What is the pH of the solution made by mixing equal volumes of solutions having $pH_1 = 4$ and $pH_2 = 6$?

Solution: As it is known, $pH = -\lg[H^+]$, then $[H^+] = 10^{-pH}$. After the mixing of solutions, the volume of the system doubles, and the amounts of substance of protons are adding.

$[H^+]_1 = 10^{-pH1} = 10^{-4}$ M; $[H^+]_2 = 10^{-pH2} = 10^{-6}$ M;

$n(H^+)_1 = V\cdot[H^+]_1 = V\cdot10^{-4}$ mol; $n(H^+)_2 = V\cdot[H^+]_2 = V\cdot10^{-6}$ mol;

$$[H^+]_\Sigma = \frac{n(H^+)_1 + n(H^+)_1}{2V} = \frac{V\cdot10^{-4} + V\cdot10^{-6}}{2V} = 5.05\cdot10^{-5}\text{M};$$

$pH_\Sigma = -\lg[H^+]_\Sigma = -\lg(5.05\cdot10^{-5}) = 4.3$.

Answer: 4.3.