What's the difference between acid strength and concentration? And how does pH fit in with these? This graphic explains the basics.

**Acids, \( K_a \) and \( pK_a \)**

\[
\begin{align*}
K_a &= \frac{[H^+][A^-]}{[HA]} \\
pK_a &= -\log_{10}[K_a]
\end{align*}
\]

<table>
<thead>
<tr>
<th>Acid</th>
<th>( K_a )</th>
<th>( pK_a )</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCl (Hydrochloric Acid)</td>
<td>(&lt;1)</td>
<td>(&lt;1)</td>
</tr>
<tr>
<td>HNO₃ (Nitric Acid)</td>
<td>(10^{-3}-10^{-3})</td>
<td>(3-5)</td>
</tr>
<tr>
<td>H₂SO₄ (Sulfuric Acid)</td>
<td>(10^{-15}-10^{-15})</td>
<td>(&gt;15)</td>
</tr>
<tr>
<td>CH₃COOH (Acetic Acid)</td>
<td>(&lt;0.1)</td>
<td>(&lt;1)</td>
</tr>
<tr>
<td>H₃PO₄ (Phosphoric Acid)</td>
<td>(10^{-3})</td>
<td>(5-15)</td>
</tr>
<tr>
<td>HF (Hydrofluoric Acid)</td>
<td>(10^{-3})</td>
<td>(1-3)</td>
</tr>
<tr>
<td>H₂CO₃ (Carbonic Acid)</td>
<td>(10^{-5})</td>
<td>(10^{-5})</td>
</tr>
</tbody>
</table>

**Strong Acids VS. Weak Acids**

- **Strong Acid**: HA → H⁺ + A⁻
- **Weak Acid**: HA ⇌ H⁺ + A⁻

**Concentration and pH**

\[
pH = -\log_{10}[H^+]
\]

A decrease of one on the pH scale represents a tenfold increase in H⁺ concentration.

**Concentrated Acid**

- Hydrogen ions (H⁺)
- Negative ions (A⁻)

**Dilute Acid**

- Hydrogen ions (H⁺)
- Negative ions (A⁻)

Concentration is distinct from strength. It refers to the amount of acid in a given solution. A concentrated acid contains a large amount of acid in a given volume; a dilute solution contains a small amount. The pH scale gauges the amount of hydrogen ions in solution.

**Acids React with Water**

Acids react with water when they are added to it, forming ions. The degree to which they do this is what determines whether they are strong or weak acids. Strong acids are essentially 100% ionised in solution. Weak acids ionise very little in solution.

**Acid Dissociation Constant**

The acid dissociation constant, \( K_a \), is a measure of the strength of an acid. The higher its value, the stronger the acid (i.e. the more readily it ionises in water). \( pK_a \) converts \( K_a \) number to a logarithmic scale that makes it easier to compare strengths of different acids.

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