Water:

Amphoteric—has acidic and basic (alkaline) properties

Autoionizes

K_w the ion dissociation constant of water

At 25°C, $[H^+] = [OH^-] = 1.0 \times 10^{-7}$ mol/L

$K_w = [H^+][OH^-]$

$= (1.0 \times 10^{-7} \text{mol/L})(1.0 \times 10^{-7} \text{mol/L})$

$= 1.0 \times 10^{-14} \text{mol}^2/\text{L}^2$

(units are often dropped)

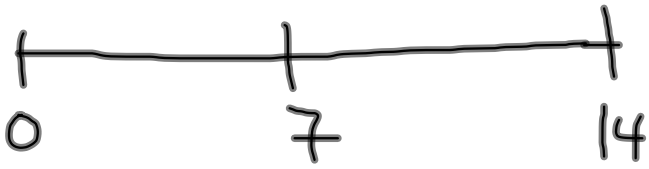
increases as temp. increases

neutral soln: $[H^+] = [OH^-]$

acidic soln: $[H^+] > [OH^-]$

basic soln: $[H^+] < [OH^-]$

pH scale: used to represent soln. acidicity



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determines acid or base

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

2 decimal places

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

alkaline
basic

$pH + pOH = 14$

Ex. 1

Calculate the $[H^+]$, $[OH^-]$, pH, and/or pOH for the following:

a. 1.0×10^{-5} M OH^-

b. 1.0×10^{-7} M OH^-

c. 10.0 M H^+

d. 1.0×10^{-3} M OH^-

e. 1.0 M H^+

$K_w = [H^+][OH^-]$

a. $[OH^-] = 1.0 \times 10^{-5}$ M

$[H^+] = \frac{K_w}{[OH^-]}$

$[H^+] = \frac{1.0 \times 10^{-14}}{1.0 \times 10^{-5}}$

$= 1.0 \times 10^{-9}$ M

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

$= -\log(1.0 \times 10^{-5})$

$= 5$

$pH + pOH = 14$

$pH = 14 - 5$

$= 9$

b. $1.0 \times 10^{-7} M = [OH^-]$

$1.0 \times 10^{-7} M = [H^+]$

$pOH = 7.00$ $pH = 7.00$

c. $10.0 M\ H^+$

$1.0 \times 10^{1} M = [H^+]$ $pH = -1$

$[OH^-] = 1.0 \times 10^{-15} M$ $pOH = 15$

d. 1.0×10^{-3} M OH^-

$pOH = 3.00$

$pH = 14 - 3$

$= 11.00$

$[H^+] = 1.0 \times 10^{-11}$ M

e. 1.0 M H^+

1.0×10^{0} M $[H^+]$

$pH = 0.00$

$pOH = 14 - 0$

$= 14.00$

$[OH^-] = 1.0 \times 10^{-14}$ M

Ex. 2
The pH of a sample of human blood was measured to be 7.41 at 25°C. Calculate the pOH, $[H^+]$, and $[OH^-]$ for the sample.

$pH = 7.41$

$pOH = 14 - 7.41$

$= 6.59$

$[H^+] = 10^{-7.41}$

$= 3.89 \times 10^{-8} M$

$[OH^-] = 10^{-6.59}$

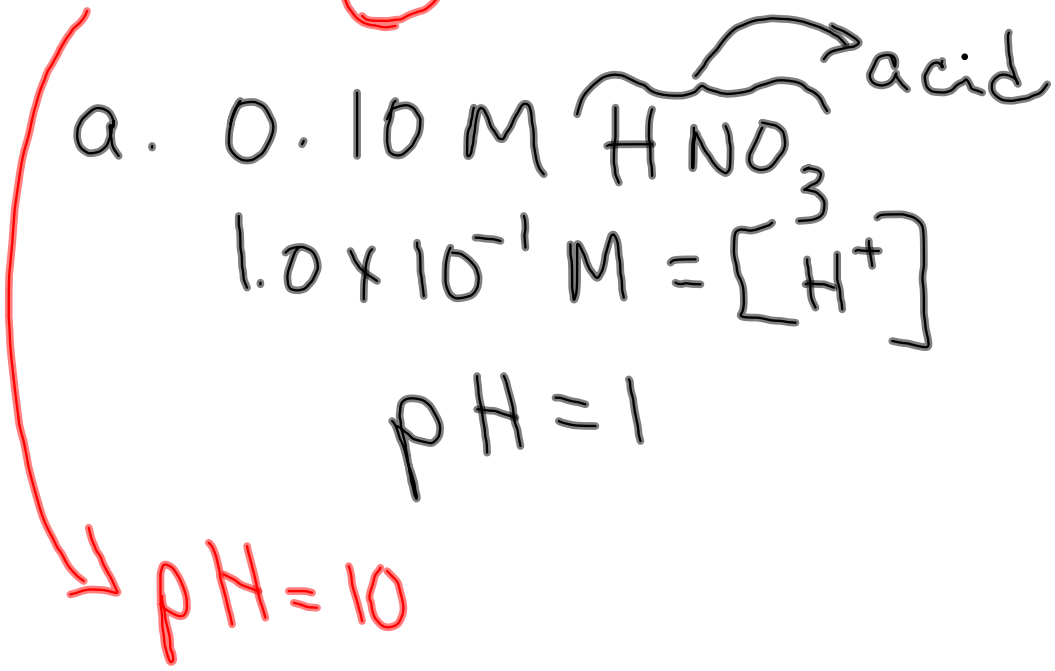
$= 2.57 \times 10^{-7} M$

Ex. 3

Calculate the pH of the following:

a. 0.10 M HNO_3

b. 1.0×10^{-10} M HCl



Fill in the following table:

Solution	pH	pOH	[H+]	[OH-]	Acid base or neutral
A	6.88	7.12	1.32×10^{-7}	7.59×10^{-8}	acid
B				8.4 x 10-14	
C		3.11			
D			1.0 x 10-7		

$pH + pOH = 14$

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

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

$K_w = [H^+][OH^-]$