What are buffer solutions? Calculate the pH of 1.0 M of acetic acid having Ka = 1.8 x 10^(-5)

Solution. Given the concentration of acetic acid 1.0 M. Write the equation of dissociation of acetic acid: $H_3C\text{-}COOH = H_3C\text{-}COO^- + H^+$. Let x mol / l acetic acid be dissociated, then its equilibrium concentration will be (1.0-x) mol / l, and the equilibrium concentration of hydrogen ions and acetate ion will be x mol / l. Then we write the equation for the dissociation constant of acetic acid, the numerical value of which is 1.8×10^{-5}: $Ka=\frac{[H^+]\times[H_3C-COO^-]}{[H_3C-COOH]}=1.8 \times 10^{-5}=\frac{x^2}{1-x}$. We solve this equation for x, given that x can only take positive values. $x=4.234 \times 10^{-3}$ mol/l and $x=[H^+]$ and we know that $pH=-lg[H^+]$, then $pH=-lg(4.234 \times 10^{-3})=2.37$.

Answer: a buffer solution is a solution that is able to maintain a certain pH value with small deviations from this value to a smaller or larger side when acid or base is added to it, respectively; pH=2.37.