}} = \frac{M \cdot V}{V_1 + V_2} = \frac{10^{-4} \times 1}{1 + 1} = 5 \times 10^{-5} \text{ M}$$

Menentukan Q_{sp} PbS



$$Q_{sp} = [Pb^{2+}][S^{2-}]$$

$$Q_{sp} = [5 \times 10^{-5}][5 \times 10^{-5}] = 2,5 \times 10^{-9}$$

$Q_{sp} PbS = FeS = CdS = CuS$ karena jumlah ion yang sama dengan konsentrasi yang sama. Ion yang mengendap yaitu yang $Q_{sp} > K_{sp}$ berarti semua ion akan mengendap karena semua $Q_{sp} > K_{sp}$.

Latihan 8.4

Hitunglah kelentaran PbI_2 di dalam larutan KI $0,2 M$

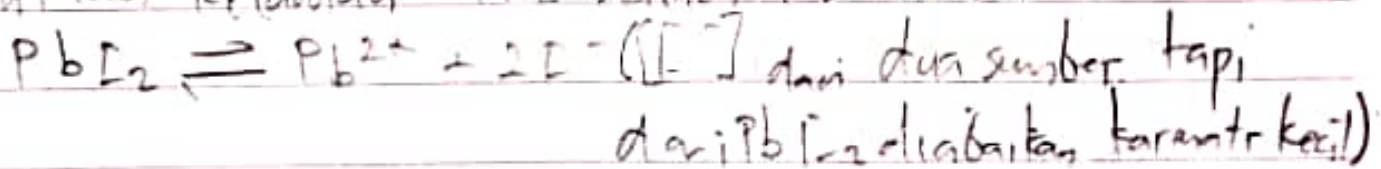
Jika pada suhu tersebut diketahui hasil kali kelentaran,

$$K_{sp} PbI_2 = 7 \times 10^{-9}$$



$$0,2 \quad \quad 0,2 \quad 0,2$$

Menentukan kelentaran PbI_2 dalam KI $0,2 M$



$$K_{sp} = S[2S + 0,2]^2$$

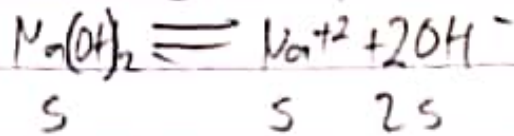
$$7 \times 10^{-9} = S \cdot 4 \times 10^{-2}$$

$$S = \frac{7 \times 10^{-9}}{4 \times 10^{-2}} = 1,75 \times 10^{-7} M$$

2. Pada suhu 25°C $K_{sp} \text{ Ni}(\text{OH})_2 = 6 \times 10^{-16}$. Hitunglah kelentaran $\text{Ni}(\text{OH})_2$ pada:

a. larutan NaOH $0,001 \text{ M}$.

menentukan $[\text{OH}^-]$ dari NaOH



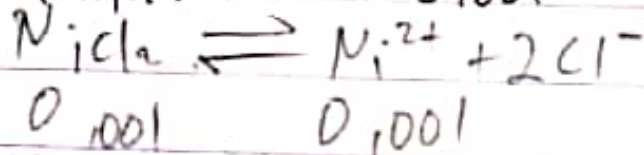
$K_{sp} = [\text{Ni}^{2+}][\text{OH}^-]^2$ (OH^- dari dua sumber tapi diabaikan)

$$K_{sp} = s(2s + 0,001)^2$$

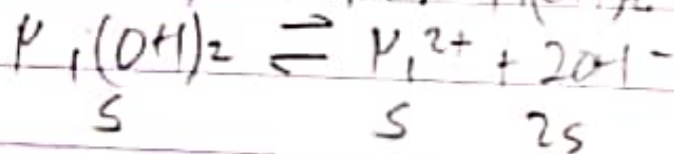
$$6 \times 10^{-16} = s \cdot 1 \cdot 6$$

$$s = \frac{6 \times 10^{-16}}{10^{-6}} = 6 \times 10^{-12} \text{ M}$$

b. larutan NiCl_2 $0,001 \text{ M}$



Mempertanyakan kelentaran $\text{Ni}(\text{OH})_2$ dalam NiCl_2 $0,001 \text{ M}$



$$K_{sp} = [\text{Ni}^{2+}][\text{OH}^-]^2 \quad + \text{Ni}^{2+} \text{ diabaikan}$$

$$K_{sp} = (s + 0,001)(2s)^2$$

$$6 \times 10^{-16} = 10^{-3} \cdot 4s^2$$

$$s^2 = \frac{6 \times 10^{-16}}{4 \times 10^{-3}} = 15 \times 10^{-16} \text{ M}$$

$$s = \sqrt{15 \times 10^{-16}} = 3,87 \times 10^{-8} \text{ M}$$

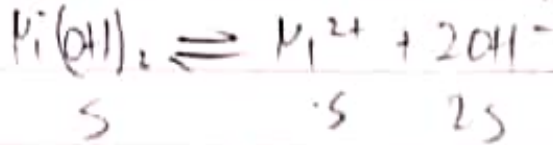
c. larutan yang mempunyai $\text{pH} = 11$

$$\text{pH} = 11$$

$$\text{pOH} = 3$$

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

Menentukan kelarutan $\text{Pb}(\text{OH})_2$ dalam larutan $\text{pH} = 11$



$$K_{sp} = [\text{Pb}^{2+}] [\text{OH}^-]^2 \quad [\text{OH}^-]^2 \text{ diketahui}$$

$$K_{sp} = S \cdot (2S + 0,001)^2$$

$$6 \times 10^{-10} = S \cdot 10^{-6}$$

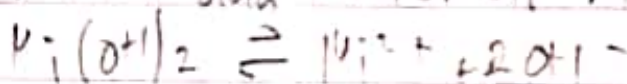
$$S = \frac{6 \times 10^{-10}}{10^{-6}} = 6 \times 10^{-12} \text{ M}$$

d. Larutan yang berisi PbH_3 $0,1 \text{ M}$ dan $\text{PbH}_4 \text{Cl}$ $0,1 \text{ M}$.
($K_b \text{ PbH}_3 = 10^{-5}$)

Menentukan $[\text{OH}^-]$ dari larutan pengganggu basa (PbH_3 $0,1 \text{ M}$ dan $\text{PbH}_4 \text{Cl}$ $0,1 \text{ M}$)

$$[\text{OH}^-] = K_b \frac{\text{mol basa}}{\text{mol garam}} = 10^{-5} \frac{0,1}{0,1} = 10^{-5} \text{ M}$$

Menentukan kelarutan $\text{Pb}(\text{OH})_2$ dalam larutan yg berisi PbH_3 $0,1 \text{ M}$ dan $\text{PbH}_4 \text{Cl}$ $0,1 \text{ M}$.



$$K_{sp} = [\text{Pb}^{2+}] [\text{OH}^-]^2 \quad [\text{OH}^-] \text{ diketahui}$$

$$K_{sp} = S(2S + 10^{-5})^2$$

$$6 \times 10^{-10} = S \cdot 10^{-10}$$

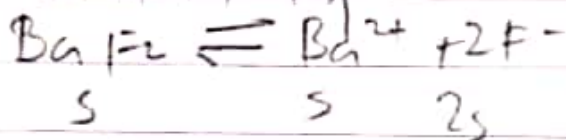
$$S = \frac{6 \times 10^{-10}}{10^{-10}} = 6 \times 10^{-0} \text{ M}$$

3. Pada suhu tertentu 0,350 gr BaF_2 ($M_r = 175$) dilarutkan dalam air murni; membentuk 1 L larutan jenuh BaF_2 . Pada suhu tersebut, hitunglah K_{sp} BaF_2 dan kelarutan BaF_2 dalam larutan yg mengandung $\text{Ba}(\text{PO}_3)_2$ 0,1 M.

Mencari kelarutan / Molalitas

$$M = \frac{Gr}{M_r} \times \frac{1}{L} = \frac{0,35}{175} \times \frac{1}{1} = 0,002 \text{ M}$$

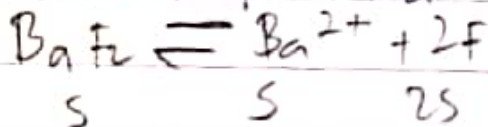
Mencari K_{sp}



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

$$K_{sp} = s \cdot (2s)^2 = 4s^3 = 4(2 \cdot 10^{-3})^3 = 3,2 \times 10^{-8}$$

Mencari $[\text{Ba}^{2+}]$ dari $\text{Ba}(\text{PO}_3)_2$ 0,1 M



$$K_{sp} = [\text{Ba}^{2+}] [\text{F}^-]^2 \quad [\text{Ba}^{2+}] \text{ diabaikan}$$

$$K_{sp} = (0,1) \cdot (2s)^2$$

$$3,2 \times 10^{-8} = 0,1 \cdot 4s^2$$

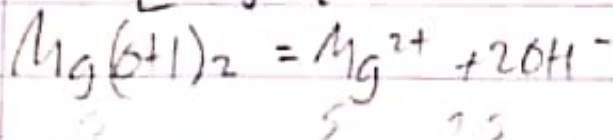
$$s^2 = \frac{32 \times 10^{-9}}{4 \cdot 0,1} = 8 \times 10^{-8} \text{ M}$$

$$s = \sqrt{8 \times 10^{-8}} = 2,82 \times 10^{-4} \text{ M}$$

4. Pada 25°C nilai $K_{sp} \text{ Mg(OH)}_2$ adalah $3,2 \times 10^{-11}$.
Hitunglah kelentaran Mg(OH)_2 di dalam larutan yang mengandung mampunyai $\text{pH} = 12$

$$\text{pOH} = 2$$

$$[\text{OH}^-] = 10^{-2}$$



$$K_{sp} = [\text{Mg}^{2+}][\text{OH}^-]^2 \cdot [\text{OH}^-] \text{ kelentaran}$$

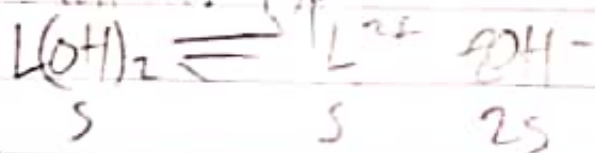
$$K_{sp} = S \cdot (2S + 10^{-2})^2$$

$$3,2 \times 10^{-11} = S \cdot 10^{-4}$$

$$S = \frac{3,2 \times 10^{-11}}{10^{-4}} = 3,2 \times 10^{-7} \text{ M}$$

5. Kelentaran L(OH)_2 pada suhu tertentu adalah 2×10^{-5} mol/L. Hitunglah kelentaran zat tsb Air-2 gelas 500 mL larutan yg mempunyai $\text{pH} = 4 - \log 2$

Mamutkan K_{sp}



$$K_{sp} = [\text{L}^{2+}][\text{OH}^-]^2$$

$$K_{sp} = 4S^3 = 4(2 \cdot 10^{-5})^3 = 3,2 \cdot 10^{-14}$$

Menentukan $[\text{OH}^-]$ dari larutan dg $\text{pH} = 9 - \log 2$

$$\text{pH} = 9 - \log 2$$

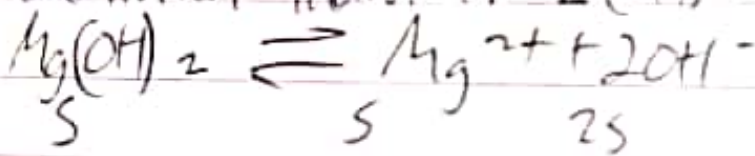
$$[\text{H}^+] = 2 \cdot 10^{-9}$$

$$10^{-14} = [\text{H}^+] [\text{OH}^-]$$

$$10^{-14} = 2 \cdot 10^{-9} [\text{OH}^-]$$

$$[\text{OH}^-] = \frac{10^{-14}}{2 \cdot 10^{-9}} = 5 \times 10^{-11} \text{ M}$$

Menentukan kelarutan $\text{L}(\text{OH})_2$ dalam larutan $\text{pH} = 9 - \log 2$



$$K_{sp} = [\text{Mg}^{2+}] [\text{OH}^-]^2 \quad [\text{OH}^-] \text{ diketahui}$$

$$K_{sp} = \text{S} (2\text{S} + 5 \times 10^{-11})^2$$

$$3,2 \times 10^{-14} = 4\text{S}^3$$

$$\text{S} = \sqrt[3]{\frac{3,2 \times 10^{-14}}{4}} = 2 \times 10^{-5} \text{ M}$$