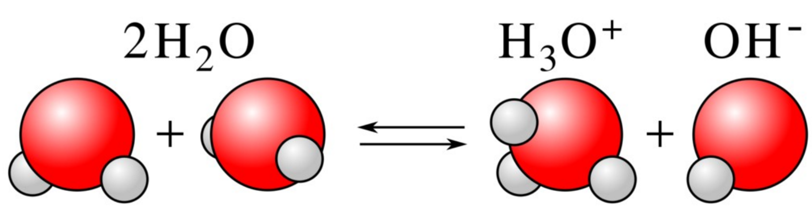
LO: Students will be able to determine the pH and pOH of a solution based on the concentration of the dissolved solutes.

DO: Students will be able to correctly calculate pH and pOH at least 4/5 times.

Aqueous Solutions and the Concept of pH

Water has been shown to be a very weak electrolyte. This is due to the self-ionization of the water molecules.



Concentration of molecules

[molecule] means the concentration of that molecule

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Water -

- It undergoes self-ionization

$$H_2O_{(l)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + OH^-_{(aq)}$$

- $[H_3O^+]$ means "hydronium ion concentration in moles per liter"
- In water, $[H_3O^+] = 1.0 \times 10^{-7}$ M and
  $[OH^-] = 1.0 \times 10^{-7}$ M
- Ionization constant for water $K_w = 1.0 \times 10^{-14}$

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When $[H_3O^+] = [OH^-]$, the solution is neutral.

When $[H_3O^+] > [OH^-]$, the solution is acidic.

When $[H_3O^+] < [OH^-]$, the solution is basic.

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Calculating $[H_3O^+]$ and $[OH^-]$

Consider a 1 L solution containing 0.4 g of NaOH. The concentration would be .01 M. In scientific notation, this is 1.0×10^{-2} M.

Since there is one ion of OH^- for every molecule of NaOH, then $[OH^-] = 1.0 \times 10^{-2}$ M.

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Given that in water, $[H_3O^+][OH^-] = 1.0 \times 10^{-14}$,

and our solution of NaOH is in water and we already know the $[OH^-] = 1 \times 10^{-2}$,

then $[H_3O^+] = \frac{1.0 \times 10^{-14}}{1 \times 10^{-2}} = 1.0 \times 10^{-12}$

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pH is defined as the negative of the common logarithm of the hydronium ion concentration.

$$pH = -\log[H_3O^+]$$

pOH is defined as the negative of the common logarithm of the hydroxide ion concentration.

$$pOH = -\log[OH^-]$$

The sum of the pH and pOH of a solution is 14

$$pH + pOH = 14$$

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hence, the pH of the .01 M solution of NaOH

$pH = -log[H_3O^+]$

$pH = -log\ (1.0 \times 10^{-12})$

$pH = 12$

$pOH = 14 - pH$

$pOH = 14 - 12 = 2$

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Determine the pH of a 0.500 Lsolution containing 15 g of HCl

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Determine the pH of 0.2M H_2SO_4

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Determine the pH of concentrated HCl (12M)

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Determine how many grams of NaOH you would need make a 250 mL solution with a pH of 11.2

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