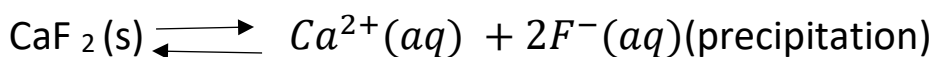
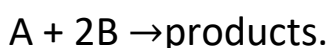


CHEMICAL KINETICS, REACTION RATES:



$$K_{ps} = [\text{Ca}^{2+}][\text{F}^-]^2 \text{ is } [\text{F}^-] \text{ the determinant}$$

$$\frac{[\text{F}^-]}{2} = [\text{Ca}^{2+}] = \text{solubility.}$$

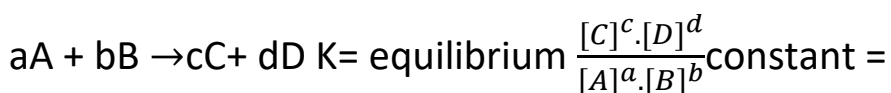


$$t=0 \quad [\text{A}] = [\text{A}]_0 \text{ and } [\text{B}] = [\text{B}]_0$$

$$t=t' \quad [\text{A}] = [\text{A}]_0 - x \quad [\text{B}] = [\text{B}]_0 - 2x$$

Returning to the mechanics of the velocity equations, we have that $dx/dt = k \cdot ([\text{A}]_0 - x) \cdot ([\text{B}]_0 - 2x)^2 (*)$

remember that in acid-base we also use the rate constants "k" and they follow the same criterion when it comes to exponents:



(*) is solved using the method of *rational integrals* :

we have $dx/([A]_0 - x) \cdot ([B]_0 - 2x)^2 = k \cdot dt$ then

$$\int \frac{dx}{(A_0 - x)(B_0 - 2x)^2} = \int k \cdot dt$$

Which we will solve using rational integrals:

$$\begin{aligned} & \int \frac{dx}{(A_0 - x)(B_0 - 2x)^2} \\ &= \int \frac{Mdx}{([A]_0 - x)} + \int \frac{Ndx}{([B]_0 - 2x)} + \int \frac{Qdx}{([B]_0 - 2x)^2} \\ & \frac{M(B_0 - 2x)^2}{(A_0 - x)(B_0 - 2x)^2} + \frac{N(A_0 - x)(B_0 - 2x)}{(A_0 - x)(B_0 - 2x)^2} + \frac{Q(A_0 - x)}{(A_0 - x)(B_0 - 2x)^2} \\ & 1 = M(B_0 - 2x)^2 + N(A_0 - x)(B_0 - 2x) + Q(A_0 - x) \end{aligned}$$

$$1 = M.B_0^2 - M.4.B_0x + M.4.x^2 + N.A_0B_0 - N.A_02x - N.B_0x + M.4.x^2 + Q.A_0 - Qx$$

$$\left. \begin{aligned} M.4.x^2 + 2.N.x^2 &= 0 \\ M.4.B_0x - N.A_02x - N.B_0x - Qx &= 0 \\ M.B_0^2 + N.A_0B_0 + Q.A_0 &= 1 \end{aligned} \right\}$$

$$M = -N/2, -N/2.4.B_0 - N.2A_0 - N.B_0 - Q = 0,$$

$$-\frac{N}{2}.B_0^2 + N.A_0B_0 + Q.A_0 = 1$$

$$N(2B_0 + A_0^2) + Q = 0 \quad \frac{-Q}{(2B_0 + A_0^2)} + Q.A_0 = 1$$

$$Q = \frac{2B_0 + A_0^2}{(B_0^2 + A_0B_0 + 2B_0 + A_0^2)} N = \frac{-1}{(B_0^2 + A_0B_0 + 2B_0 + A_0^2)}$$

$$M = \frac{1}{2.(B_0^2 + A_0B_0 + 2B_0 + A_0^2)}$$

Therefore:

$$\begin{aligned} \int \frac{dx}{(A_0 - x)(B_0 - 2x)^2} &= \int \frac{Mdx}{([A]_0 - x)} + \int \frac{Ndx}{([B]_0 - 2x)} + \int \frac{Qdx}{([B]_0 - 2x)^2} = \\ &= -M.Ln([A]_0 - x) + M.Ln([B]_0 - 2x) - \frac{Q}{2.([B]_0 - 2x)} = kt \end{aligned}$$