Clase 5 23 octubre 2020

Título de la nota 23/10/2020

Solubilidad $\Delta H_{sol} = +$

$\uparrow T$ $\uparrow$ solubilidad

Solubilidad $\Delta S_{sol.} -$

$\uparrow T$ $\downarrow$ solubilidad

$K_a = K_{eq}$

$$\ln \frac{K_2}{K_1} = \frac{\overline{\Delta H_R}}{R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

$$T_1 = 298.15\ K \text{ ó } 25^\circ C$$

$$K_1 = K_{eq} \text{ a } 298.15\ K$$

$$\ln \frac{K_{w_2}}{K_{w_1}} = \frac{\overline{\Delta H_R}}{R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

Sol. $\frac{4\ g}{L}$ $M = \frac{183.2\ g}{mol.}$

$pKa = 1.3$

$\frac{Ka}{Co} = \frac{10^{-1.3}}{10^{-2.3}} = 10^{1}$

ácido Fte.

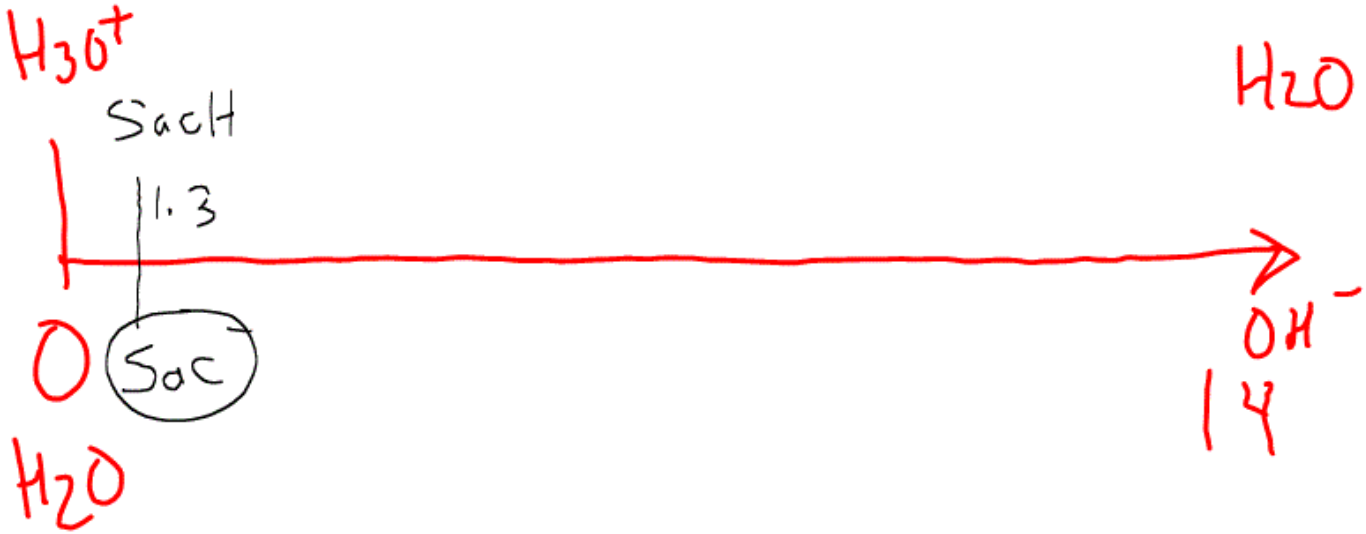
$$10^{-2.3} = 0.005\,M$$

$$\left(0.005\,\frac{mol}{L}\right)\left(183.2\,\frac{g}{mol}\right)$$

$$= 0.916\,\frac{g}{L}$$

$$= 91\,mg/100\,mL$$

ácido	HA	$+ OH^-$	$\rightleftharpoons$	$A^- + H_2O$
Fuerte	$5 \times 10^{-3} M$	$0.01 M$		muy débil
Inicio	C_0			
Ag		xC_0		
BPE	$C_0(1-x)$	~ 0		
PE	εC_0	εC_0		
DPE	~ 0	$C_0(x-1)$		


H3O+
SacH
1.3
H2O
OH-
0
Sac
14
H2O

$HCO_3^- + H_3O^+ \rightleftharpoons H_2CO_3 + H_2O$

$x = 0 \quad pH = ?$

$x = 0$ anfolito

$H_2CO_3 \rightleftharpoons CO_2 + H_2O$ (g)

$pH = (pKa_1 + pKa_2)/2$

$= \frac{6.35 + 10.35}{2}$

$= 8.35$

$x = 0.5$ Amort. débil

$pH = pKa_1 + \log \frac{C_B}{C_A}$

$$pH = 6.35 + \log \frac{[HCO_3^-]}{[H_2CO_3]}$$

$$= 6.35 + \log \frac{C_0(1-x)}{x C_0}$$

$$= 6.35 + \log \frac{10^{-2}(1-0.5)}{0.5\,(10^{-2})}$$

$$= 6.35 + \log 1$$

$$= 6.35$$

$x = 1$ $\qquad \frac{K_a}{C_0} = \frac{10^{-6.35}}{10^{-2}} = 10^{-4.35}$

ácido débil

$x = 1$

$$pH = \frac{1}{2}(pKa_1) - \frac{1}{2}\log c_A$$

$$= \frac{1}{2}(6.35) - \frac{1}{2}\log 10^{-2}$$

$$= 3.175 + 1 = 4.175$$

$x = 1.5$ ácido fte

$$pH = -\log c_A = -\log C_0(x-1)$$

$$= -\log 10^{-2}(1.5-1)$$

$$= -\log 5 \times 10^{-3} = 2.3$$

$$x = 2$$

$$pH = -\log c_a = -\log c_0(x-1)$$

$$= -\log 10^{-2}(2-1)$$

$$= -\log 10^{-2}$$

$$= 2$$

1°/. APE

Amortiguador

$$pH = pKa_1 + \log \frac{CB}{CA}$$

$$= 6.35 + \log \frac{1}{100}$$

$$= 6.35 + \log 10^{-2}$$

$$= 6.35 - 2 \quad 4.35$$

1°/. DPE

Acido Fte

$$pH = -\log CA$$

$$pH = -\log Co\,10^{-1}\,10^{-2}$$

$$pH = -\log 10^{-1}\,10^{-2}$$

$$pH = -\log 10^{-3}$$

$$pH = 3$$

$$pH_{p.e.} = \frac{4.35 + 3}{2} = 3.675$$

Aceptabilidad

Bicarbonato inyectable (10% p/v)

Contenido (95-105)%

$\left(\frac{10\ g}{100\ mL}\right)$ gasto de 25 mL de titulante

Base débil - ácido fte.

$pKa = 4.5$

10^{-2} M 10^{-2} M

Inicio	C_0	xC_0	
Ag			
APE	$C_0(1-x)$	~ 0	xC_0
PE	εC_0	εC_0	C_0
DPE	~ 0	$C_0(x-1)$	C_0

$$K_r = \frac{[\text{Anilinium}]}{[\text{Aniline}][H_3O^+]}$$

$$= \frac{1}{K_a} = 10^{4.5}$$

$$K_r = \frac{C_0}{\varepsilon C_0 \, \varepsilon C_0} = 10^{4.5}$$

$$10^{4.5} = \frac{1}{\varepsilon^2 C_0} \quad \therefore \varepsilon^2 = \frac{1}{K_r C_0}$$

$$\varepsilon = \sqrt{\frac{1}{K_r C_0}} = \sqrt{\frac{1}{10^{4.5} 10^{-2}}} = 10^{-2.5/2}$$

$$\varepsilon = 10^{-2.5/2} = 10^{-1.25}$$

$$\%Q = (1-\varepsilon)100 = 94.35\%$$

Para ser cuantitativo el producto

$$K_r C_0 \geq 10^5$$

$$\varepsilon = \sqrt{\frac{1}{K_r C_0}} = 10^{-5/2} = 10^{-2.5}$$

$$\%Q = (1-\varepsilon)100 = 99.7\%$$

$C_0 = 10^{-2}\ M$

$K_r = 10^{7}$

$K_r C_0 = 10^{7}\ 10^{-2} = 10^{5}$

$pKa \geq 7 \quad pKb \leq 7$

base de interes farmacéutico

$pKa = 8$

$$K_r = \frac{[BH]}{[B][H_3O^+]} = \frac{1}{Ka}$$

$$= \frac{1}{10^{-8}} = 10^8$$

$$\varepsilon = \sqrt{\frac{1}{K_r C_0}} = \sqrt{\frac{1}{10^8 10^{-2}}}$$

$$= 10^{-6/2} = 10^{-3}$$

$$\% \theta = (1-\varepsilon)100 = 99.9\%$$

$$\frac{Kb}{Co} = \frac{10^{-6}}{10^{-2}} = 10^{-4}$$ base débil

X	pH	comportamiento
0	10	base débil
0.5	8	amortiguador débil
1	5	ácido débil
1.5	2.3	ácido Fuerte
2.0	2	ácido Fuerte

$\frac{Ka}{Co}$ 4 −

$\frac{10^{-8}}{10^{-2}} = 10^{-6}$

ácido débil

$$X = 0$$

$$pH = \frac{1}{2} pKw + \frac{1}{2} pKa + \frac{1}{2} \log C_B$$

$$= 7 + \frac{1}{2}(8) + \frac{1}{2} \log 10^{-2}$$

$$= 7 + 4 - 1 = 10$$

$X = 0.5$ amortiguador débil

$$pH = pKa + \log \frac{C_B}{C_A}$$

$$= 8 + \log \frac{C_0(1-x)}{x C_0}$$

$$= 8 + \log \frac{10^{-2}(1-0.5)}{10^{-2}(0.5)} = 8$$

X = 1 ácido débil

$pH = \frac{1}{2} pKa - \frac{1}{2} \log CA$

$= \frac{1}{2}(8) - \frac{1}{2} \log 10^{-2}$

$= 4 + 1 = 5$

X = 1.5 ácido Fte

$pH = -\log CA = -\log 10^{-2}(x-1)$

$= -\log 10^{-2}(1.5-1)$

$= -\log 5 \times 10^{-3} = 2.3$

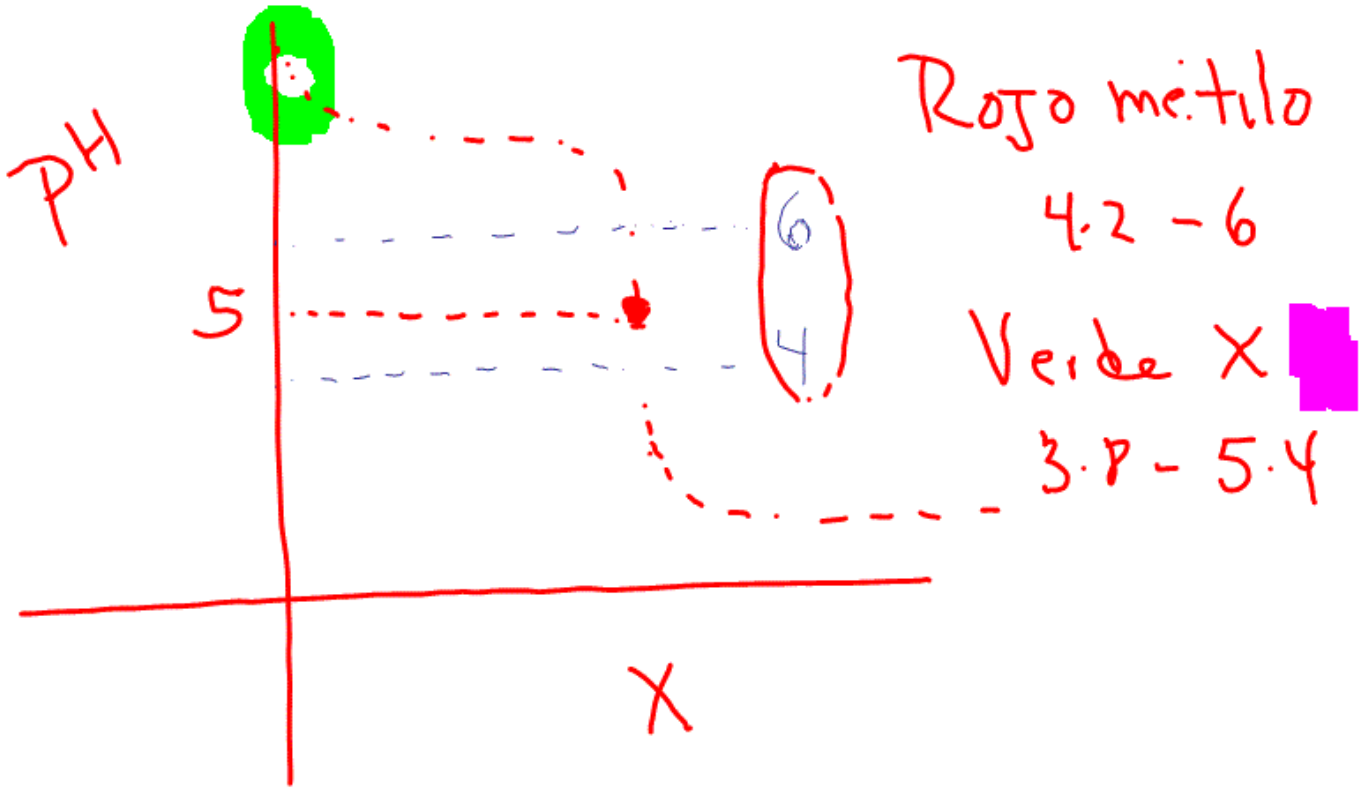
X = 2

$pH = -\log CA = -\log 10^{-2}(2-1)$

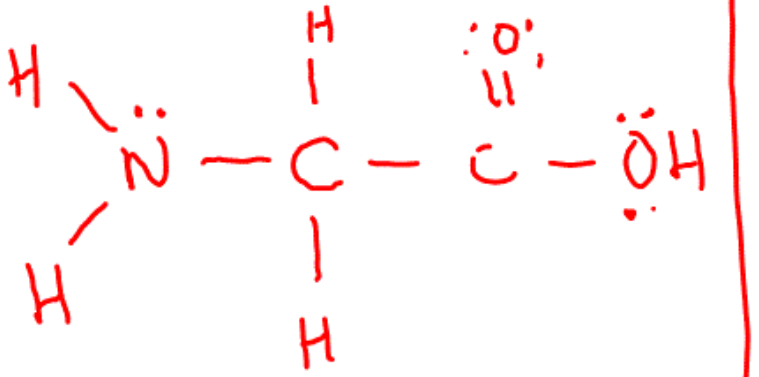
$= -\log 10^{-2} = 2$

1.1 APE	1.1 DPE
Amortiguador:	Acido Fte
$pH = pKa + \log \frac{CB}{CA}$	$pH = -\log CA$
$= 8 + \log \frac{1}{100}$	$= -\log 10^{-2}\ 10^{-2}$
$= 8 + \log 10^{-2}$	$= -\log 10^{-4}$
$= 6$	$= 4$

$$pH\,p.e = \frac{6+4}{2} = 5$$


pH
5
6
4
X
Rojo metilo
4.2 - 6
Verde X
3.8 - 5.4

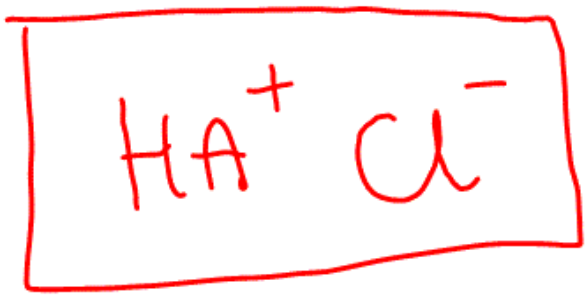
$H_2N - CH_2 - COOH$



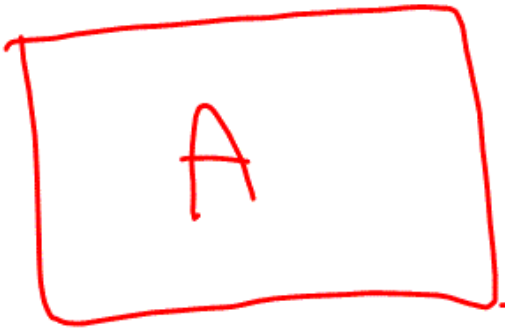
A

$$H_2O + AH^+ \rightleftharpoons H_3O^+ + A$$

$$H_2O + A^- \rightleftharpoons AH + OH^-$$



clorhidrato del aminoácido



aminoácido base

sal sódica

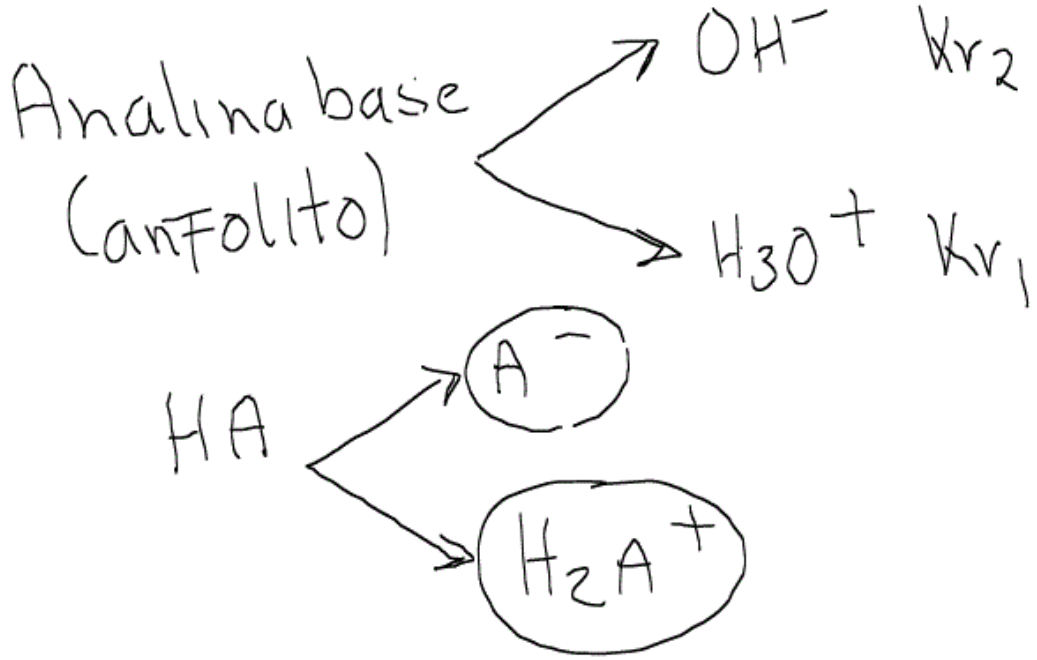
Alanina $pKa_1 = 2.35$

$pKa_2 = 9.7$

Diácido Clorhidrato de Alanina

Anfolito o Alanina base

Dibase Alaninato de sodio



$$HA + H_3O^+ \rightleftharpoons H_2A^+ + H_2O$$

$$Kr_1 = \frac{[H_2A^+]}{[HA][H_3O^+]} = \frac{1}{Ka_1} = \frac{1}{10^{-2.35}}$$

$$= 10^{2.35}$$

$$HA + OH^- \rightleftharpoons A^- + H_2O$$

$$K_{v2} = \frac{[A^-]}{[HA][OH^-]} \cdot \frac{[H_3O^+]}{[H_3O^+]}$$

$$\simeq \frac{K_{a2}}{K_w} = \frac{10^{-9.7}}{10^{-14}} = 10^{4.3}$$

$$K_v = \frac{C_0'}{\varepsilon C_0 \varepsilon C_0'} = 10^{4.3} \qquad C_0 = 10^{-2}\,M$$

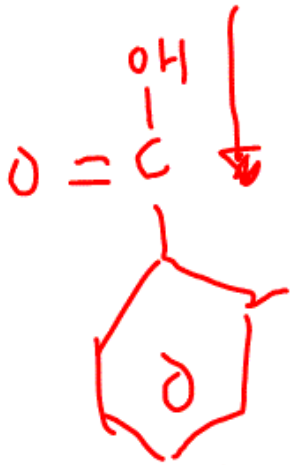
$$\varepsilon = \sqrt{\frac{1}{K_v C_0}} = \sqrt{\frac{1}{10^{4.3}\,10^{-2}}} = \sqrt{\frac{1}{10^{2.3}}}$$

$$\varepsilon = 10^{-2.3/2} = 10^{-1.15}$$

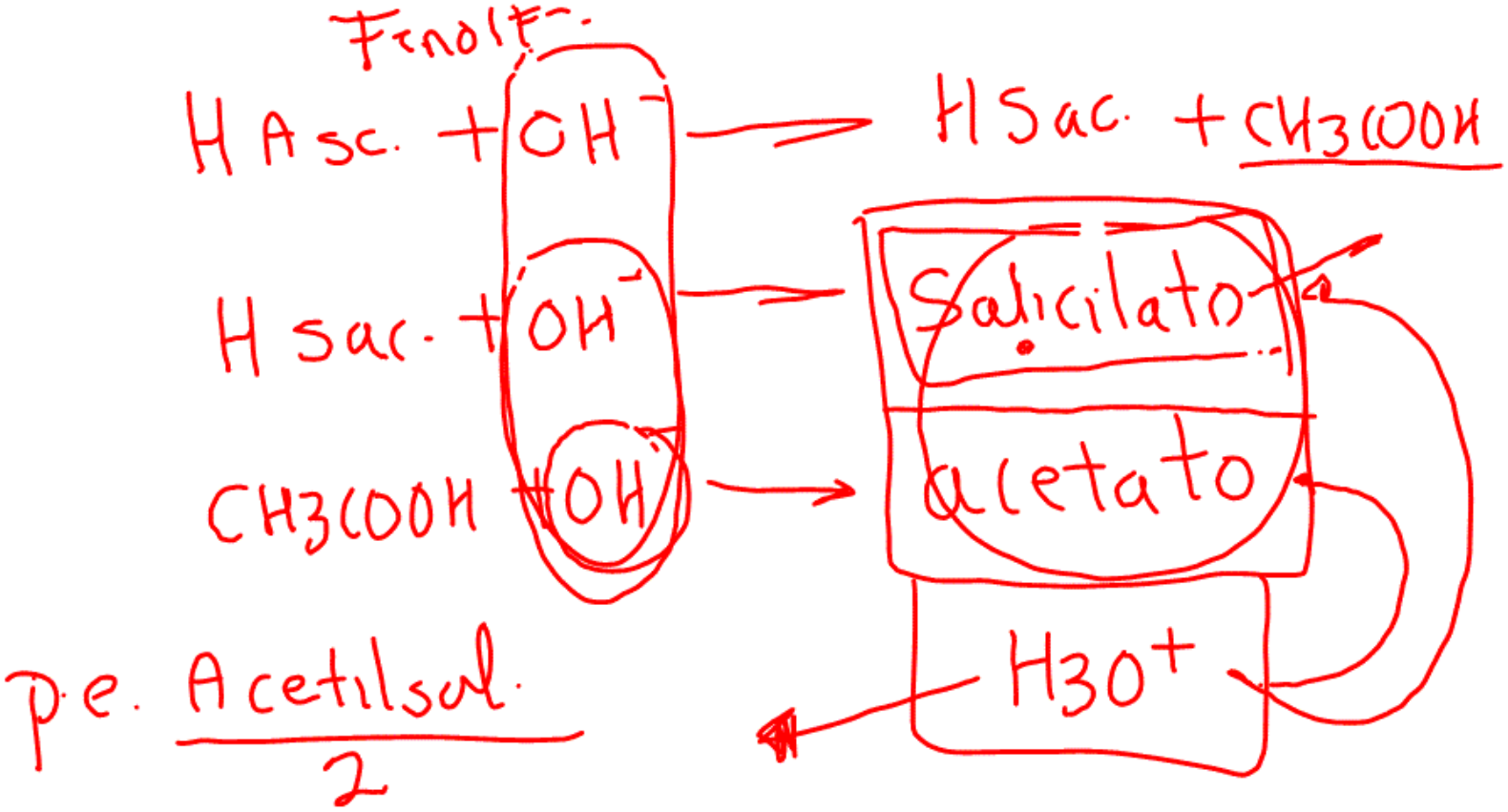
$$1.0\,(1-\varepsilon)100 = 92.9\,\%$$

Acido acetilsalicílico

base fte exceso → hidrolisis



ácido salicílico


Fenolf.
HAsc. + OH⁻
HAsc. + CH3COOH
Hsac. + OH⁻
Salicilato
CH3COOH + OH⁻
acetato
H3O+
p.e. Acetilsal.
2