(2) لـ $D_3 \text{ علـى } 4$

$\text{نـشـنك تـكوـن تـمـهـدـه - 1-4}$

$\text{نـشـنك تـكوـن تـمـهـدـه - 2-4}$

$\text{نـشـنك تـكوـن تـمـهـدـه - 3-4}$

$pH\text{ تـمـهـدـه - 4-4}$

$pK_A, N_K_A\text{ تـمـهـدـه - 5-4}$

$2 \text{ لـ } D_3 \text{ تـمـهـدـه - 6-4}$

$f\text{ تـمـهـدـه - 4}$

$2 \text{ لـ } D_3 \text{ تـمـهـدـه - 5}$
للماء والتدفق:

- الماء القليل في بكمية شوارد، يحتوي فه وتدفق نحو، ضعيف ناقل لنقي.

كذلكل و pH = 7 في 25°C و = 10⁻⁷ mol / ل. [H₃O⁺]

بترولوجيف فقد الماء فأن التصادمات أثناء و تتحرك الماء جزيئات H+ يتحول و الأخرى ماء إلى الجزيرة الهيدروكسي شردة إلى الأول الجزء OH⁻ شردة إلى الثاني الجزء H₃O⁺ التعادل تكتبه و الماء تتدفق:

\[
H₂O + H₂O = H₃O⁺ + OH⁻
\]

. \( [H₃O⁺] = [OH⁻] = 10⁻⁷ \text{ mol/L} \) 25°C

: قاطفر

m = 1000 g في 1 لتر لYTE - 2-4

\[ n = \frac{m}{M} = \frac{1000}{18} = 55.6 \text{ mol} \] : لازم

\[ n_{H₃O⁺} = [H₃O⁺]V = 10⁻⁷ \text{ mol} \]

\[ n_{OH⁻} = [OH⁻]V = 10⁻⁷ \text{ mol} \]
4-3

<table>
<thead>
<tr>
<th>درجة الحرارة (°C)</th>
<th>0</th>
<th>25</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ke</td>
<td>$0,10 \times 10^{-14}$</td>
<td>$1,0 \times 10^{-14}$</td>
<td>$5,5 \times 10^{-14}$</td>
<td>$55 \times 10^{-14}$</td>
</tr>
<tr>
<td>pKe $= - \log$ Ke</td>
<td>15</td>
<td>14</td>
<td>13,3</td>
<td>12,3</td>
</tr>
</tbody>
</table>
\[ [H_3O^+] = 10^{-pH} \]

\[ \text{pH} = -\log [H_3O^+] \]

\[ Ke = \frac{[H_3O^+][OH^-]}{[H_2O]} \]

\[ -\log Ke = -\log([H_3O^+][OH^-]) = -\log[H_3O^+] - \log[OH^-] \]

\[ \text{pKe} = \text{pH} - \log[OH^-] \]

\[ \text{pH} = \text{pKe} + \log[OH^-] \]

\[ \log[OH^-] = \text{pH} - \text{pKe} \]

\[ [OH^-] = 10^{\text{pH}-\text{pKe}} \]

\[ : \text{\texttt{pKe} = 14 \text{ at} 25^\circ C} \]

\[ \text{pH} = 14 + \log[OH^-] \]

\[ [OH^-] = 10^{\text{pH}-14} \]

\[ n_{H_3O^+} = n_{OH^-} \]

\[ N_{H_3O^+} > N_{OH^-} \]

\[ N_{H_3O^+} < N_{OH^-} \]

\[ \text{\texttt{pH}} \]
4-

\[ [\text{H}_3\text{O}^+]_{\text{eq}} > [\text{OH}^-]_{\text{eq}} \]

\[ [\text{H}_3\text{O}^+]_{\text{eq}} < [\text{OH}^-]_{\text{eq}} \]

\[ \text{pH} < 7 \]

\[ \text{pH} = 7 \]

\[ \text{pH} > 7 \]

25°C في pH

\[ : pK_A \quad \text{Nitrogen} \quad -5 \text{-} 4 \]

\[ \text{HA}_{(aq)} + \text{H}_2\text{O}(l) = \text{A}^-_{(aq)} + \text{H}_3\text{O}^+_{(aq)} \]

\[ \text{K}_A = \frac{[\text{H}_3\text{O}^+]_{\text{eq}}[\text{A}^-]_{\text{eq}}}{[\text{AH}]_{\text{eq}}} \]

\[ \text{pK}_A = -\log K_A \]
\[
K_A = \frac{[H_3O^+]_{eq}}{[\text{حمض}]_{eq}} \left(\frac{\text{أساس}}{\text{حمض}}\right)_{eq}
\]

\[-\log K_A = pK_A = -\log[H_3O^+]_{eq} - \log\left(\frac{[\text{أساس}]_{eq}}{[\text{حمض}]_{eq}}\right)\]

\[\text{pH} = pK_A + \log\left(\frac{[\text{أساس}]_{eq}}{[\text{حمض}]_{eq}}\right)\]

\[
\text{HCOOH}_{(aq)} + \text{H}_2\text{O}_{(l)} = \text{HCOO}^-_{(aq)} + \text{H}_2\text{O}^+_{(aq)}
\]

\[
K_A = \frac{[H_3O^+]_{eq} [\text{HCOO}^-]_{eq}}{[\text{HCOOH}]_{eq}}
\]
\[
pK_A = 3.7 \quad \text{Å} \quad K_A = 1.9 \times 10^{-4} : 25^\circ C
\]

<table>
<thead>
<tr>
<th>Compound</th>
<th>( pK_A )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{C}_2\text{H}_5\text{O}^- )</td>
<td>15.9</td>
</tr>
<tr>
<td>( \text{OH}^- )</td>
<td>14</td>
</tr>
<tr>
<td>( \text{CO}_3^{2-} )</td>
<td>10.3</td>
</tr>
<tr>
<td>( \text{NH}_3 )</td>
<td>9.2</td>
</tr>
<tr>
<td>( \text{HCO}_3^- )</td>
<td>6.35</td>
</tr>
<tr>
<td>( \text{CH}_3\text{COO}^- )</td>
<td>4.8</td>
</tr>
<tr>
<td>( \text{HCOO}^- )</td>
<td>3.7</td>
</tr>
<tr>
<td>( \text{H}_2\text{O} )</td>
<td>0</td>
</tr>
<tr>
<td>( \text{NO}_3^- )</td>
<td>1.8</td>
</tr>
<tr>
<td>( \text{Cl}^- )</td>
<td>6.3</td>
</tr>
</tbody>
</table>

\[
\text{H}_2\text{O} + \text{H}_2\text{O} = \text{H}_3\text{O}^+_{(aq)} + \text{OH}^-_{(aq)}
\]

\[
K_A = [\text{H}_3\text{O}^+][\text{OH}^-] = 10^{-14} \quad \text{at } 25^\circ C
\]

\[
pK_{A_1} = -\log K_{A_1} = 14 \text{ Å}
\]
ثلثین


\[ H_3O^+ + H_2O \rightarrow H_3O_\text{aq}^+ + H_2O_\text{aq} \]

\[ K_{A_2} = \frac{[H_3O^+]}{[H_3O^+]^2} = 1 \text{، } 25^\circ C \]

\[ pK_{A_2} = -\log K_{A_2} = 0 \]

\[ A_1H_\text{aq} + A_2^- \text{aq} \rightarrow A_1^- \text{aq} + A_2H_\text{aq} \]

\[ K = Q_{eq} = \frac{[A_1^-]_{eq}[A_2H]_{eq}}{[A_1H]_{eq}[A_2^-]_{eq}} \]

\[ K = \frac{[A_1^-]_{eq}[H_3O^+]_{eq}[A_2H]_{eq}}{[A_1H]_{eq}[A_2^-]_{eq}[H_3O^+]_{eq}} \]
$$K_{A_2} = \frac{[A_2^-]_{eq}[H_3O^+]_{eq}}{[A_2H]_{eq}} \quad \overset{\overset{\text{eq}}{\text{eq}}} \quad A_{K_{A_1}} = \frac{[A_1^-]_{eq}[H_3O^+]_{eq}}{[A_1H]_{eq}}$$

$$K = \frac{K_{A_1}}{K_{A_2}}$$

: أَنْيَزَدْكُ لِفَلْكَ كَلْكُولْ يَخْلُطْكُهُ

: حَلْدُزُ

$$A_2^- + H_2O \rightleftharpoons A_2H + OH^-$$

$$A_1^- + H_2O \rightleftharpoons A_1H + OH^-$$

$$K_{A_2} = \frac{K_{A_1}}{K_{A_2}} \quad K = \frac{K_{A_1}}{K_{A_2}}$$

: فَعَلْ بِعَدْدُ ذِّ - 4

$$K_A = \frac{C.\tau^2}{1-\tau}$$

: دِيَ دِرْقُمْدُز

\[ pK_{A_1} = 3.7 \]

\[ pH_2 = 3.4 \]

\[ pK_{A_2} = 4.8 \]

: أَنْيَزَدْكُ لِفَلْكَ كَلْكُولْ يَخْلُطْكُهُ

: أَنْيَزَدْكُ لِفَلْكَ كَلْكُولْ يَخْلُطْكُهُ
\[
\text{HCOOH}(\text{aq}) + \text{H}_2\text{O}(\text{l}) = \text{HCOO}^-\text{(aq)} + \text{H}_3\text{O}^+\text{(aq)}
\]

\[
\left[\text{HCOO}^-\right]_{\text{eq}} = \left[\text{H}_3\text{O}^+\right]_{\text{eq}} = 10^{-2.9}\text{ mol/L}
\]

\[
\tau_1 = \frac{N(\text{HCOO}^-)_{\text{eq}}}{N(\text{HCOOH})_{\text{initial}}}
\]

\[
\tau_1 = \frac{\left[\text{HCOO}^-\right]_{\text{eq}}}{C} = \frac{10^{-2.9}}{10^{-2}} = 0.13 = 13%
\]

\[
\text{CH}_3\text{COOH} + \text{H}_2\text{O} = \text{CH}_3\text{COO}^- + \text{H}_3\text{O}^+
\]

\[
\left[\text{CH}_3\text{COO}^-\right]_{\text{eq}} = \left[\text{H}_3\text{O}^+\right]_{\text{eq}} = 10^{-3.4}\text{ mol/L}
\]

\[
\tau_2 = \frac{N(\text{CH}_3\text{COO}^-)_{\text{eq}}}{N(\text{CH}_3\text{COOH})_{\text{initial}}}
\]

\[
\tau_2 = \frac{\left[\text{CH}_3\text{COO}^-\right]_{\text{eq}}}{C} = \frac{10^{-3.4}}{10^{-2}} = 0.04 = 4%
\]
\[ K_{A1} > K_{A2} \quad \text{and} \quad \tau_1 > \tau_2 : \text{analytical} \]

**Comparison:**

\[ W_1 > W_2 \]

**Result:**

**Comparison:**

- The ionization constant of the first acid \( K_{A1} \) is greater than the second acid \( K_{A2} \), and the ionization potential \( \tau_1 \) is greater than \( \tau_2 \).

For the first acid \( \text{pK}_A = 9.2 \), and for the second acid \( \text{pK}_A = 11.0 \).

At \( 25^\circ C \),

\[ \text{NH}_3 + \text{H}_2\text{O} = \text{NH}_4^+ + \text{OH}^- \]

\[ [\text{H}_3\text{O}^+] [\text{OH}^-] = 10^{-14} \]

\[ [\text{OH}^-] = \frac{10^{-14}}{[\text{H}_3\text{O}^+]} = \frac{10^{-14}}{10^{-9}} = 10^{-5} \text{ mol/L} \]

\[ [\text{OH}^-]_{eq} = [\text{NH}_4^+]_{eq} = 10^{-5} \text{ mol/L} : \text{equilibrium} \]
\[ \tau_1 = \frac{n\left(NH_4^+\right)_{eq}}{n\left(NH_3\right)_{initial}} \]

\[ \tau_1 = \frac{\left[NH_4^+\right]_{eq}}{C} \]

\[ \tau_1 = \frac{10^{-5}}{10^{-2}} = 0.001 \approx 0.1\% \]

\[(CH_3)_2NH + H_2O = (CH_3)_2NH_2^+ + OH^-\]

\[ [H_3O^+] [OH^-] = 10^{-14} \]

\[ [OH^-] = \frac{10^{-14}}{[H_3O^+]} = \frac{10^{-14}}{10^{-10.6}} = 10^{-3.4} \text{ mol/L} \]

\[ [OH^-]_{eq} = [(CH_3)_2NH_2^+]_{eq} = 10^{-3.4} \text{ mol/L} \]
$$\tau_2 = \frac{n \left( (\text{CH}_3)_2 \text{NH}_2^+ \right)_{\text{eq}}}{n \left( (\text{CH}_3)_2 \text{NH} \right)_{\text{initial}}}$$

$$\tau_2 = \frac{\left( \text{CH}_3 \right)_2 \text{NH}_2^+_{\text{eq}}}{C}$$

$$\tau_2 = \frac{10^{-3.4}}{10^{-2}} = 10^{-1.4} = 0.039 \approx 4\%$$

$$K_{A1} > K_{A2} \text{ و } \tau_1 < \tau_2$$

$$\text{AH}$$

$$\text{pK}_A$$

$$A^-$$
\[
1 \text{ H}_3\text{O}^+ (aq) + 2 \Sigma \text{ A}^- (aq) = 1 \Sigma \text{ A}^- (aq) + 2 \text{ H}_3\text{O}^+ (aq)
\]

\[
K = \frac{[\text{H}_3\text{O}^+]_{aq}}{[\Sigma \text{ A}^-]_{aq}} \frac{[\Sigma \text{ A}^-]_{aq}}{[\Sigma \text{ A}^-]_{aq}} = \frac{K_{A_1}}{K_{A_2}}
\]

\[
pH = pK_A + \log \frac{[\Sigma \text{ A}^-]_{aq}}{[\Sigma \text{ A}^-]_{aq}}
\]
: AH(aq)/ A^-(aq) + \text{碱} \rightarrow \text{酸}

\[ \text{Example: } \text{TH} \text{at } 25^\circ C \text{ has } K_a \text{ as } 2,9 \text{ mol/L} \text{.} \]

\[ \text{As } \text{ [base]} > [\text{acid}] \text{, } \text{pH} < K_a \]

\[ \text{As } \text{ [base]} = [\text{acid}] \text{, } \text{pH} = K_a \]

\[ \text{As } \text{ [base]} < [\text{acid}] \text{, } \text{pH} > K_a \]

\[ K_a = 9,2 \text{ at } 25^\circ C \text{ for } \text{NH}_4^+(aq)/\text{NH}_3(aq) \]

\[ \text{NH}_4^+ \text{ and } \text{NH}_3 \text{ at } \text{pK}_a = 9,2 \]

\[ \text{pH vs. } \% \text{ of } A^- \text{ or } \% \text{ of } AH \text{ at different pH levels.} \]
The second-order distribution of the individuals shows the progression of the AH/A- kaolin particles as a function of temperature in the given system.

\[ [AH]_{aq} = [A^-]_{aq} \]

\[ \text{pH} = pK_a \]

\( \theta \) is the intersection point of the graph.