

Indicadores ácido-base

Los indicadores ácido-base son ácido orgánicos y por tanto ácido débiles. Para ello se puede plantear el siguiente equilibrio:



$$K_{HIn} = \frac{[In^-] * [H_3O^+]}{[HIn]}$$

La especie HIn tiene un color

y la especie In⁻ un color distinto

de manera que, según cual sea la especie

más abundante, será el color que predomine

$$\frac{K_{HIn}}{[H_3O^+]} = \frac{[In^-]}{[HIn]}$$

*si $[In^-] = 10 * [HIn]$ observaremos el color de In^-*

*si $10 * [In^-] = [HIn]$ observaremos el color de HIn*

Rango de viraje del Indicador

Color HIn

$$\frac{K_{HIn}}{[H_3O^+]} = \frac{1}{10} \Rightarrow \frac{K_{HIn}}{[H_3O^+]} = \frac{1}{10} \quad \text{---} \log$$

$$-\log K_{HIn} + \log [H_3O^+] = \log 10$$

$$pK_a - pH = 1 \Rightarrow pH = pK_a - 1$$

Rango de viraje del Indicador

Color In⁻

$$\frac{K_{HIn}}{[H_3O^+]} = \frac{10}{1} \Rightarrow \frac{K_{HIn}}{[H_3O^+]} = \frac{10}{1} \quad \text{---} \log$$

$$-\log K_{HIn} + \log [H_3O^+] = -\log 10$$

$$pK_a - pH = -1 \Rightarrow pH = pK_a + 1$$

Rango de viraje del Indicador

Color mezcla si $[In^-] = [HIn]$

$$\text{Color } HIn \Rightarrow \frac{K_{HIn}}{[H_3O^+]} = 1 \Rightarrow \frac{K_{HIn}}{[H_3O^+]} = 1 \quad \bigg/ -\log$$

$$-\log K_{HIn} + \log [H_3O^+] = \log 1$$

$$pK_a - pH = 0 \Rightarrow pH = pK_a$$

Rango de viraje del Indicador

$$pH = pK_a \pm 1$$

$$pH = pK_a + 1 \Rightarrow \text{color de } In^-$$

$$pH = pK_a - 1 \Rightarrow \text{color } HIn$$

$$pH = pK_a \Rightarrow \text{color mezcla}$$

TABLE 17.1 pH and the Colors of Acid–Base Indicators**Acid Color****Intermediate Color****Base Color**

$$[\text{In}^-]/[\text{HIn}] < 0.10$$

$$\text{pH} < \text{p}K_{\text{HIn}} + \log 0.10$$

$$\text{pH} < \text{p}K_{\text{HIn}} - 1$$

$$[\text{In}^-]/[\text{HIn}] \approx 1$$

$$\text{pH} \approx \text{p}K_{\text{HIn}} + \log 1$$

$$\text{pH} \approx \text{p}K_{\text{HIn}}$$

$$[\text{In}^-]/[\text{HIn}] > 10$$

$$\text{pH} > \text{p}K_{\text{HIn}} + \log 10$$

$$\text{pH} > \text{p}K_{\text{HIn}} + 1$$

Rango de viraje del Indicador

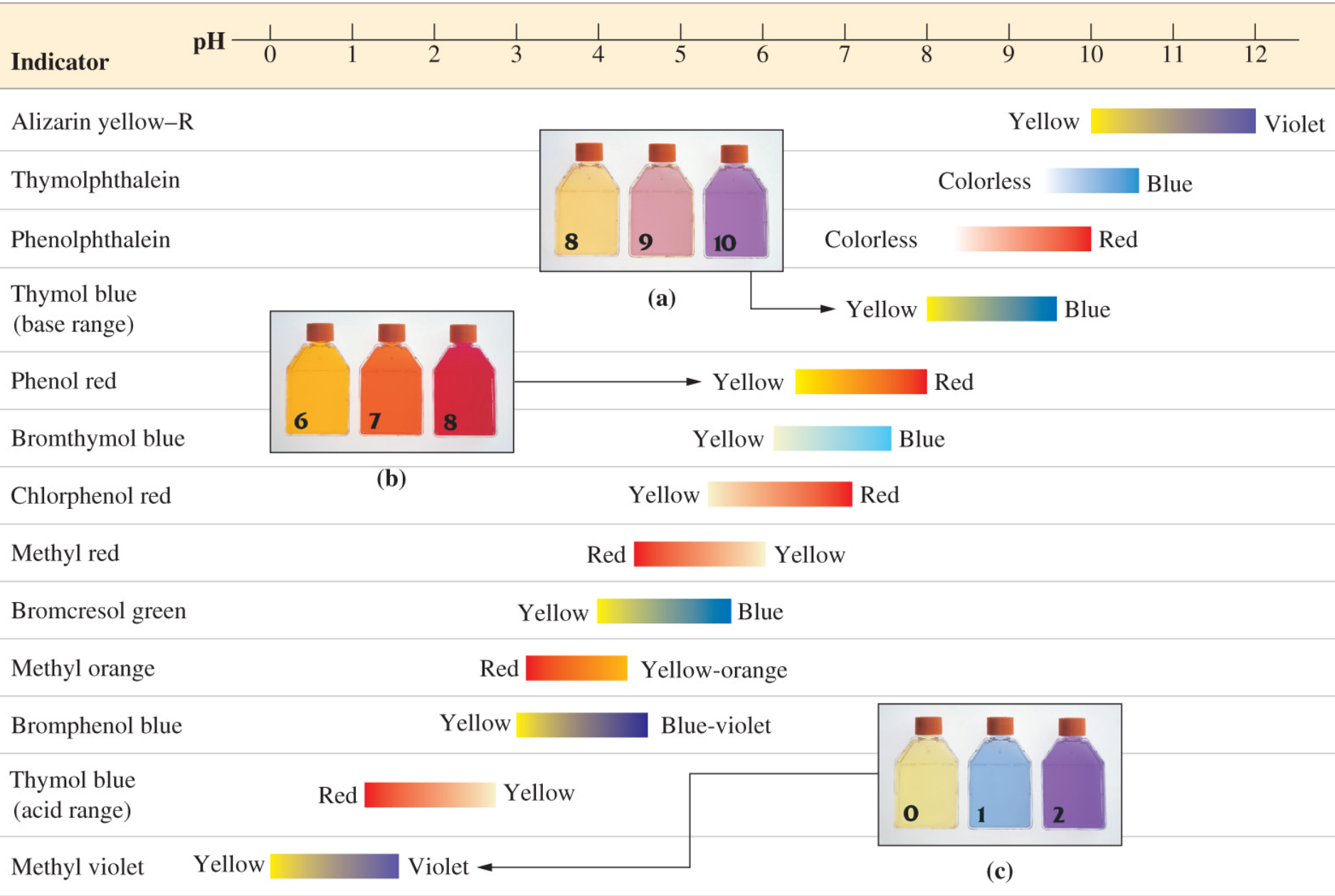
Azul de bromotimol $\Rightarrow pK_{HIn} = 7,1$

Rango de viraje :

$pH < 6,1 \Rightarrow$ amarillo

$pH \approx 7,1 \Rightarrow$ verde

$pH > 8,1 \Rightarrow$ azul



Titulaciones ácido-base

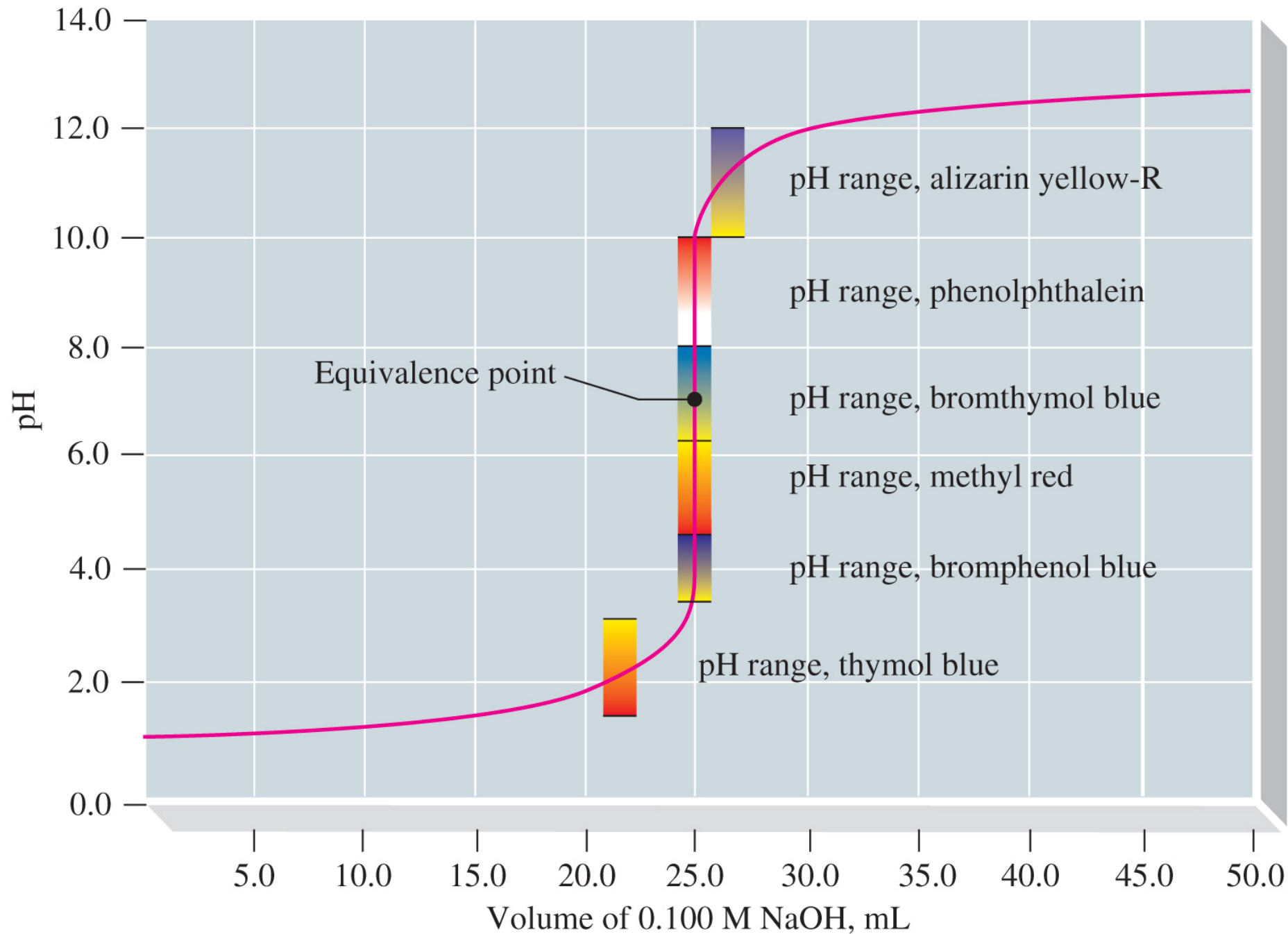
ácido fuerte con base fuerte

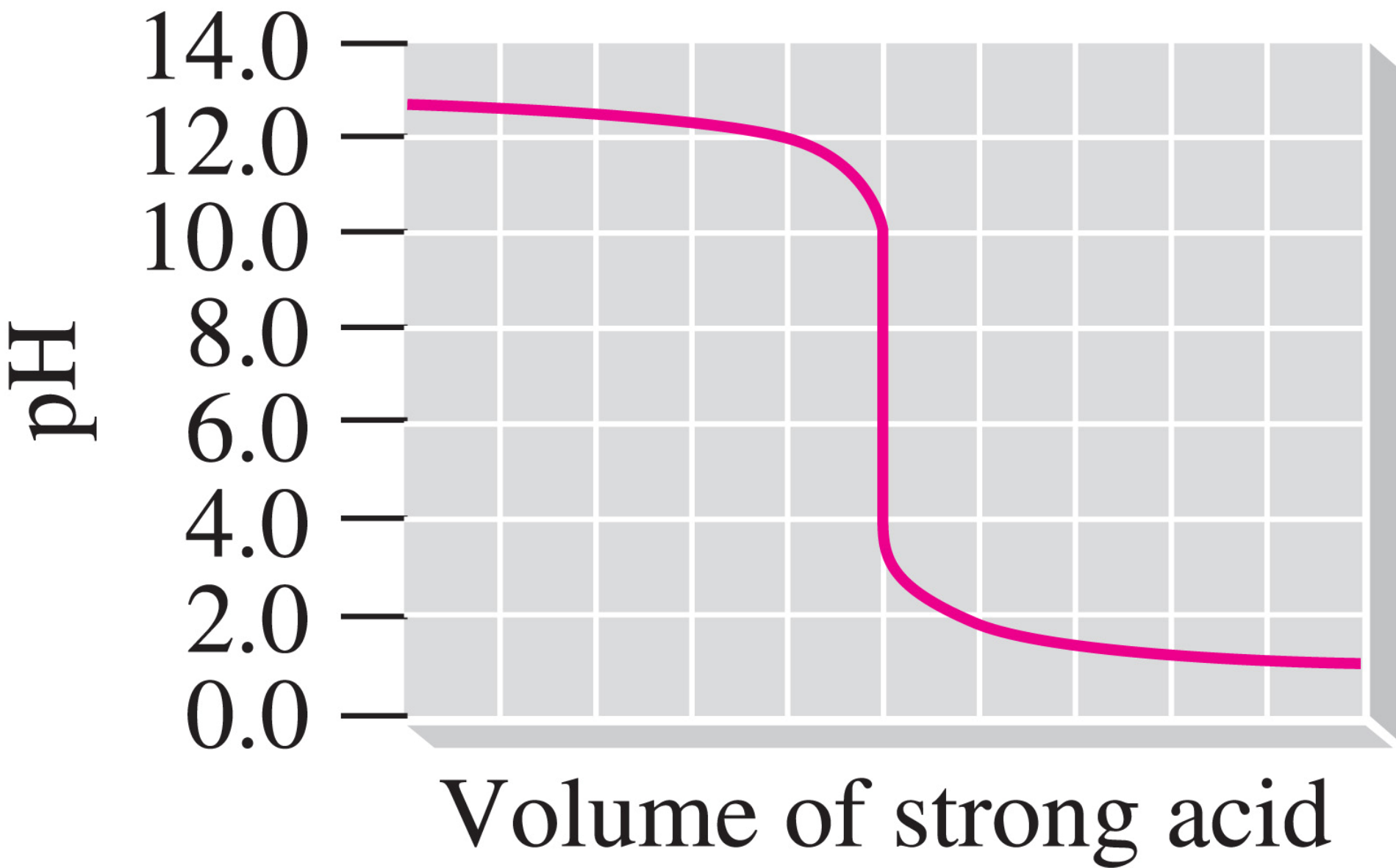
Caso:

25 mL de HCl 0,1mol/L

con NaOH 0,1 mol/L

Titration Data	
mL NaOH(aq)	pH
0.00	1.00
10.00	1.37
20.00	1.95
22.00	2.19
24.00	2.70
25.00	7.00
26.00	11.30
28.00	11.75
30.00	11.96
40.00	12.36
50.00	12.52





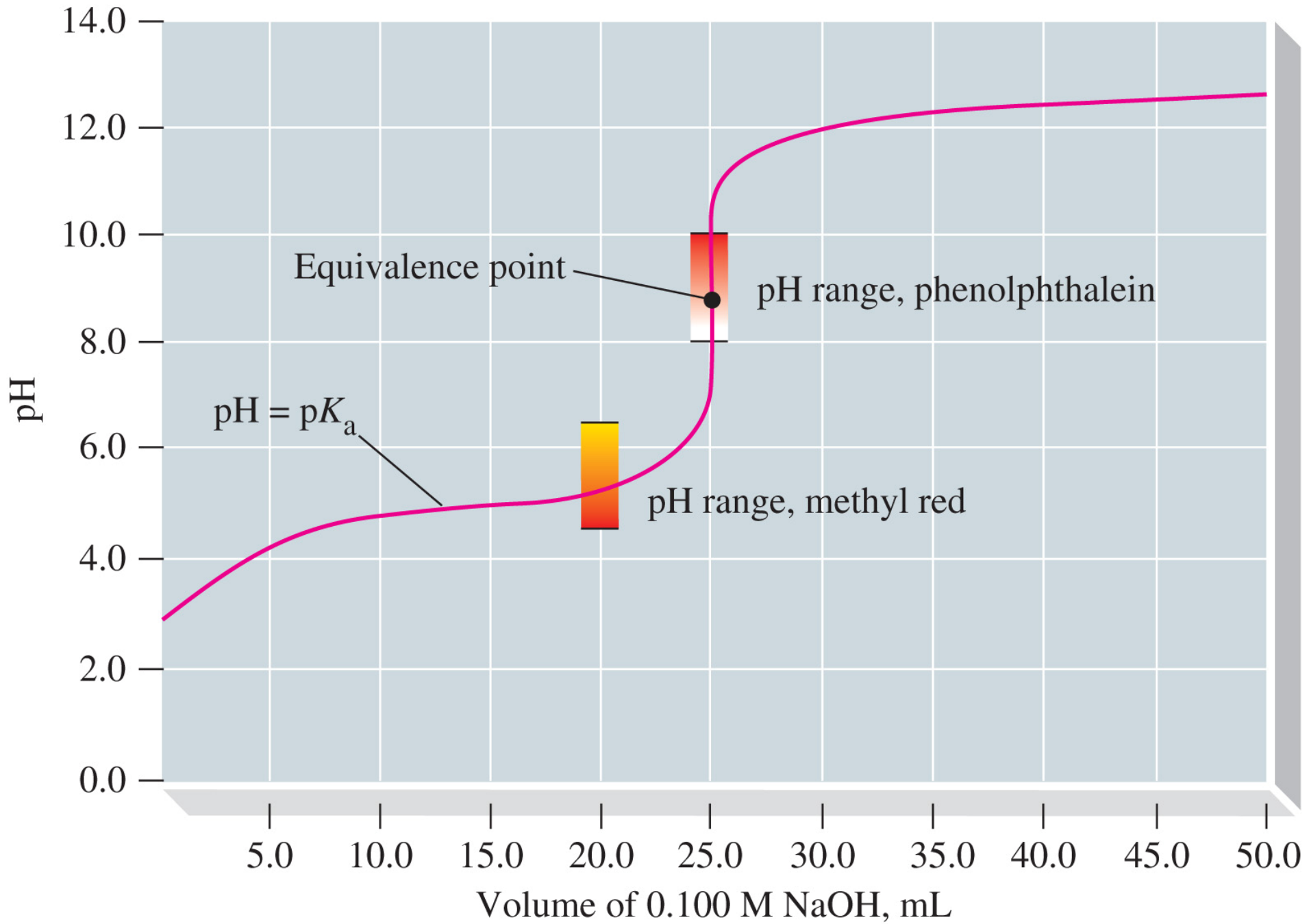
Titulaciones ácido-base

ácido débil con base fuerte

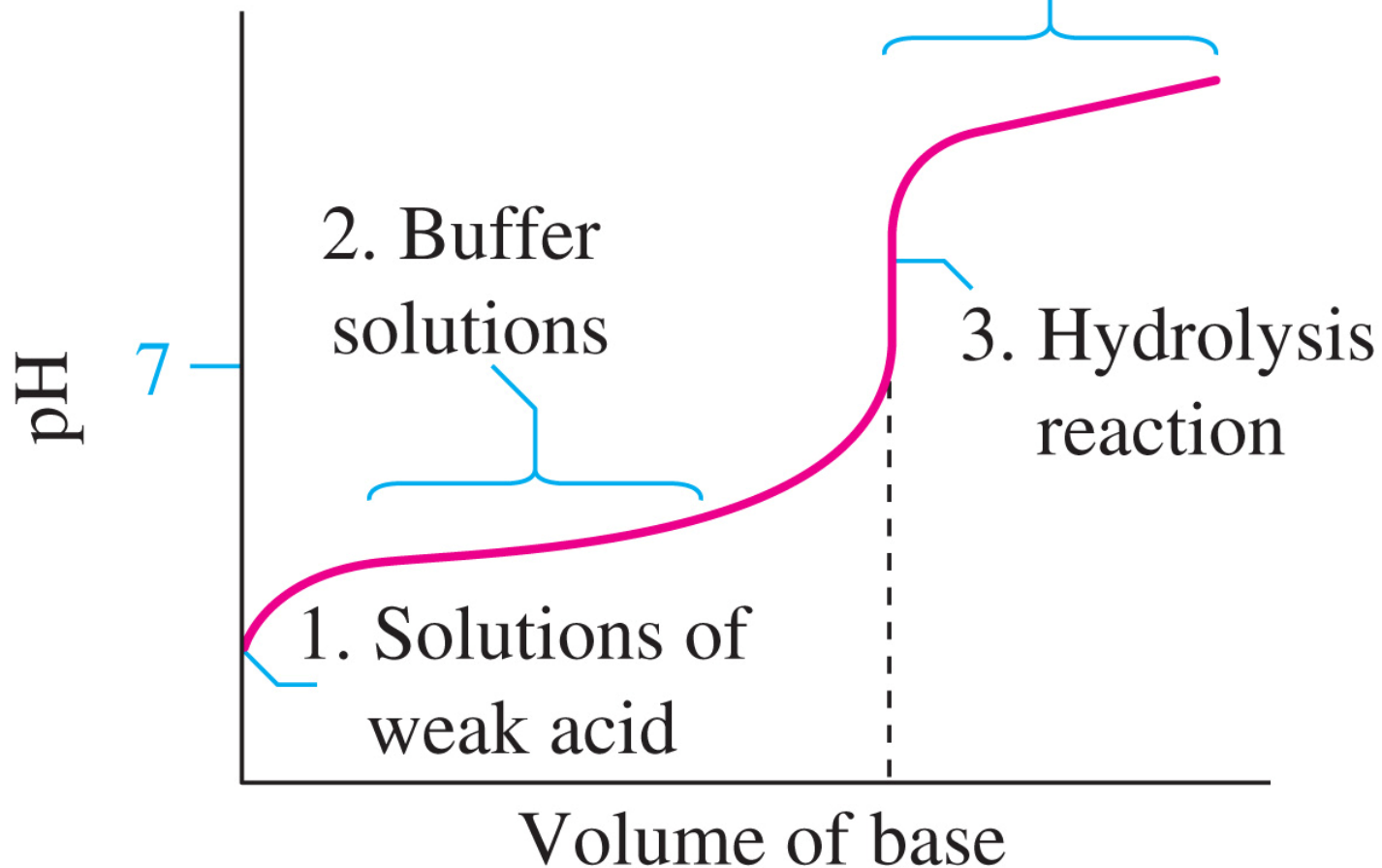
Caso:

*25 mL de HAc 0,1mol/L
con NaOH 0,1 mol/L*

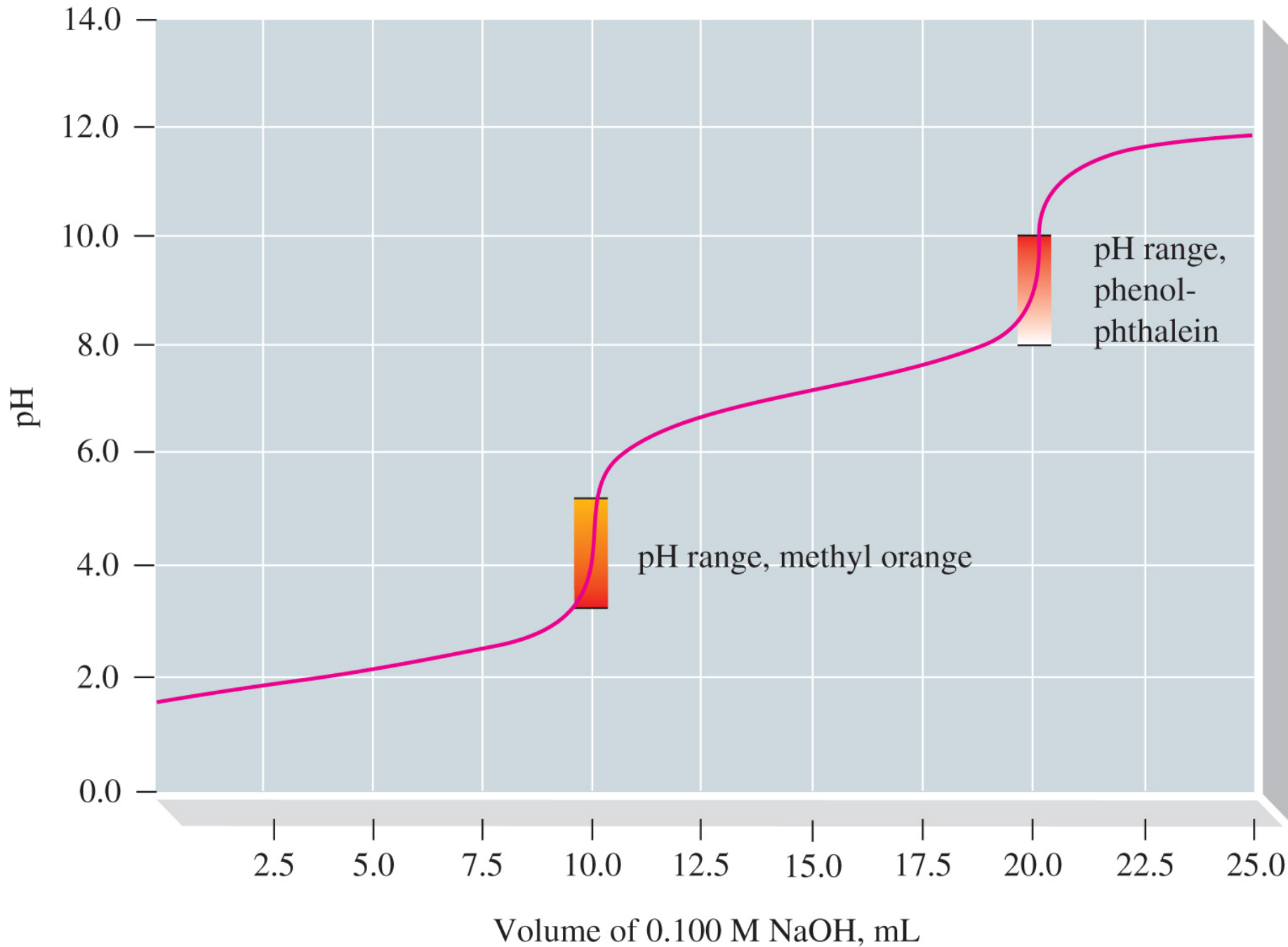
Titration Data	
mL NaOH(aq)	pH
0.00	2.89
5.00	4.14
10.00	4.57
12.50	4.74
15.00	4.92
20.00	5.35
24.00	6.12
25.00	8.72
26.00	11.30
30.00	11.96
40.00	12.36
50.00	12.52

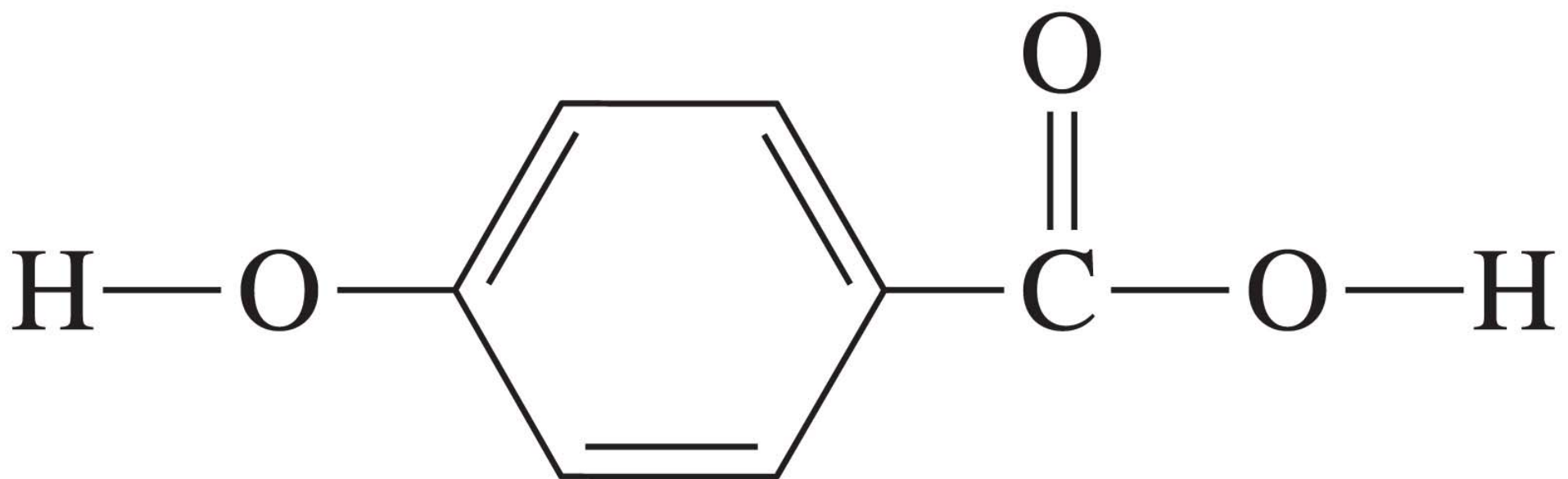


4. Solutions of strong base

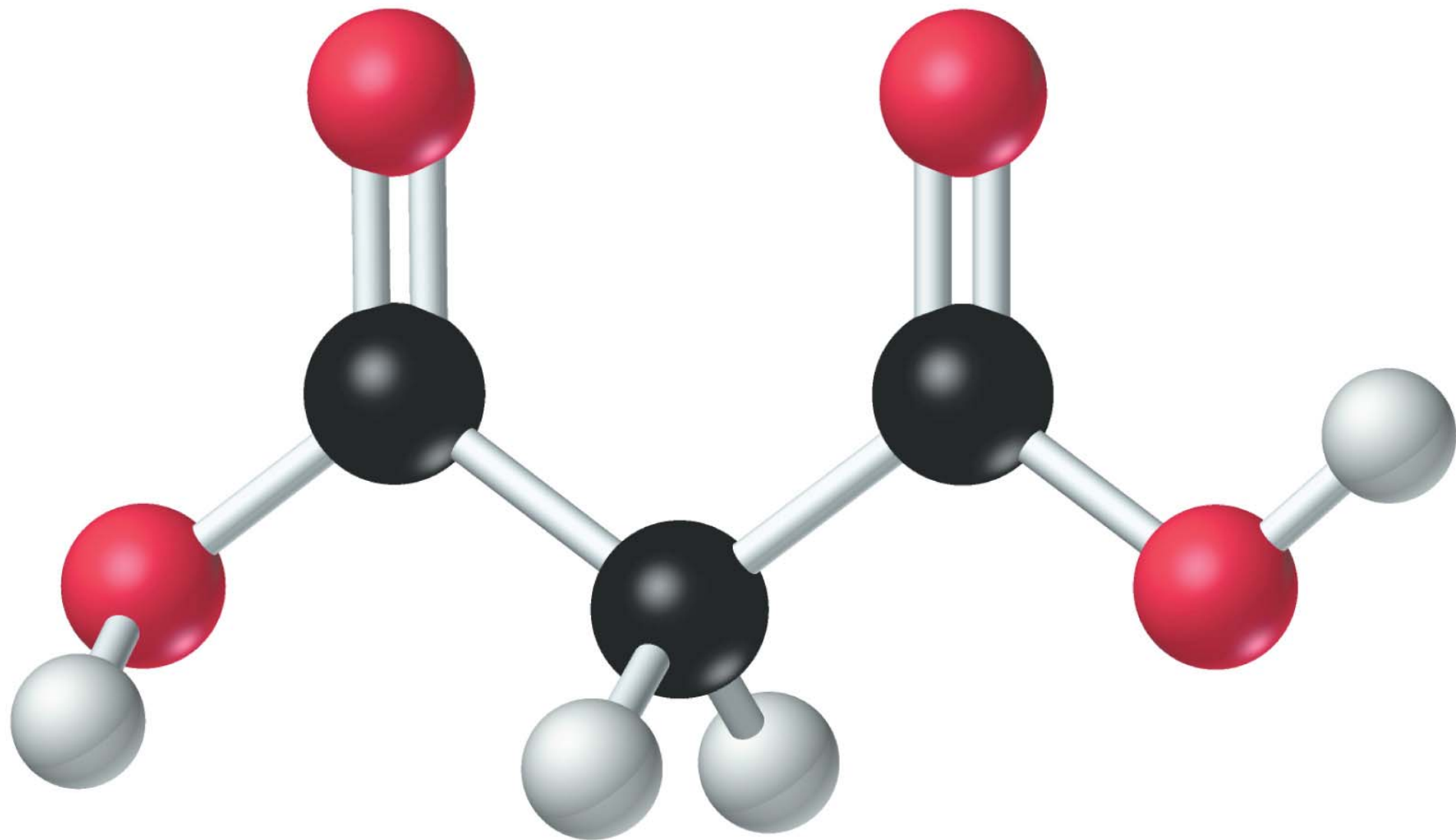


Ácidos polipróticos



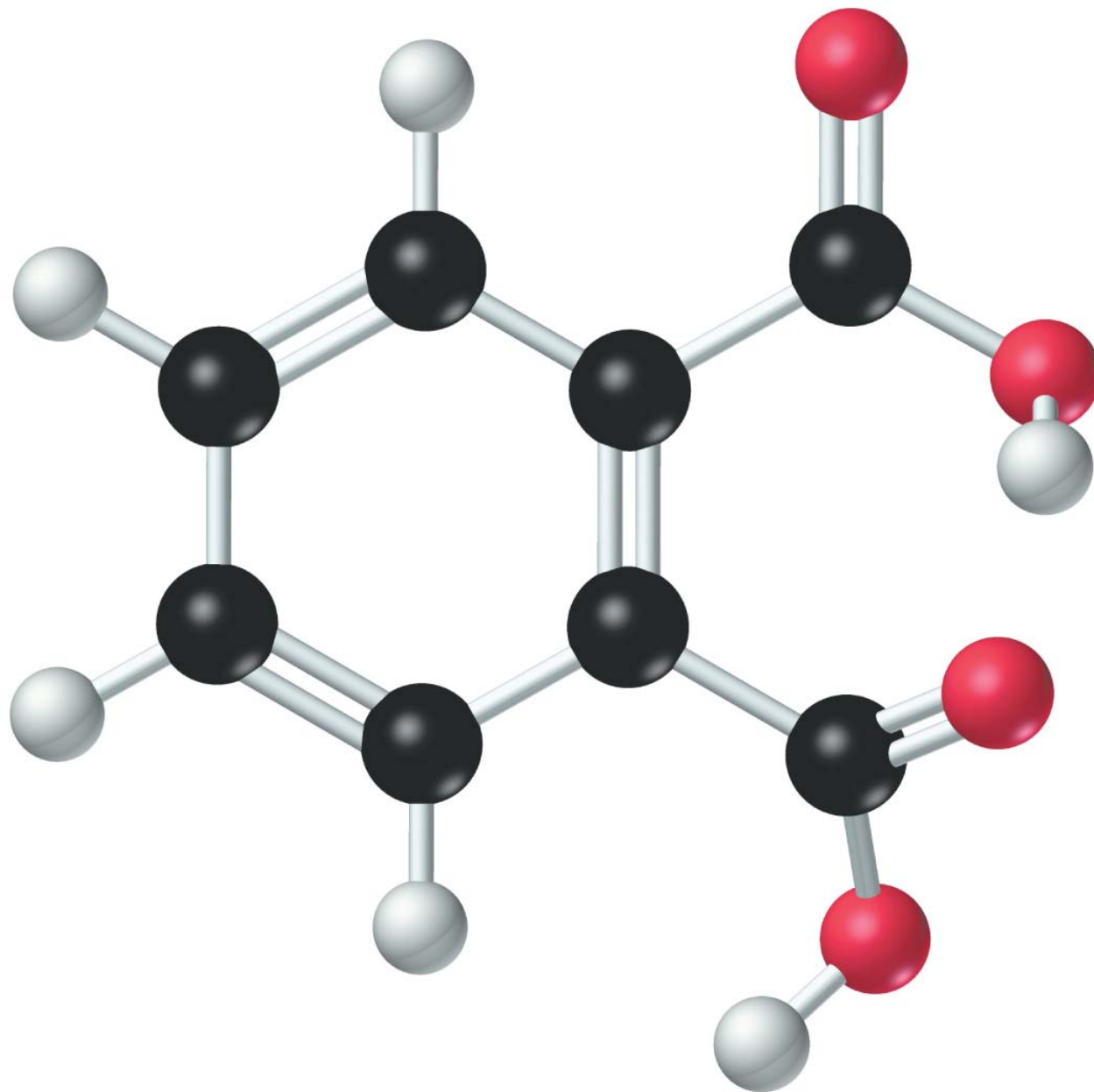


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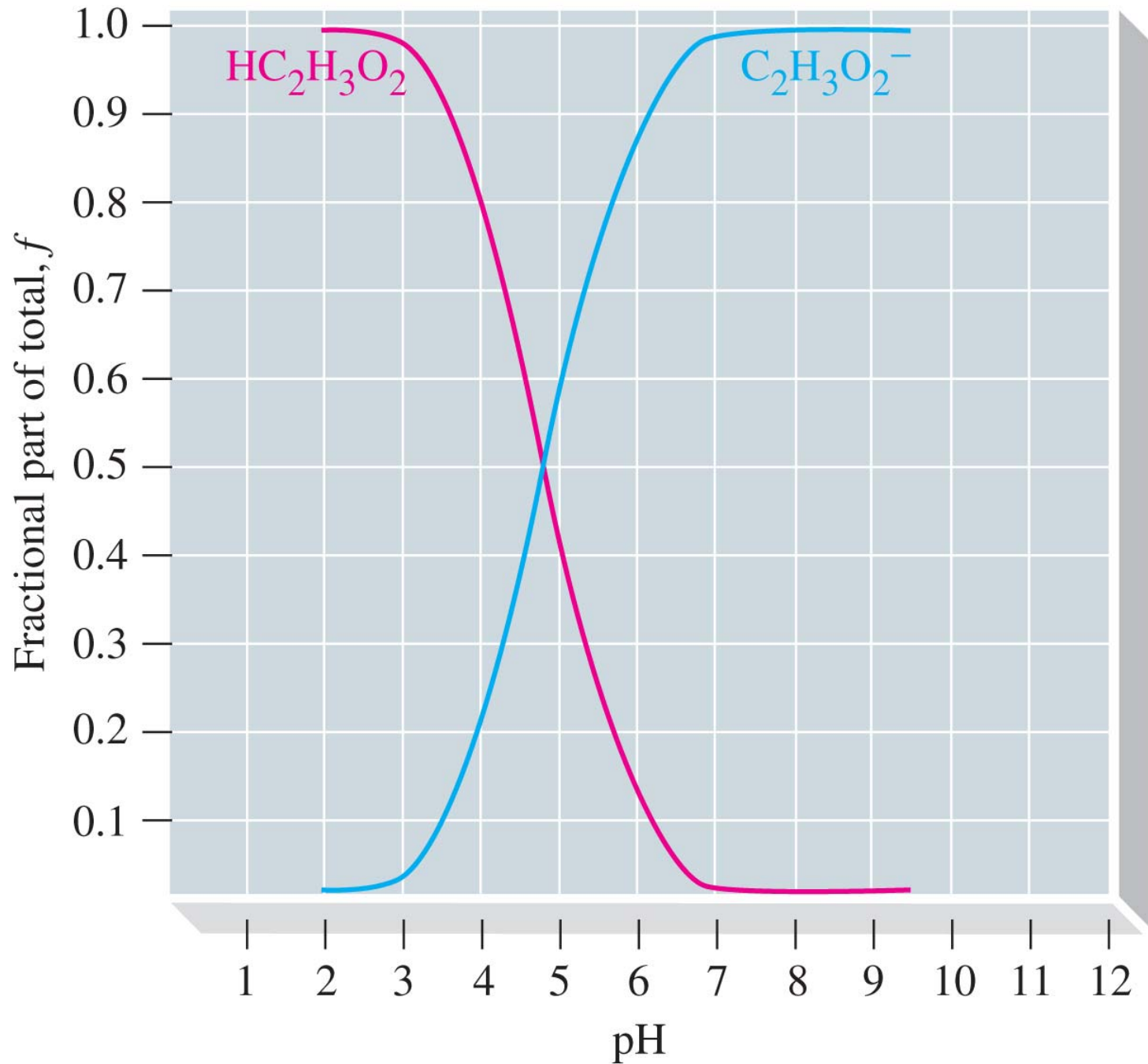
Malonic acid

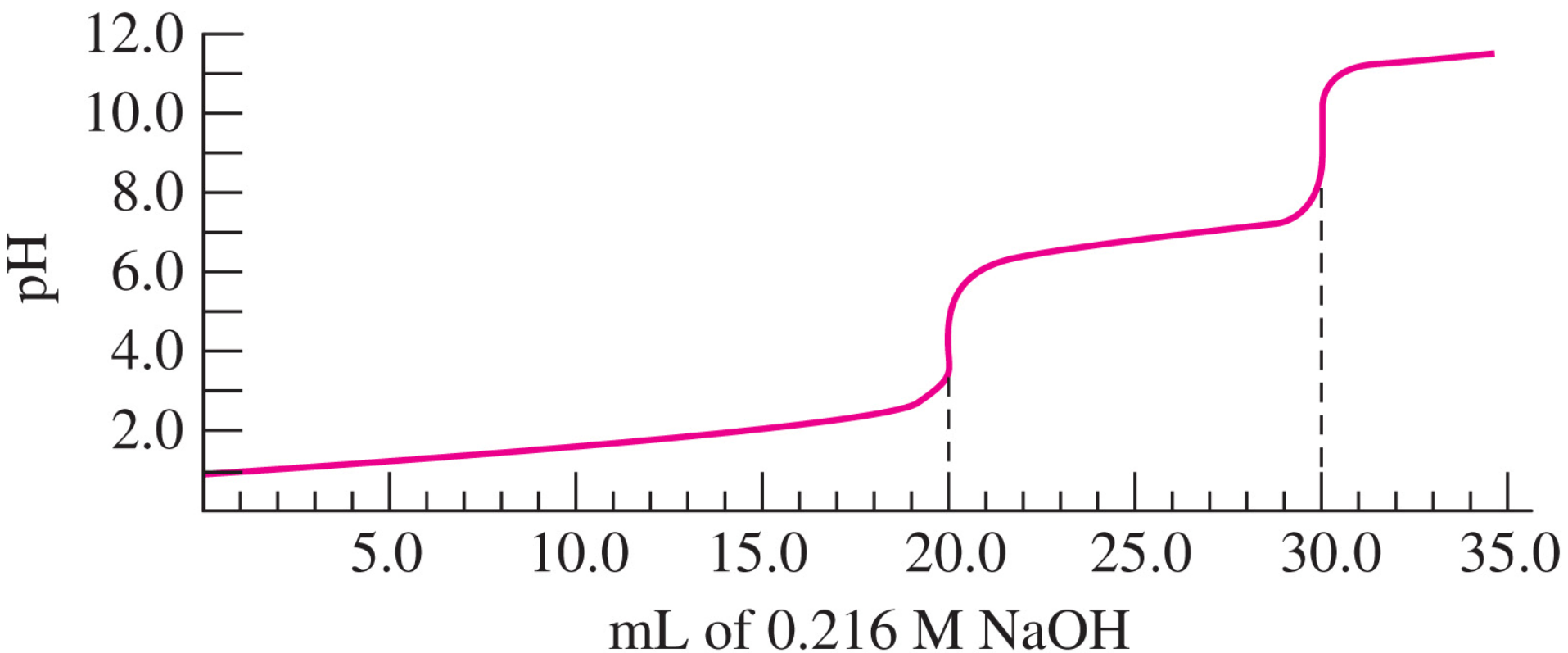
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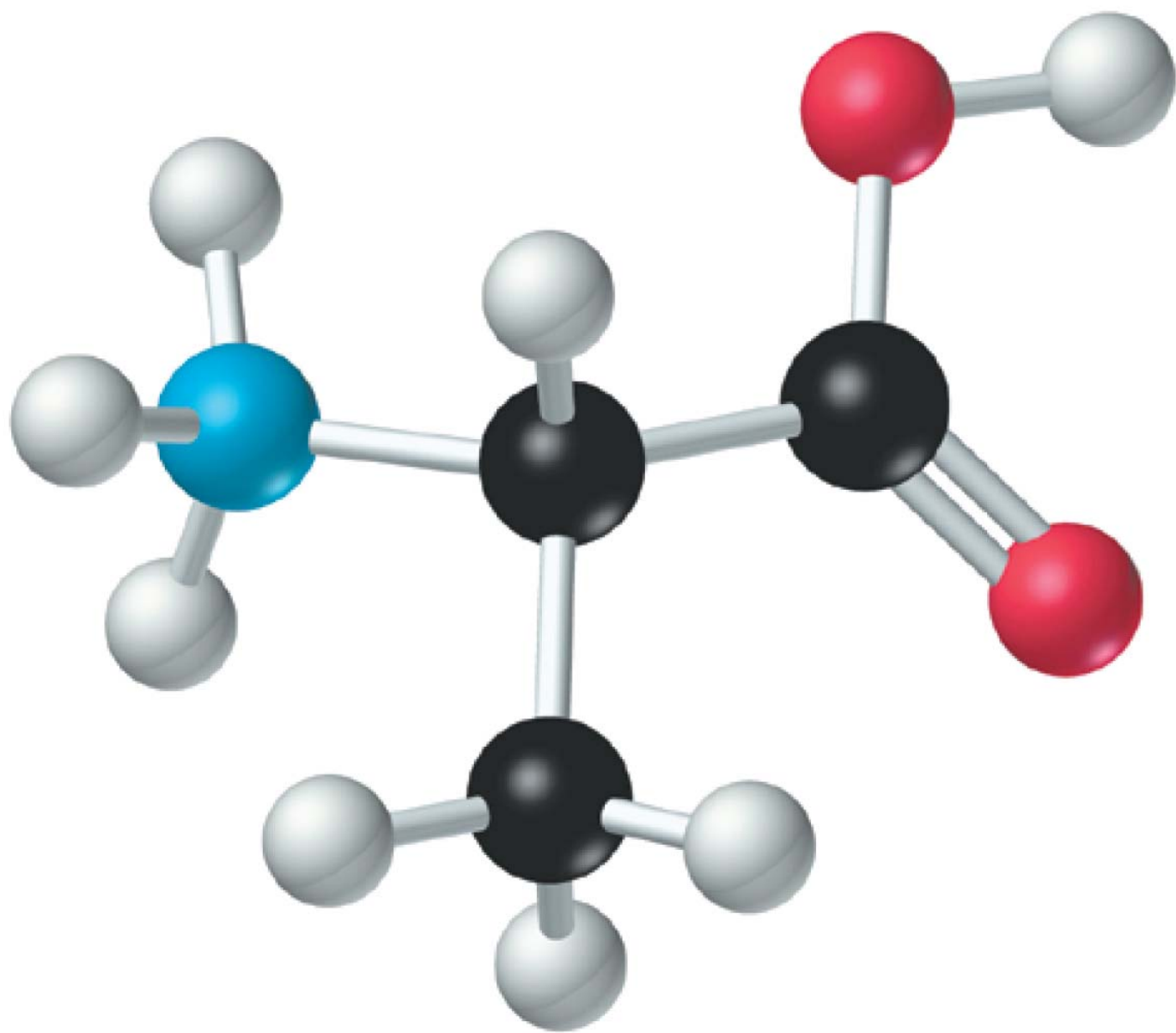
ortho-Phthalic acid

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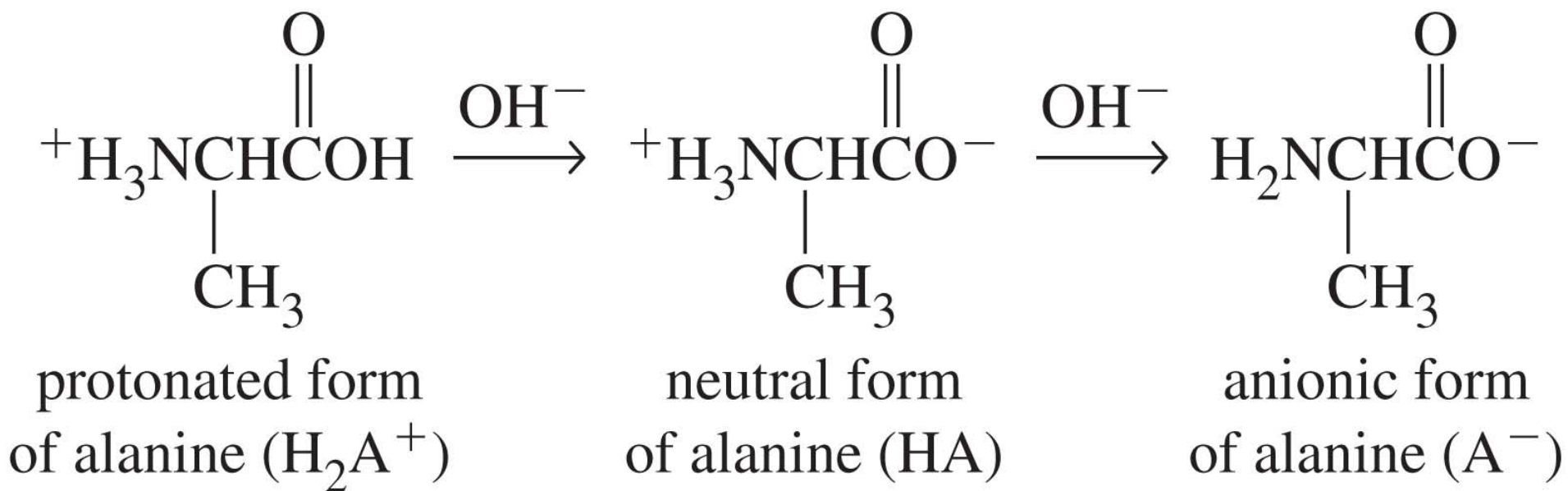


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Protonated alanine

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