

1. What is the difference between a strong acid and a weak acid?
 A strong acid is one which is almost completely ionized in aqueous solution. It has a high dissociation constant (K_a).
 A weak acid is one which is only partially ionized in aqueous solution. It has a low dissociation constant (K_a).
 Examples: HCl is a strong acid, CH_3COOH is a weak acid.

2. What is the pH of a 0.1 M solution of HCl ?
 HCl is a strong acid and dissociates completely in water.
 $HCl \rightarrow H^+ + Cl^-$
 For 0.1 M HCl , $[H^+] = 0.1$ M.
 $pH = -\log[H^+] = -\log(0.1) = 1$.

3. What is the pH of a 0.1 M solution of CH_3COOH ?
 CH_3COOH is a weak acid. Its dissociation constant $K_a = 1.8 \times 10^{-5}$.
 $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$
 Let the concentration of H^+ be x .
 $K_a = \frac{[CH_3COO^-][H^+]}{[CH_3COOH]} = \frac{x \cdot x}{0.1 - x} \approx \frac{x^2}{0.1}$
 $1.8 \times 10^{-5} = \frac{x^2}{0.1}$
 $x^2 = 1.8 \times 10^{-6}$
 $x = \sqrt{1.8 \times 10^{-6}} = 1.34 \times 10^{-3}$
 $[H^+] = 1.34 \times 10^{-3}$ M.
 $pH = -\log(1.34 \times 10^{-3}) = 2.87$.

4. What is the pH of a 0.1 M solution of $NaOH$?
 $NaOH$ is a strong base and dissociates completely in water.
 $NaOH \rightarrow Na^+ + OH^-$
 For 0.1 M $NaOH$, $[OH^-] = 0.1$ M.
 $pOH = -\log[OH^-] = -\log(0.1) = 1$
 $pH = 14 - pOH = 14 - 1 = 13$.

5. What is the pH of a 0.1 M solution of Na_2CO_3 ?
 Na_2CO_3 is a salt of a weak acid (H_2CO_3) and a strong base ($NaOH$). It will hydrolyze to form HCO_3^- and OH^- .
 $Na_2CO_3 + H_2O \rightleftharpoons NaHCO_3 + OH^-$
 The pH will be greater than 7.