Equilibrio químico FASE GAS (tema 5 baúa) PARTE I

1.- Concepto equilibrio químico

2.- ley acción masas y constante de equilibrio

- Ej: 1-2-3 p225 (K_c)
- Ej: 4 p 225. (K_p)
- Ej: 5 p225

3.- Relación entre K_c y K_p

- Ej: resuelto p 201

4.- Cociente de reacción

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- Enunciado
- factores — [ ] / P TOTAL por ΔV / T

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1.- $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ $K_c = 2{,}38 \cdot 10^{-3} = \frac{[NH_3]^2}{[N_2][H_2]^3}$ M^{-2}

a) $2NH_3 \rightleftharpoons N_2(g) + 3H_2(g)$

$$k_c = \frac{[N_2][H_2]^3}{[NH_3]^2} = \frac{1}{k_c} = \frac{1}{2{,}38 \cdot 10^{-3}} = 420\ M^2$$

b) $\frac{1}{2}N_2(g) + \frac{3}{2}H_2(g) \rightleftharpoons NH_3(g)$ $k_c = \frac{[NH_3]}{[N_2]^{1/2}[H_2]^{3/2}} = \sqrt{K_c} = \sqrt{2{,}38 \cdot 10^{-3}} =$

$= 4{,}88 \cdot 10^{-2}\ M$

2.-

a) $3Fe(s) + 4H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4H_2(g)$ $k_c = \frac{[H_2]^4}{[H_2O]^4}$

b) $\frac{1}{2}N_2(g) + \frac{3}{2}H_2(g) \rightleftharpoons NH_3(g)$ $k_c = \frac{[NH_3]}{[N_2]^{1/2}[H_2]^{1/2}}$

c) $C(s) + O_2(g) \rightleftharpoons CO_2(g)$ $k_c = \frac{[CO_2]}{[O_2]}$

d) $S(s) + H_2(g) \rightleftharpoons H_2S(s)$ $k_c = \frac{1}{[H_2]}$ M^{-1}

3.-

$FeO(s) + CO(g) \rightleftharpoons Fe(s) + CO_2(g)$ $1000^\circ C$ K_p

2,19 mol 0,88 mol

$$K_p = \frac{P_{CO_2}}{P_{CO}} = \frac{[CO_2]RT}{[CO]RT} = \frac{\frac{0{,}88}{V}}{\frac{2{,}19}{V}} = 0{,}402$$

$= K_c [RT]^0 =$

4.- $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ $K_c = 2{,}5 \cdot 10^{-3}$ K_p? $800 + 273 = 1073\ K$

$$K_p = p(CO_2) = [CO_2]RT = K_c RT = 2{,}5 \cdot 10^{-3}(0{,}082 \cdot 1073) = 0{,}22\ atm$$

5.- $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ $K_p = 1{,}67 \cdot 10^{-4}$ (400°C)

mol a 25°C	0,0100	0,0200	0,0300	2,00 dm^3	400 + 273 = 673 K
a 400°C	?	?	?		

$$K_p = \frac{P_{NH_3}^2}{P_{N_2} \cdot P_{H_2}^2} = \frac{[NH_3]^2 (RT)^2}{[N_2] RT [H_2]^2 (RT)^2} = \Pi C_i (RT)^{\Delta n} = K_c RT^{\Delta n}$$

$$K_c = \frac{K_p}{(RT)^{\Delta n}} = K_p (RT)^{-\Delta n} = 1{,}67 \cdot 10^{-4} (0{,}082 \cdot 673\ k)^{+2} = 0{,}5086\ M^{-2}$$

$(\Delta n = 2 - 3 - 1 = -2)$

$$Q = \frac{[NH_3]^2}{[N_2][H_2]^3} = \frac{\frac{(0{,}03)^2}{2^2}}{\frac{(0{,}01)}{2} \cdot \frac{(0{,}02)^3}{(2)^{+2}}} = \frac{(0{,}03)^2}{(0{,}01)(0{,}02)^3} = 45.000\ M^{-2}$$

Como $Q > K$ ~~el eq. está desplatado hacia~~ la dcha hay + P y − R de los que corresponden a una situac. de eq. El eq. tiende a desplatarse a la itda.

6.- $H_2(g) + CO_2(g) \rightleftharpoons H_2O(g) + CO(g)$ $K_c = 1{,}6$ 986°C 1L

i moles	0,2	0,3	0,4	0,4	a) eq?
e	0,2−x	0,3−x	0,4+x	0,4+x	b) [ ]eq
					c) Pinic Pfinal metcle

$$Q = \frac{[CO][H_2O]}{[H_2][CO_2]} = \frac{0{,}4 \cdot 0{,}4}{0{,}2 \cdot 0{,}3} = 2{,}67$$ como $Q > K$ hay más P y menos R de lo q corresponde. Se desplaza "←"

$$K = \frac{[CO][H_2O]}{[H_2][CO_2]} = \frac{\frac{0{,}4+x}{1} \cdot \frac{0{,}4+x}{1}}{\frac{(0{,}2-x)}{1} \cdot \frac{(0{,}3-x)}{1}} = \frac{(0{,}4+x)^2}{0{,}06 - 0{,}2x - 0{,}3x + x^2} = \frac{0{,}16 + 0{,}8x + x^2}{0{,}06 - 0{,}5x + x^2} = 1{,}6$$

$0{,}16 + 0{,}8x + x^2 = 1{,}6(0{,}06 - 0{,}5x + x^2)$; $0{,}16 + 0{,}8x + x^2 = 0{,}096 - 0{,}8x + 1{,}6x^2$

$0{,}6x^2 - 1{,}6x - 0{,}064 = 0$

$x = \frac{1{,}6 \pm 1{,}647}{1{,}2}$ $x_1 < 0$ $x_2 =$

6.- $H_2(g) + I_2(g) \longrightarrow 2HI(g)$ $\quad T = 670K,\ V = 2L$

mol I: 0,003 mol $\quad$ 0,003 $\quad$ 0,024 $\longrightarrow$ $n_T = 0,024 + 0,003 + 0,003$

$n_T = 0,03$ mol

$$K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{\left(\frac{0,024}{2}\right)^2}{\left(\frac{0,003}{2}\right)\left(\frac{0,003}{2}\right)} = 64$$

$$K_p = K_c(RT)^{\Delta n} \cong K_c = 64$$

$\Delta n = 0$

$$P = \frac{nRT}{V} = \frac{(0,024 + 0,003 + 0,003)}{2}\, 0,082 \cdot 670 = 0,82 \text{ atm}$$

$$P_{H_2} = \frac{0,003}{0,3} P = 0,1 \cdot 0,82 = 0,082 = P_{I_2}$$

$$P_{HI} = \frac{0,024}{0,03} \cdot 0,082 = 0,656 \text{ atm}$$

7.- $CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g)$ $\quad V = 10,0L$, $T = 1250°C = 1523K$

n_o	0,61 mol	0,39	—	—
n_e	0,61 − x	0,39 − x	x = x	x

a) $n_{CO_2} = 0,61 - x = 0,35 \longrightarrow x = 0,61 - 0,35 = 0,26$ mol

$n_{CO_2} = 0,61 - 0,26 = 0,35$ mol CO_2

$n_{H_2} = 0,39 - 0,26 = 0,13$ mol H_2

$n_{CO} = n_{H_2O} = x = 0,26$ mol

b) $$K_c = \frac{[CO][H_2O]}{[CO_2][H_2]} = \frac{\frac{0,26}{10} \cdot \frac{0,26}{10}}{\frac{0,35}{10} \cdot \frac{0,13}{10}} = 1,49$$

8.-

$V = 5L$

$T = 727^\circ C + 273 = 1000K$

mol	$2\,SO_2(g)$ +	$O_2(g)$ ⇌	$2SO_3(g)$
inic	1,0 mol	1,0 mol	–
.	1,0 − 2x	1,0 − x	2x
eq.	0,15 mol		

$0,15 = 1 - 2x \rightarrow 0,15 - 1 = -2x \rightarrow x = 0,425\,mol$

cant SO_3 en equil.:

$2x = 2 \cdot 0,425\,mol\,SO_3 = 0,85\,mol\,SO_3$; $0,85\,mol\,SO_3 \cdot \frac{80\,g\,SO_3}{1\,mol} = 68\,g\,SO_3$

$n_{SO_2} = 0,15\ mol$; $n_{O_2} = 1 - 0,425 = 0,575\,mol$; $n_{SO_3} = 0,85\,mol$

$$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]} = \frac{\left(\frac{0,85}{5}\right)^2}{\left(\frac{0,15}{5}\right)^2\left(\frac{0,575}{5}\right)} = 279,2\ M^{-1}$$

9.- $2\,Ag_2O(s) \rightleftharpoons 4\,Ag(s) + O_2(g)$

$6,0\,g\,Ag_2O \cdot \frac{1\,mol\,Ag_2O}{231,8\,g\,Ag_2O} = 2,59 \cdot 10^{-2}\,mol$

	6,0 g		
no	$2,59 \cdot 10^{-2}$ mol		
ne:	$2,59 \cdot 10^{-2} - 2x$	4x	x

$V = 0,40L$

$T = 460k$

$P = 0,93\,atm$

$K_p = P_{O_2} = P = 0,93\,atm$

(única sust. gaseosa)

- $P = \frac{nRT}{V} \rightarrow n = \frac{PV}{RT} = \frac{0,93 \cdot 0,4}{0,082 \cdot 460} = 9,86 \cdot 10^{-3}\,mol = x$
- $\alpha = \frac{2x}{2,59 \cdot 10^{-2}} = \frac{2 \cdot 9,86 \cdot 10^{-3}}{2,59 \cdot 10^{-2}} = 0,76 \xrightarrow{\%} 76\%$

10.- $I_2(g) + H_2(g) \rightleftharpoons 2HI(g)$ $T = 448°C = 721K$

	I_2	H_2	HI
no	1,0	1,0	-
ne	1-x	1-x	2x

$K_c = 50$; $V = 1L$

$$K_c = 50 = \frac{[HI]^2}{[I_2][H_2]} = \frac{\left(\frac{2x}{1}\right)^2}{\left(\frac{1-x}{1}\right)\left(\frac{1-x}{1}\right)} = \frac{4x^2}{1^2 - 2x + x^2} = 50.$$

$4x^2 = 50 - 100x + 50x^2$

$46x^2 - 100x + 50 = 0$

$23x^2 - 50x + 25 = 0$; $x = \frac{50 \pm 14'14}{46}$ / $x = 1,39$ mol No se puede disociar más de lo que tengo

$x = 0,78$ mol

$n_{HI} = 2x = 2 \cdot 0,78 = 1,56$ mol HI

$$P_{I_2} = P_{H_2} = \frac{(1 - 0,78) \cdot 0,082 \frac{atm \cdot L}{mol\,k} \cdot 721\,k}{1L} = 13atm$$

$$P_{HI} = \frac{2 \cdot 0,78 \cdot 0,082 \cdot 721}{1} = 92atm$$

11.- $N_2O_4(g) \rightleftharpoons 2NO_2(g)$

	N_2O_4	NO_2
masa	1,660g	0,385g.
ne	$1,8 \cdot 10^{-2}$	$8,37 \cdot 10^{-3}$

$T = 35°C + 273 = 308K$

$V = 0,310L$

$1,660g \frac{1mol N_2O_4}{92g N_2O_4} = 1,8 \cdot 10^{-2}$ mol N_2O_4

$0,385g \frac{1mol NO_2}{46g NO_2} = 8,37 \cdot 10^{-3}$ mol NO_2

a) $$K_c = \frac{[NO_2]^2}{[N_2O_4]} = \frac{\left(\frac{8,37 \cdot 10^{-3}}{0,310}\right)^2}{\left(\frac{1,8 \cdot 10^{-2}}{0,310}\right)} = 1,26 \cdot 10^{-2} M$$

b)

11 b)

$N_2O_4(g) \rightleftharpoons 2NO_2(g)$

ne 1 mol 2 mol

$$K_c = 3{,}20 = \frac{[NO_2]^2}{[N_2O_4]} = \frac{\left(\frac{2}{V}\right)^2}{\left(\frac{1}{V}\right)} = \frac{4}{V} \rightarrow V = \frac{4}{3{,}20} = 1{,}25\ L$$

12)

$N_2O_4(g) \rightleftharpoons 2NO_2(g)$ $\quad V = 2L \quad T = 298{,}15\ K$

mol	n_0	
equil	$n_0 - x$	$2x$
	$n_{N_2O_4}$	n_{NO_2}

$P = 1{,}0\ atm$ } EQUILIBRIO
$P_{N_2O_4} = 0{,}70\ atm$ }

K_p ; composición en equil.

a) $K_p = \dfrac{P_{NO_2}^2}{P_{N_2O_4}} = \dfrac{0{,}30^2}{0{,}70} = 0{,}129\ atm$

Si $P = 1\ atm = P_{N_2O_4} + P_{NO_2}$

$P_{N_2O_4} = 0{,}70$

$P_{NO_2} = 1 - 0{,}70 = 0{,}30\ atm$

b) $PV = nRT \rightarrow n = \dfrac{PV}{RT} = \dfrac{1{,}0\ atm \cdot 2\ L}{0{,}082 \cdot 298{,}15} = 0{,}0818\ mol$ TOTAL

$P_{N_2O_4} = \chi_{N_2O_4} \cdot P \rightarrow 0{,}70 = \dfrac{n_{N_2O_4}}{0{,}0818} \cdot 1 \rightarrow n_{N_2O_4} = 0{,}70 \cdot 0{,}818 =$

$n_{N_2O_4} = 5{,}7 \cdot 10^{-2}\ mol$

$n_{NO_2} = 0{,}0818 - 5{,}7 \cdot 10^{-2} = 2{,}5 \cdot 10^{-2}\ mol\ NO_2$

13.- ↓ sulfuro de carbonilo

	$CO_{2(g)}$	+ $H_2S_{(g)}$	⇌ $COS_{(g)}$	+ $H_2O_{(g)}$
n_o	0,1	n	—	—
n_e	0,1 − x	n − x	x	x

x = 0,01

→ $4,4\,g\,CO_2 \cdot \frac{1\,mol}{44\,g} = 0,1\,mol$

→ 2,55 L

→ P = 10 atm

→ x = 0,01 mol

→ T = 337°C = 610 K

$n_e = 0,1 - x + n - x + x + x = 0,1 + n$

$n_e = \frac{PV}{RT} = \frac{10 \cdot 2,55}{0,082 \cdot 610} = 0,51\,mol$

$0,51 = 0,1 + n \rightarrow n = 0,51 - 0,1 = 0,41\,mol\,H_2S$

$n_{CO_2} = 0,1 - 0,01 = 0,09\,mol\,CO_2$

$n_{H_2S} = n - x = 0,41 - 0,01 = 0,4\,mol\,H_2S$

$n_{H_2O} = n_{COS} = x = 0,01\,mol$

$$K_c = \frac{[COS][H_2O]}{[CO_2][H_2S]} = \frac{\left(\frac{0,01}{V}\right)\left(\frac{0,01}{V}\right)}{\left(\frac{0,09}{V}\right)\left(\frac{0,4}{V}\right)} = 2,78 \cdot 10^{-3}$$

$$K_p = K_c (RT)^{\Delta n} = 2,78 \cdot 10^{-3}$$

$\Delta n = 0$

14.- V = 1 L ; $1,998\,g\,I_2 \cdot \frac{1\,mol\,I_2}{253,8\,g\,I_2} = 7,87 \cdot 10^{-3}\,mol\,I_2 = n_o$; T = 1473 K ; P = 1,33 atm

$I_{2(s)} \rightleftharpoons 2\,I_{(g)}$

n_o	—
$n_o - x$	2x

$n = n_o - x + 2x = n_o + x = 7,87 \cdot 10^{-3} + x$

$n = \frac{PV}{RT} = \frac{1,33 \cdot 1}{0,082 \cdot 1473} = 1,1 \cdot 10^{-2}\,mol_{TOTAL}$

$1,1 \cdot 10^{-2} - 7,87 \cdot 10^{-3} = x$

$x = 3,14 \cdot 10^{-3}\,mol$

$\alpha = \frac{x}{n_o} = \frac{3,14 \cdot 10^{-3}}{7,87 \cdot 10^{-3}} = 0,399$

$$K_c = \frac{[I]^2}{[I_2]} = \frac{\left(\frac{2x}{V}\right)^2}{\left(\frac{n_0 - x}{V}\right)} = \frac{2^2 x^2}{V(n_0 - x)} = \frac{4 \cdot (3{,}14 \cdot 10^{-3})^2}{1\,(7{,}87 \cdot 10^{-3} - 3{,}14 \cdot 10^{-3})}$$

$$\boxed{K_c = 8{,}3 \cdot 10^{-3}\ M}$$

$$K_p = K_c (RT)^{\Delta n} = 8{,}3 \cdot 10^{-3}\ (0{,}082 \cdot 1473)^1 = \boxed{1\ atm}$$

15.- 5 L ; $n_0 = 0{,}92$ mol N_2 $n_0 = 0{,}51$ mol O_2 , T = 2200 K ; $\alpha = \frac{1{,}09}{100}$

$$N_2(g) + O_2(g) \rightleftharpoons 2\,NO(g)$$

	N_2	O_2	NO
n_0	0,92	0,51	–
n_e	0,92 − x	0,51 − x	2x

$$\alpha = \frac{x}{n_0} \rightarrow \frac{1{,}09}{100} = \frac{x}{0{,}92} \rightarrow \boxed{x = 1 \cdot 10^{-2}\ mol}$$

$$\begin{cases} [N_2] = \dfrac{0{,}92 - 1 \cdot 10^{-2}}{5} = 0{,}182\ M \\ [O_2] = \dfrac{0{,}51 - 1 \cdot 10^{-2}}{5} = 0{,}100\ M \\ [NO] = \dfrac{2 \cdot 1 \cdot 10^{-2}}{5} = 0{,}004\ M \end{cases}$$

$$K_c = \frac{[NO]^2}{[N_2][O_2]} = \frac{(0{,}004)^2}{(0{,}182)(0{,}100)} = 8{,}79 \cdot 10^{-4}$$

$$\boxed{K_p = K_c (RT)^{\Delta n} = K_c = 8{,}79 \cdot 10^{-4}}$$

$\Delta n = 0$

16.- $V = 1\,L$; $n_0 = 0{,}100$ mol PCl_5 ; $T = 250^\circ C = 523\,K$; $\alpha = 0{,}48$

mol	$PCl_5(g)$	$\rightleftharpoons$	$PCl_3(g)$	+	$Cl_2(g)$
	$n_0 = 0{,}100$		–		–
	$n_0 - x$		x		x
$\alpha = \frac{x}{n_0}$	$n_0(1-\alpha)$		$n_0\alpha$		$n_0\alpha$

$n_{PCl_5} = 0{,}100\,(1-0{,}48) = 0{,}052$ mol

$n_{PCl_3} = n_{Cl_2} = x = \alpha = 0{,}48$ mol

$$P = \frac{nRT}{V} = \frac{n_0(1+\alpha)\cdot RT}{V} = \frac{0{,}1\,(1+0{,}48)\cdot 0{,}082\cdot 523}{1} = 6{,}35 \text{ atm}$$

$$n = n_0 - n_0\alpha + n_0\alpha + n_0\alpha = n_0(1+\alpha)$$

$$K_c = \frac{[Cl_2][PCl_3]}{[PCl_5]} = \frac{\left(\frac{n_e}{V}\right)\left(\frac{n_e}{V}\right)}{\left(\frac{n_e}{V}\right)} = \frac{(n_0\alpha)^2}{V\,n_0(1-\alpha)} = \frac{(0{,}48\cdot 0{,}1)^2}{1\cdot 0{,}1\cdot(1-0{,}48)}$$

$K_c = 0{,}0443$

$K_p = K_c(RT)^{\Delta n} = 4{,}43\,(0{,}082\cdot 523)^{1} = 1{,}9$ atm

17.-

mol	$CO Cl_2(g)$	$\rightleftharpoons$	$CO(g)$	+	$Cl_2(g)$
	n_0		–		–
	$n_0 - x$		x		x
$\alpha = \frac{x}{n_0}$	$n_0(1-\alpha)$		$n_0\alpha$		$n_0\alpha$

$T = 1000$ K ; $P = 1$ atm ; $\alpha = 0{,}492$

$n = n_0 - n_0\alpha + n_0\alpha + n_0\alpha$

$n = n_0(1+\alpha)$

No necesario suponerlo

$PV = n_0(1+\alpha)RT$

$$n_0 = \frac{PV}{(1+\alpha)RT} = \frac{1\cdot 1}{(1+0{,}492)\cdot 0{,}082\cdot 1000}$$

$n_0 = 8{,}17\cdot 10^{-3}$ mol

$$K_p = \frac{P_{CO} \cdot P_{Cl_2}}{P_{COCl_2}} = \frac{\left(\frac{n_0\alpha}{n_0(1+\alpha)}\right)\left(\frac{n_0\alpha}{n_0(1+\alpha)}\right)}{\left(\frac{n_0(1-\alpha)}{n_0(1+\alpha)}\right)} \cdot P$$

$$K_p = \frac{\frac{\alpha^2}{(1+\alpha)(1+\alpha)}}{\frac{(1-\alpha)}{(1+\alpha)}} = \frac{\alpha^2}{(1^2-\alpha^2)} = \frac{0,492^2}{1-0,492^2} = 0,32 \text{ atm}$$

b) $$0,32 = \frac{\alpha^2}{1^2-\alpha^2} \cdot 5$$

$$0,32 - 0,32\alpha^2 = 5\alpha^2$$

$$5,32\alpha^2 = 0,32$$

$$\alpha = \pm\sqrt{\frac{0,32}{5,32}} = 0,25.$$

18.- $V = 10L$, $T = 270°C + 273 = 543K$; $P = 15,68 atm$.

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$; ΔH_{20}

n_0	2,5 mol		
n_e	$2,5-x$	x	x

$n = 2,5 - x + x + x = 2,5 + x$

a) $$K_c = \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{\left(\frac{x}{10}\right)^2}{\left(\frac{2,5-x}{10}\right)} = \frac{x^2}{10(2,5-x)} = \frac{1,02^2}{10(2,5-1,02)} = 0,07 M$$

$PV = nRT$; $15,68 \cdot 10 = (2,5+x) \cdot 0,082 \cdot 543$; $x = 1,02 mol$

b) $n_{PCl_5} = 2,5 - 1,02 = 1'48 mol$; $n_{PCl_3} = n_{Cl_2} = 1,02 mol$

c) "Le Chatelier"...
- ↑P → menos n gas → "←"
- ↑T → intenta consumir calor → "←"

19.-

$H_{2(g)} + Br_{2(g)} \rightleftharpoons 2HBr_{(g)} \quad \Delta H = -68\,kJ$. exo

- ↑T → absorbe calor → "←" $\quad K = \frac{[P]}{[R]\uparrow} \downarrow$
- ↑P_{HBr} → "←"
- ↑V → ↓P → mayor mol gas → como $n_P = n_R$ → no sucede nada

21.-

22.- $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$

a) ↑P →

b) F

c) $K_p = K_c(RT)^{\Delta n} = K_c\left(\frac{RT}{K}\right)^{-1} = \frac{K_c}{RT}$

$K_p \cdot (RT) = K_c$ luego $K_p < K_c$

- Equilibrio de solubilidad. Guía de trabajo

pto 8 | p208-238

x simulación U.V ("simulación solubilidad distintas sales")

Explicar: disolución saturada, equilibrio solubilidad, solubilidad } p209-210

x p210 producto solubilidad

$A_n B_m (s) \rightleftharpoons n A^{+m}_{(aq)} + n B^{n-}_{(aq)}$; $Kps = [A^{+m}]^n [B^{n-}]^m$

- ir mirando tabla 5.2
- Ejercicio resuelto p212

x p212 relación entre S y Kps

- ejercicio tipo 1. Nos dan Kps y calculo S
- ejercicio tipo 2. Nos dan S y calculo Kps
- TAREA → coger tabla 5-2 → nombrar todas las sales
  → escribir los equilibrios
  → poner Kps en función de S

- Ej: 27-28
- Hacer ej resuelto p213

x p214 Decidir si precipita

Ej: 32-33-34-35

x p215 Ion común → S↓ → le chatelier
                    → cálculos

└ Ejercicios tipo 1 y tipo 2 pero con ion común

29-30-31-37

. Hacer ej resueltos p216

x p218 Disolución de precipitados (práctica)

{ ↓ S si ...
  ↑ S si .... }

$CaCO_{3(s)} \rightleftharpoons Ca^{2+}_{(aq)} + CO_3^{2-}_{(aq)}$

x práctica. preparar precipitado y separarlo por filtración

40-41-42-43-44-45

33.-

$K_{PS}(AgI) = 8{,}3\cdot10^{-17}$

a) $AgI_{(s)} \rightleftharpoons Ag^+_{(aq)} + I^-_{(aq)}$ $\quad K_{PS} = [Ag^+][I^-] = S^2 = 8{,}3\cdot10^{-17}$

S S

$S = \sqrt{8{,}3\cdot10^{-17}} = 9{,}1\cdot10^{-9}\ M$

$9{,}1\cdot10^{-9}\ \frac{mol\ AgI}{L} \cdot \frac{234{,}8\ g}{1\ mol\ AgI} = \boxed{2{,}1\cdot10^{-6}\ g/L}$

b) $AgNO_{3(aq)} \longrightarrow Ag^+_{(aq)} + NO_3^-{}_{(aq)}$

100 mL

0,005 mol/L

$8{,}3\cdot10^{-17} = [Ag^+][I^-] = 0{,}005 \cdot [I^-]$

$[I^-] = \frac{8{,}3\cdot10^{-17}}{0{,}005} = 1{,}66\cdot10^{-14}\ \frac{mol\ KI}{L}$

$1{,}66\cdot10^{-14}\ \frac{mol\ KI}{L} \cdot 0{,}1\ L \cdot \frac{166\ g\ KI}{1\ mol\ KI} = 2{,}8\cdot10^{-13}\ g\ KI.$

35.-

a) $\frac{26{,}0\ mg\ SrSO_4}{250\ mL} \cdot \frac{10^3\ mL}{1\ L} \cdot \frac{1\ g\ SrSO_4}{10^3\ mg} \cdot \frac{1\ mol}{186{,}62\ g} = 5{,}57\cdot10^{-4}\ \frac{mol\ SrSO_4}{L} = [Sr^{2+}] = [SO_4^{2-}]$

$SrSO_4(s) \rightleftharpoons Sr^{2+}_{(aq)} + SO_4^{2-}_{(aq)}$ $\quad \boxed{K_{PS} = [Sr^{2+}][SO_4^{2-}] = (5{,}57\cdot10^{-4})^2 = 3{,}1\cdot10^{-7}}$

S S

b) $Na_2SO_{4(aq)} + SrCl_{2(aq)} \longrightarrow SrSO_4(s) + 2NaCl_{(aq)}$

0,02M 0,02M

V V

$Q = [Sr^{2+}][SO_4^{2-}] = \left(\frac{0{,}02\ \frac{mol}{L}\cdot V}{2V}\right)\left(\frac{0{,}02\ \frac{mol}{L}\cdot V}{2V}\right) = 10^{-4}$

$Q > K_{PS}$ precipita