

Which of the following is a stronger acid?

a) HIO₃ or CH₃COOH

b) H₂O₂ or HSO₃⁻

c) H₂PO₄⁻ or HCN

Equilibrium Constant for the Ionization of Water

- a solution can be classified as acidic, basic or neutral based on the relative concentrations of H_3O^+ and OH^-

acidic	$[\text{H}_3\text{O}^+] > [\text{OH}^-]$
neutral	$[\text{H}_3\text{O}^+] = [\text{OH}^-]$
basic	$[\text{H}_3\text{O}^+] < [\text{OH}^-]$

- even in the absence of acids or bases, pure water contains a very small amount of H_3O^+ and OH^- as a result of collisions between water molecules
- self-ionization can be represented as:



- an equilibrium constant for this reaction can be written as:

$$K_{\text{eq}} = K_{\text{w}} = \frac{[\text{H}_3\text{O}^+][\text{OH}^-]}{1} = [\text{H}_3\text{O}^+][\text{OH}^-]$$

K_{w} = dissociation constant for water

In pure water, at 25°C ,

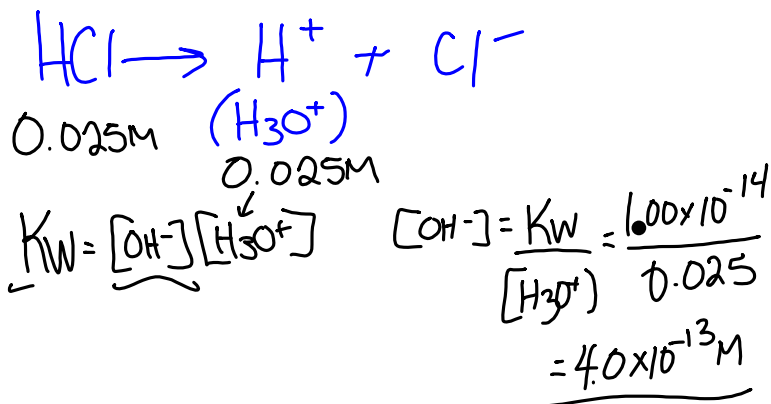
$$[\text{H}_3\text{O}^+] = 1.00 \times 10^{-7} \text{ M}$$

$$[\text{OH}^-] = 1.00 \times 10^{-7} \text{ M}$$

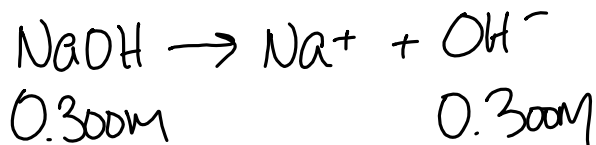
$$K_{\text{w}} = [1.00 \times 10^{-7} \text{ M}][1.00 \times 10^{-7} \text{ M}] = 1.00 \times 10^{-14}$$

- the value of K_{w} only varies with temperature
- when K_{w} or the temperature is not stated, it can be assumed that $K_{\text{w}} = 1.00 \times 10^{-14}$

ex.
What is $[\text{OH}^-]$ in 0.025 M HCl ?



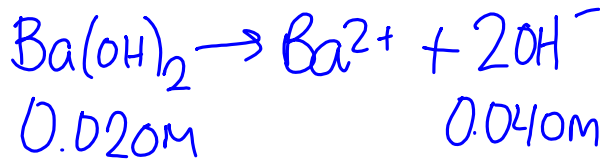
Find $[\text{H}_3\text{O}^+]$ in 0.300 M NaOH



$$K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$$

$$[\text{H}_3\text{O}^+] = \frac{K_w}{[\text{OH}^-]} = \frac{1.00 \times 10^{-14}}{0.300} = 3.33 \times 10^{-14} \text{ M}$$

Find $[\text{H}_3\text{O}^+]$ in 0.020 M Ba(OH)_2



$$[\text{H}_3\text{O}^+] = \frac{K_w}{[\text{OH}^-]} = \frac{1.00 \times 10^{-14}}{0.04} = \underline{2.5 \times 10^{-13} \text{ M}}$$

