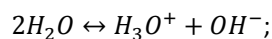


Show that the hydroxide-ion concentration in an aqueous solution is 1×10^{-4} M when the hydronium-ion concentration is 1×10^{-10} M. Recall that $10^a \times 10^b = 10^{(a+B)}$

Solution

Water molecules auto-dissociate into hydronium and hydroxide ions in the following equilibrium:



The concentration product of hydronium and hydroxide ions in water solution is constant:

$$[H_3O^+] \cdot [OH^-] = 1 \cdot 10^{-14} \text{ M}^2;$$

So, if the hydronium-ion concentration is $[H_3O^+] = 1 \cdot 10^{-10}$ M, then hydroxide-ion concentration is:

$$[OH^-] = 1 \cdot \frac{10^{-14}}{[H_3O^+]} = 1 \cdot \frac{10^{-14}}{10^{-10}} = 1 \cdot 10^{-4} \text{ M};$$

Answer: in this case the hydroxide-ion concentration in an aqueous solution is 10^{-4} M when the hydronium-ion concentration is 10^{-10} M, because the concentration product of hydronium and hydroxide ions in water solution is constant ($1 \cdot 10^{-14} \text{ M}^2$).