DEMO: Test conductivity of pure H_2O; big bulb vs. small

Observation: Dim light with small bulb

Conclusion: H_2O is a poor conductor. This means [ions] is very small.

Which ions? $H_2O_{(l)} = H^+(aq) + OH^-(aq)$

HOH

This is called, the "AUTOIONIZATION" of water; it is the basis of the pH scale.

Aim: What is the basis of the pH scale?

1. (a) In pure water, $[H^+] = [OH^-] = 0.00000010 = 1.0 \times 10^{-7}$ M

H^+ OH^- pH = 7, called "neutral"

(b)Technically pH = -log $[H^+]$, but for this course, think of pH as the "power of $[H^+]$". That is, **$\{ [H^+] = 1.0 \times 10^{-pH} \}$**

pH	$[H^+]$
7	1.0×10^{-7} M
6	1.0×10^{-6} M

Note: $\downarrow$ pH, $\uparrow [H^+]$

Why? because they are negative exponents

(c) Also, $\dfrac{1.0 \times 10^{-6}}{1.0 \times 10^{-7}} = 10^{-6-(-7)} = 10^1 = 10$

This means $[H^+]$ at pH = 6 is 10x greater than $[H^+]$ at pH = 7. In other words, there's a 10 fold difference between consecutive pH units.

For example,

Which has a greater $[H^+]$, pH = 3 vs. pH = 5? Ans: pH = 3

How much greater?

$$3 \xleftarrow{10x} 4 \xleftarrow{10x} 5$$

10^{-3} 10^{-4} 10^{-5}

2. All (aq) solutions contain H^+ and OH^-. The type of solution depends on which ion there is more of.

pH	$[H^+]$	$[OH^-]$	solution
7	1.0×10^{-7} M	1.0×10^{-7} M	neutral
6	1.0×10^{-6} M	1.0×10^{-8} M	acidic
8	1.0×10^{-8} M	1.0×10^{-6} M	basic
11	1.0×10^{-11} M	1.0×10^{-3} M	basic

* In any (aq) solution, the exponents of $[H^+]$ and $[OH^-]$ will add up to -14 b/c the $[H^+] \times [OH^-] = 1.0 \times 10^{-14}$ = Kw, "water ionization constant".