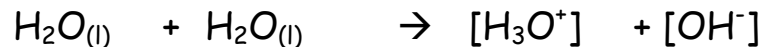


The Power of Hydrogen in Water

1. even pure water contains a few ions produced by the dissociation of water



2. at 25°C, $[\text{OH}^-] = [\text{H}_3\text{O}^+] = 1.0 \times 10^{-7} \text{ mol/L}$
3. acids $\rightarrow [\text{H}_3\text{O}^+]$ when dissolved in water
4. bases $\rightarrow [\text{OH}^-]$ when dissolved in water

The pH Scale

5. $[\text{H}_3\text{O}^+]$ range from 10 mol/L for a concentrated strong acid to 1.0×10^{-15} for a concentrated strong base, therefore a wide, inconvenient range
6. Soren Sorensen proposed using logarithms

$$\text{pH} = -\log [\text{H}^+] \quad (\text{p} = -\log \text{ and } \text{H} = [\text{H}^+])$$

e.g. $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-7} \text{ mol/L}$ in pure water. Determine the pH.

$$\begin{aligned} \text{pH} &= -\log [\text{H}^+] \\ &= -\log (1.0 \times 10^{-7}) \\ &= -(-7) \\ &= 7 \end{aligned} \quad \text{Therefore, the pH of pure water is 7.}$$

$$[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$$

e.g. A solution has a pH of 4.5. Determine its $[H_3O^+]$.

$$\begin{aligned}[H_3O^+] &= 10^{-\text{pH}} \\ &= 10^{-4.5} \\ &= 3.2 \times 10^{-5} \text{ mol/L}\end{aligned}$$

7. all acidic solutions have a pH that is less than 7
8. all basic solutions have a pH that is greater than 7

Complete the following:

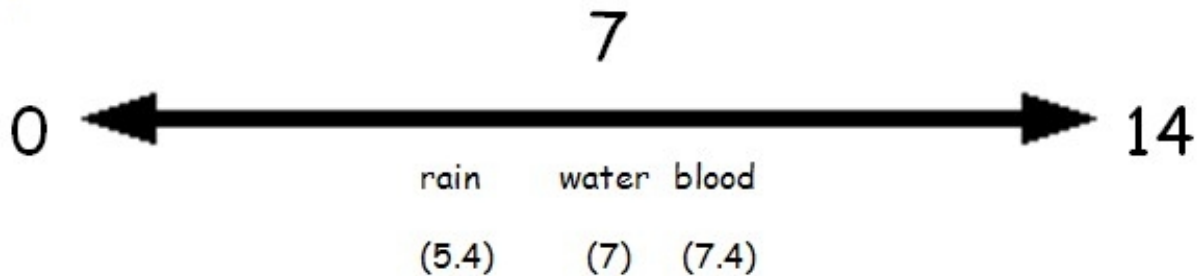
pH	$[H_3O^+]$
1	$10^{-1} = 0.1$
	$10^{-2} =$
3	
4	
	$10^{-5} =$
6	
7	$10^{-7} = 0.000\ 000\ 7$

* A single unit change in pH is a ten-fold change in $[H^+]$.

The pH Scale

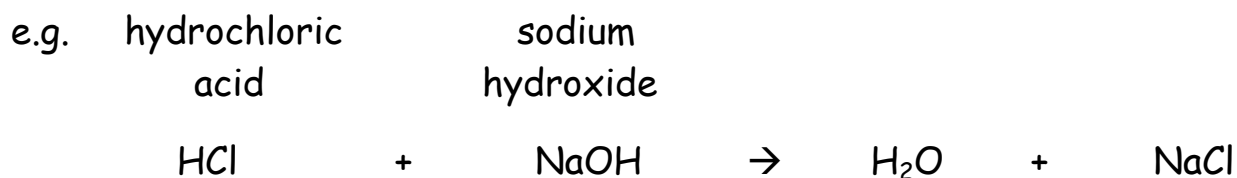
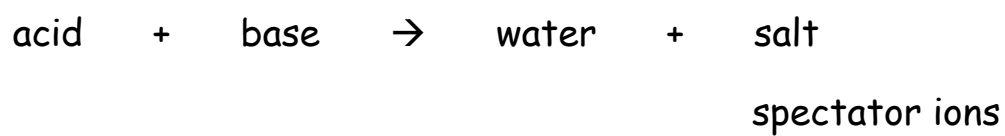
- a numbered scale from 0 to 14 that indicates the acidity of a solution
- the lower the pH the more acidic the solution
- the higher the pH, the more basic the solution
- a change of 1 on the pH scale represents a ten-fold effect on concentration

e.g.: a decrease of 2 pH changes from 6 to 4 increases the concentration of $[H^+]$ by 100 times (10^2)



Neutralization Reactions

- the reaction between an acid and a base
- a special case of a double displacement reaction



Complete the following neutralization reactions and balance the equations.

