

Clase 8 22 octubre 2021

Título de la nota

22/10/2021

Disolventes

anfipróticos

EtOH

MeOH

DMSO

DMFA

ACN

0 → PK 4.5
14 Agua

MeOH

0 → 16.9

0 → 19.5
EtOH

cte dieléctrica

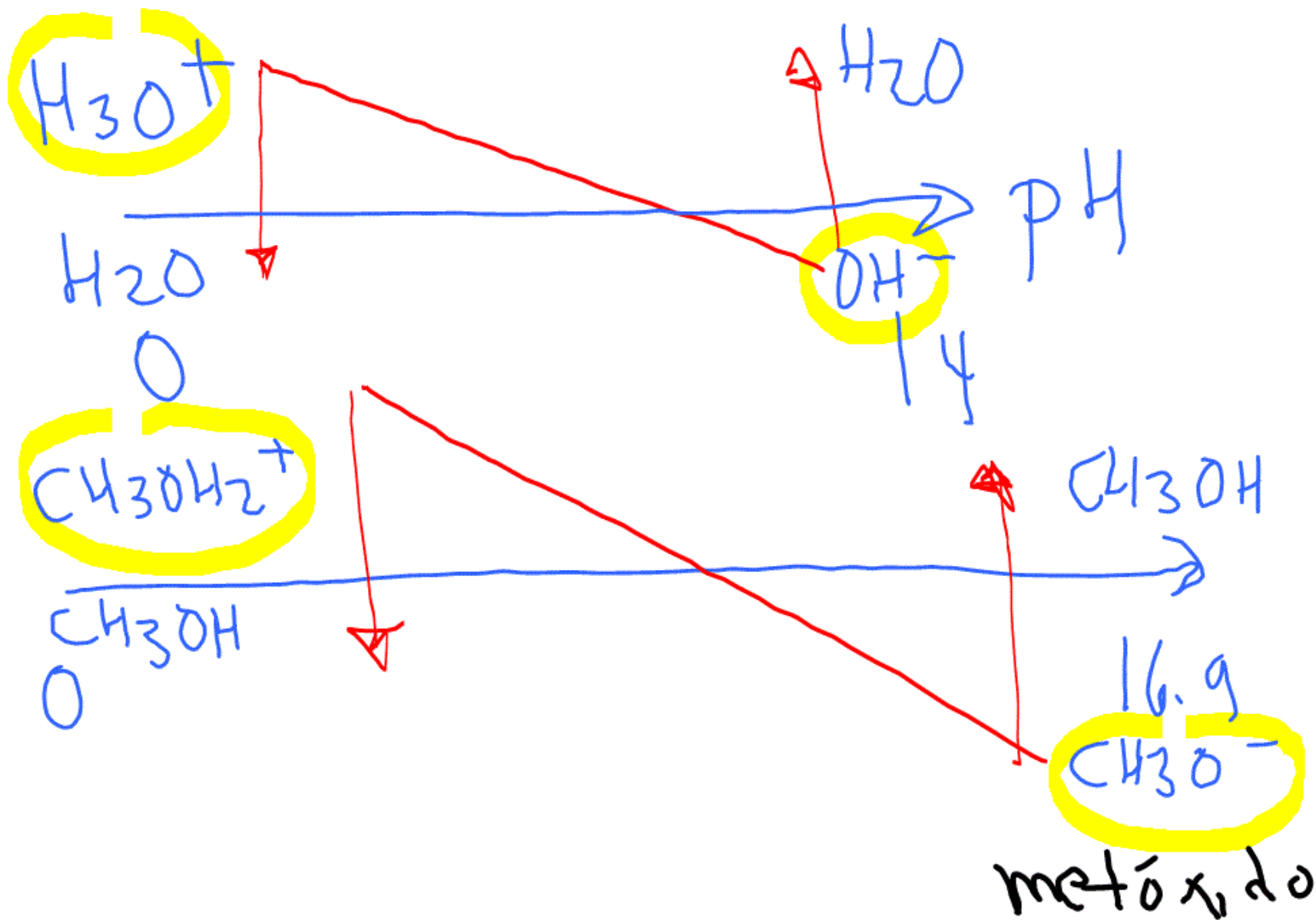
$$\epsilon > 20$$

Agua, MeOH, EtOH

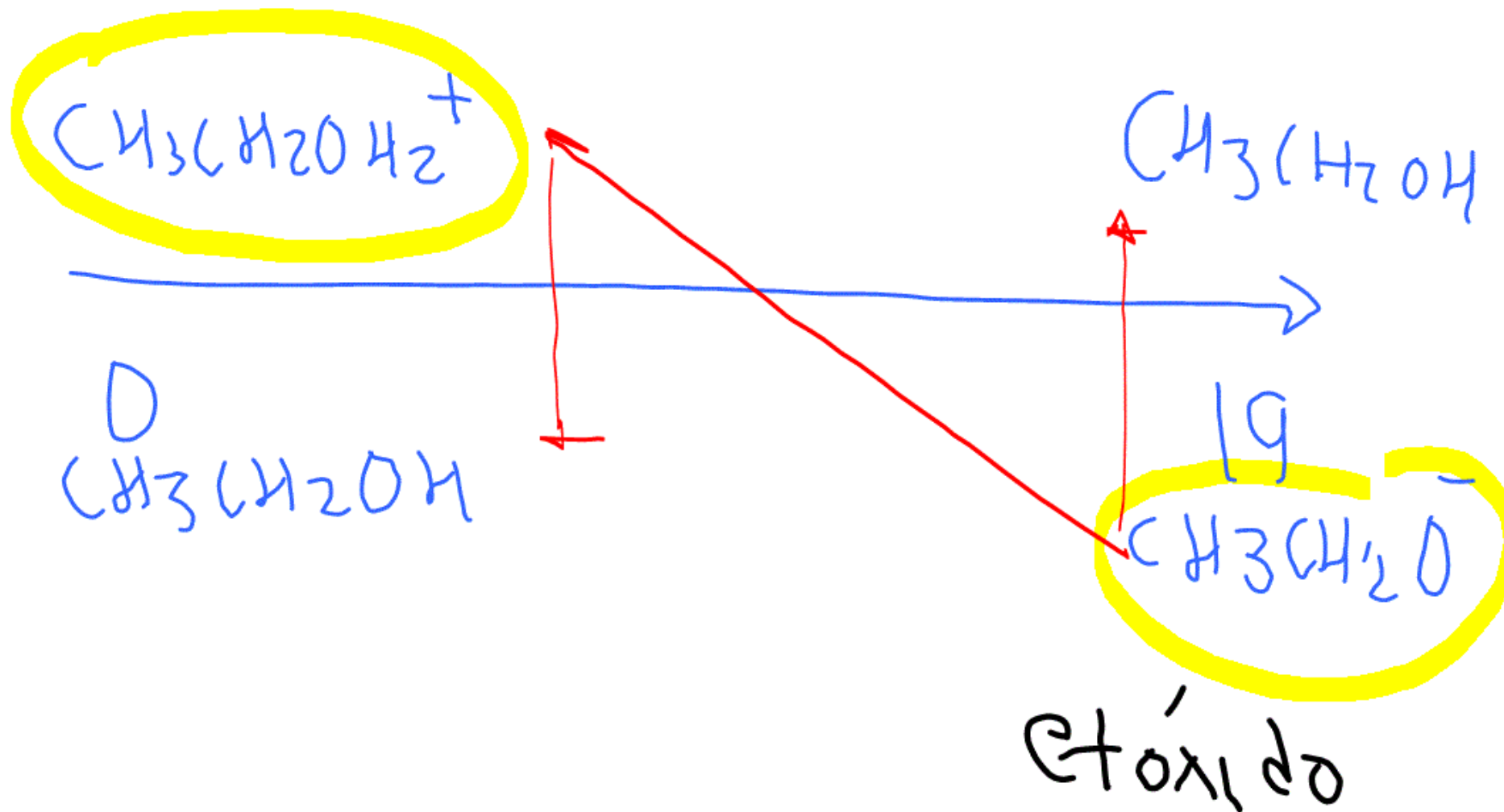
$$\epsilon < 20$$

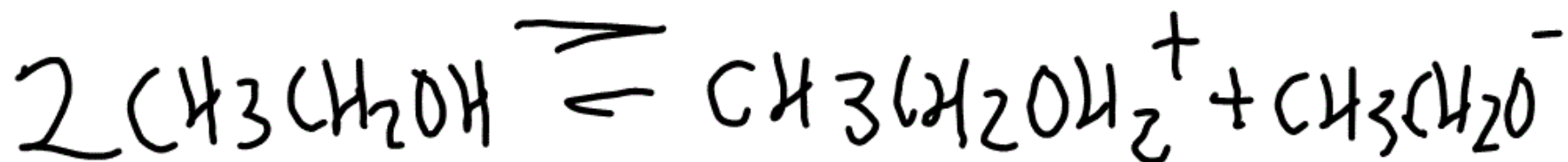
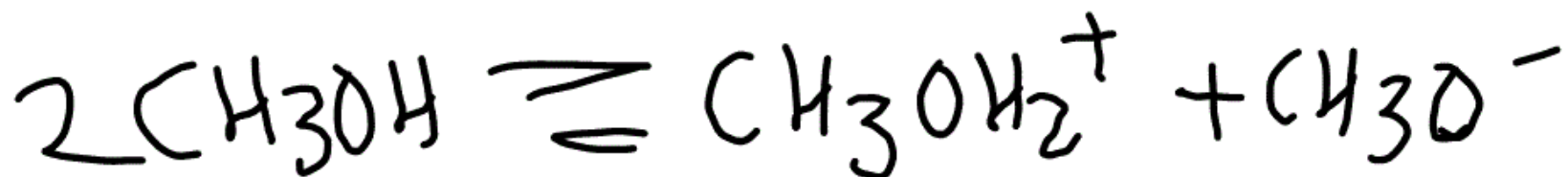
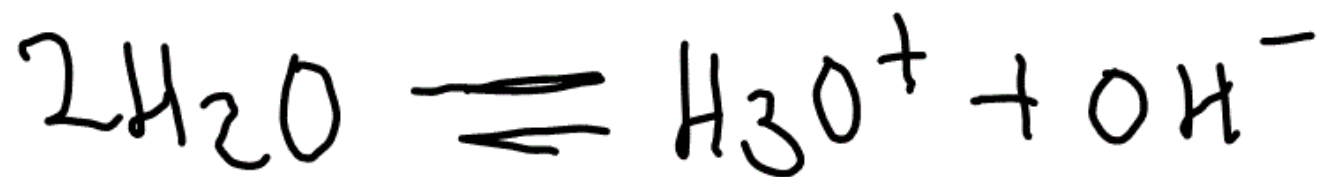
Ácido acético, piridina

dioxano, CCl₄ CHCl₃



Etanol





pK_a CH_3COOH

$$agua = 4.75$$

$$MeOH = pK_a \text{ agua} + \Delta pK_a$$

$$= 4.75 + 4.8$$

pK_a CH_3COOH
MeOH

$$= 9.55$$

$pK_a \text{CH}_3\text{COO}^-$

Agua = 4.75

$$\begin{aligned} pK_a \text{CH}_3\text{COO}^- &= pK_a \text{agua} + \Delta pK_a \\ \text{meda} & \\ &= 4.75 - 2 = 2.75 \end{aligned}$$

Azul de timol $pK_a \text{ agua} = 9.2$

$pK_a \pm 1$


8.2 - 10.2

Color 1

Color 2

Con apoyo del programa DGAPA-UNAM-PAPIME PE-				
Disolvente	Agua ▼	Cuantitatividad 1		Ácido débil
Sustancia	Acético ▼	Kr	1.80e+9	
C_A (mol/L)	0.01000	ϵ	0.00024	
C_B (mol/L)	0.01000	%Q	99.9764	
ka	1.80e-5	Cuantitativo		
pka	4.74	APE Color 1	DPE Color 2	
pk disolvente	14	8.74	8.00	

Disolvente	MeOH ▾	Cuantitatividad 1		Ácido débil
Sustancia	Acético ▾	Kr	2.27e+7	
C_A (mol/L)	0.01000	ϵ	0.00210	
C_B (mol/L)	0.01000	%Q	99.7899	
ka	2.85e-10	Cuantitativo		
pka	9.54	APE Color 1	DPE Color 2	
pk disolvente	16.9	13.54	10.90	

Disolvente	EtOH ▼	Cuantitatividad 1		Ácido débil
Sustancia	Acético ▼	Kr	1.14e+9	
C_A (mol/L)	0.01000	ϵ	0.00030	
C_B (mol/L)	0.01000	%Q	99.9703	
ka	3.59e-11	Cuantitativo		
pka	10.44	APE Color 1	DPE Color 2	
pk disolvente	19.5	14.44	13.50	

X	PH	MeOH	EtOH
0	3.37	5.77	6.22
0.5	4.74	9.54	10.44
1	8.37	12.22	13.97
1.5	11.7	14.6	17.2
2	12	14.9	17.5

$C_a = 10^{-2} M$ $\chi = 0$ ácido débil

Agua

MeOH

EtOH

pKa

4.74

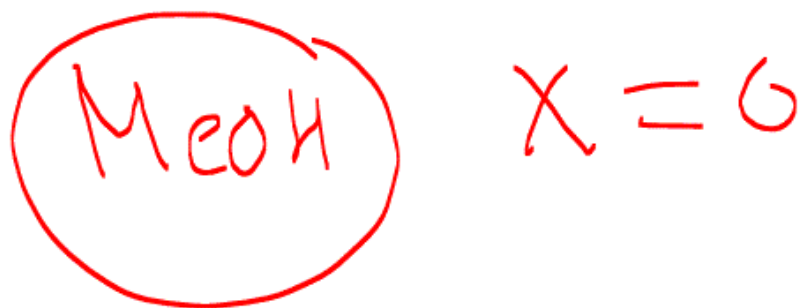
9.54

10.44

$$pH = \frac{1}{2} pKa - \frac{1}{2} \log C_a \quad \text{agua}$$

$$\text{agua} = \frac{1}{2} (4.74) - \frac{1}{2} \log 10^{-2}$$

$$= 2.37 + 1 = 3.37$$



$$\begin{aligned} \text{pH} &= \frac{1}{2} \text{pK}_a - \frac{1}{2} \log C_a \\ &= \frac{1}{2} (9.54) - \frac{1}{2} \log 10^{-2} \\ &= 4.77 + 1 = 5.77 \end{aligned}$$

$$\text{EtOH} \quad \alpha = 0$$

$$\text{pH} = \frac{1}{2} \text{pK}_a - \frac{1}{2} \log c_A$$

$$= \frac{1}{2} (10.44) - \frac{1}{2} \log 10^{-2}$$

$$= 5.22 + 1 = 6.22$$

$$X = 0.5 \quad C_B = C_A$$

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

$$pH = 4.74$$

MeOH

$$pH = 9.54$$

EtOH

$$pH = 10.44$$

$$X=1$$

$$\frac{K_b}{C_0} = \frac{10^{-9.76}}{10^{-2}} = 10^{-7.76}$$

agua

Base débil

$$pK_b = \underline{16.9} - 9.54$$

$$= 7.36$$

$$\text{MCH} \frac{K_b}{C_0} = \frac{10^{-7.36}}{10^{-2}} = 10^{-5.36}$$

Base débil

X=1 base débil

Agua

$$pH = \frac{1}{2} pK_{HS} + \frac{1}{2} pK_a + \frac{1}{2} \log c_B$$

$$= \frac{1}{2} (14) + \frac{1}{2} (4.74) + \frac{1}{2} \log 10^{-2}$$

$$= 7 + 2.37 - 1 = 8.37$$

$$X=1$$

MeOH

$$\begin{aligned} \text{pH} &= \frac{1}{2} \text{p}K_{\text{HS}} + \frac{1}{2} \text{p}K_{\text{a}} + \frac{1}{2} \log C_{\text{b}} \\ &= \frac{1}{2} (16.9) + \frac{1}{2} (9.54) + \frac{1}{2} \log 10^{-2} \\ &= 8.45 + 4.77 + 1 = 12.22 \end{aligned}$$

Σ + OH⁻ X = }

$$pH = \frac{1}{2} pK_{HS} + \frac{1}{2} pK_a + \frac{1}{2} \log CB$$

$$= \frac{1}{2} (19.5) + \frac{1}{2} (10.44) + \frac{1}{2} \log 10^{-2}$$

$$= 9.75 + 5.22 - 1$$

$$= 13.97$$

$$X = 1.5 \text{ base } fte$$

Agua

$$pH = pK_{HS} + \log CB$$

$$= 14 + \log C_0(x-1)$$

$$= 14 + \log 10^2(1.5-1)$$

$$= 14 + \log 5 \times 10^{-3} = 11.7$$

$$X = 1.5 \text{ base fte}$$

MeOH

$$pH = pK_{HS} + \log C_b$$

$$= 16.9 + \log C_b (X-1)$$

$$= 16.9 + \log 10^{-2} (1.5-1)$$

$$= 16.9 + \log 5 \times 10^{-3} = 14.6$$

$$X = 1.5$$

EtOH

$$pH = pK_{H_2O} + \log C_B$$

$$= 19.5 + \log C_0 (X-1)$$

$$= 19.5 + \log 10^{-2} (1.5-1)$$

$$= 19.5 + \log 5 \times 10^{-3} = 17.2$$

$$x=2$$

agua

$$\begin{aligned} \text{pH} &= 14 + \log C_0 (x-1) \\ &= 14 + \log 10^{-2} (2-1) \\ &= 14 + \log 10^{-2} = 12 \end{aligned}$$

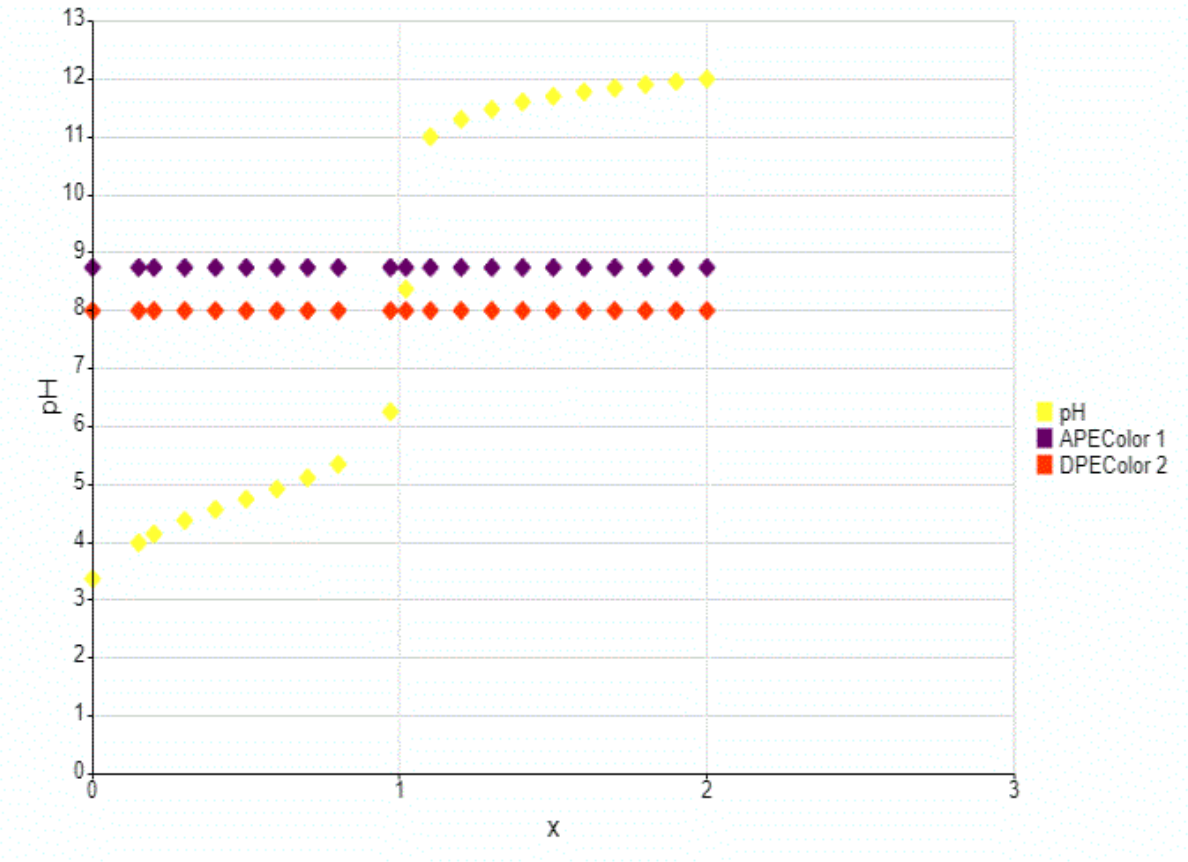
MeOH $X=2$

$$\begin{aligned} \text{pH} &= 16.9 + \log C_0 (X-1) \\ &= 16.9 + \log 10^2 (2-1) \\ &= 16.9 - 2 = 14.9 \end{aligned}$$

$$\Sigma + OH \quad X = 2$$

$$\begin{aligned} pH &= 19.5 + \log C_0 (X-1) \\ &= 19.5 + \log 10^2 (2-1) \\ &= 19.5 - 2 = 17.5 \end{aligned}$$

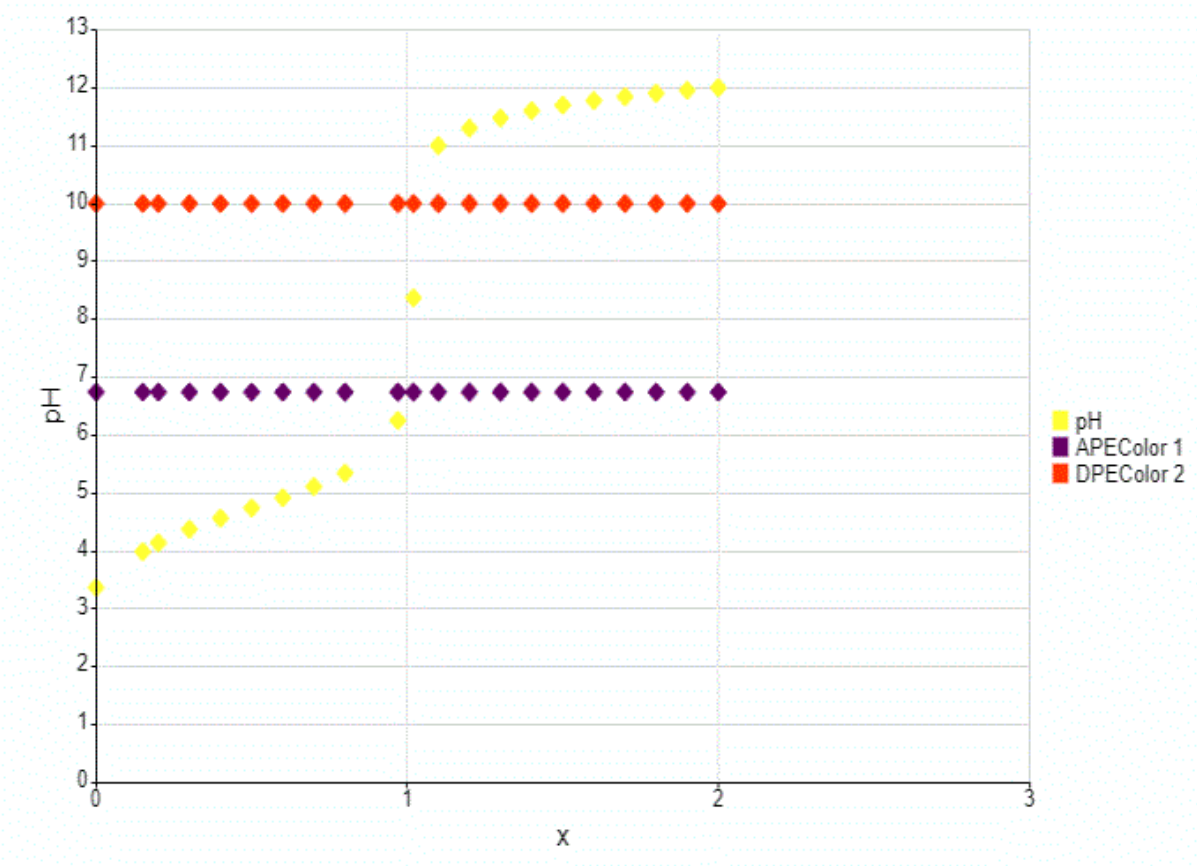
Curva de titulación ácido débil con base fuerte en disolventes anfipróticos



Disolvente	Agua
Sustancia	Acético
CA(mol/L)	0.01
CB(mol/L)	0.01

Dr. Juan Carlos Vázquez Lira 2021
 Con apoyo del programa DGAPA-UNAM-PAPIME PE-202021

Curva de titulación ácido débil con base fuerte en disolventes anfipróticos



Disolvente	Agua
Sustancia	Acético
CA(mol/L)	0.01
CB(mol/L)	0.01

Dr. Juan Carlos Vázquez Lira 2021
 Con apoyo del programa DGAPA-UNAM-PAPIME PE-202021

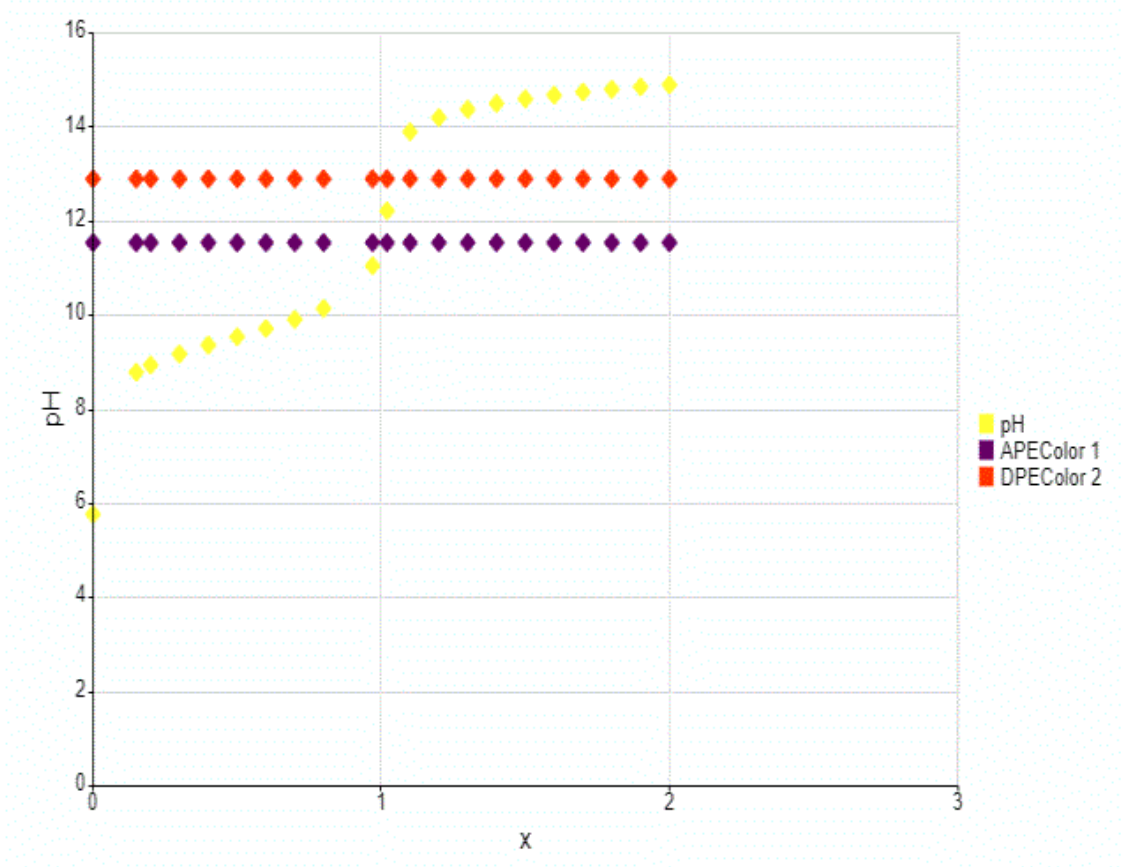
Ácido-base fuerte

Curva 1

Base-ácido fuerte

Curva 2

Curva de titulación ácido débil con base fuerte en disolventes anfipróticos

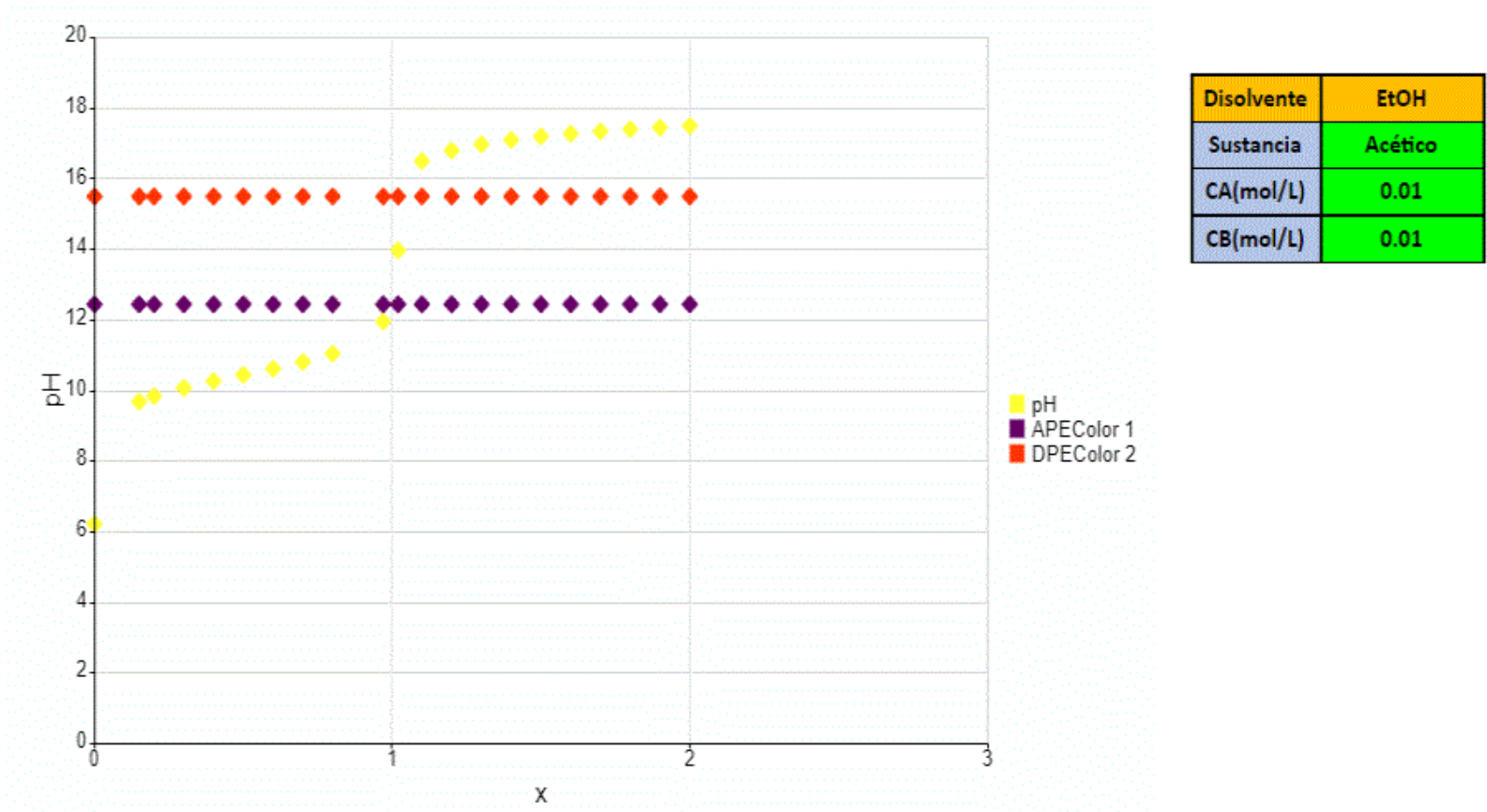


Disolvente	MeOH
Sustancia	Acético
CA(mol/L)	0.01
CB(mol/L)	0.01

Dr. Juan Carlos Vázquez Lira 2021
 Con apoyo del programa DGAPA-UNAM-PAPIIME PE-202021

Ácido-base fuerte Curva 1 Base-ácido fuerte Curva 2

Curva de titulación ácido débil con base fuerte en disolventes anfipróticos



Dr. Juan Carlos Vázquez Lira 2021
 Con apoyo del programa DGAPA-UNAM-PAPIME PE-202021

1-1. APE MeOH
Amortiguador,

$$C_A = 10^{-2}$$

$$1-1 \cdot 10^{-2} = 10^{-4}$$

$$C_B = \hat{=} 10^{-2}$$

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

$$= 9.54 + \log \frac{10^{-2}}{10^{-4}}$$

$$= 9.54 + \log 10^2 = 11.54$$

H. DPE base frte

$$pH = pK_{HS} + \log CB$$

$$CB = 10^{-2}$$

$$1/1 \cdot CB = 10^{-4}$$

$$pH = 16.9 + \log 10^{-4}$$

$$= 12.9$$

$$pH_{pe} = \frac{11.54 + 12.9}{2} = 12.22$$

K_r

ácido débil - base Fte

$$K_r = \frac{K_a}{K_w}$$

K_r base débil

$$K_r = \frac{1}{K_a}$$



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

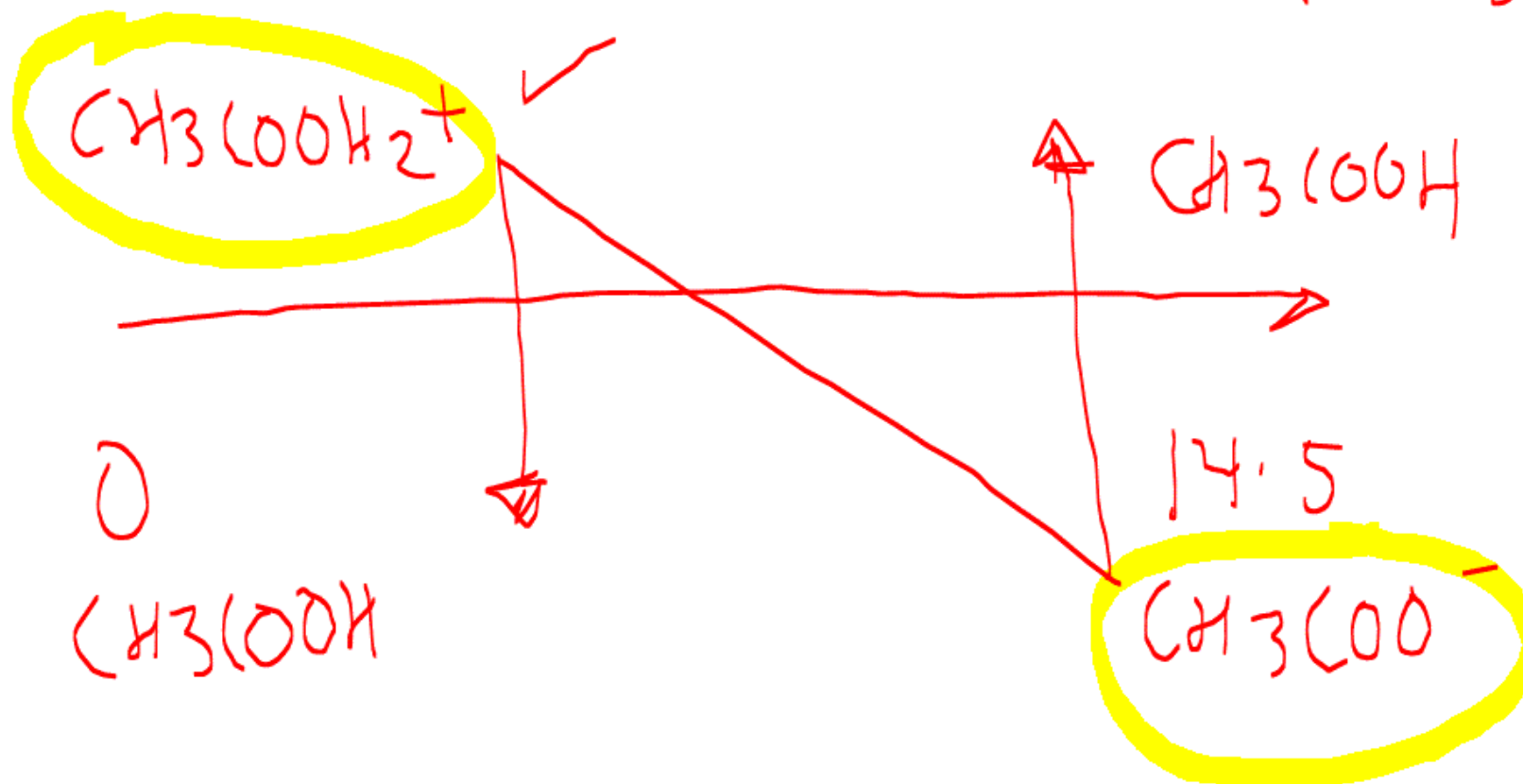
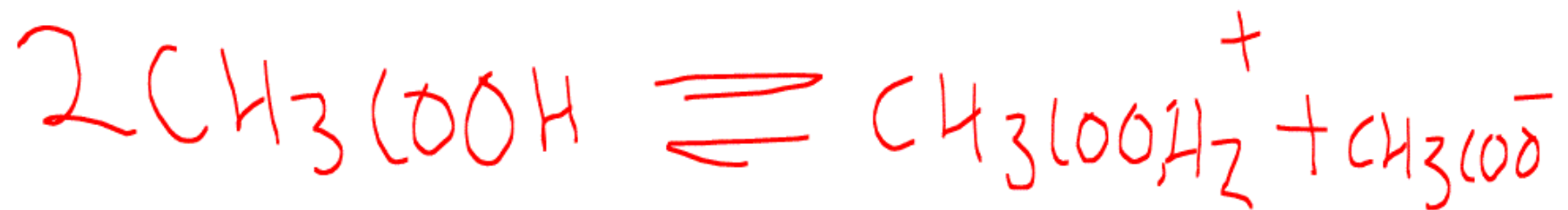
Bases débiles

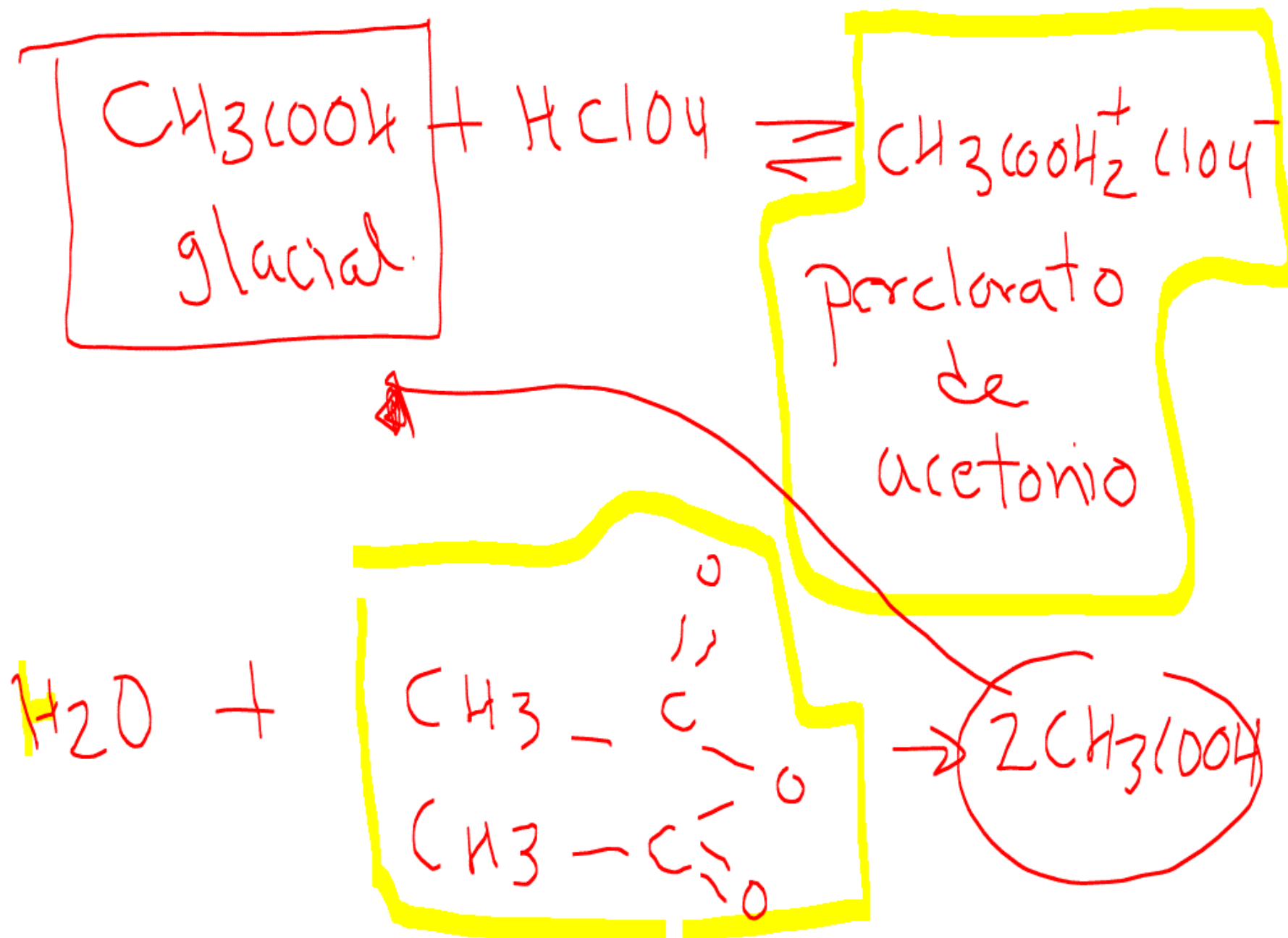
Medio CH_3COOH

$$pK_{\text{HS}} = 14.5$$

Verde de malaquita

Cristal violeta





Metóxido
Etóxido

