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

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

$$p\,anything = -\log(anything)$$

$$K_w = [H_3O^+][OH^-]$$

$$\log K_w = \log([H_3O^+][OH^-])$$

$$\log K_w = \log[H_3O^+] + \log[OH^-]$$

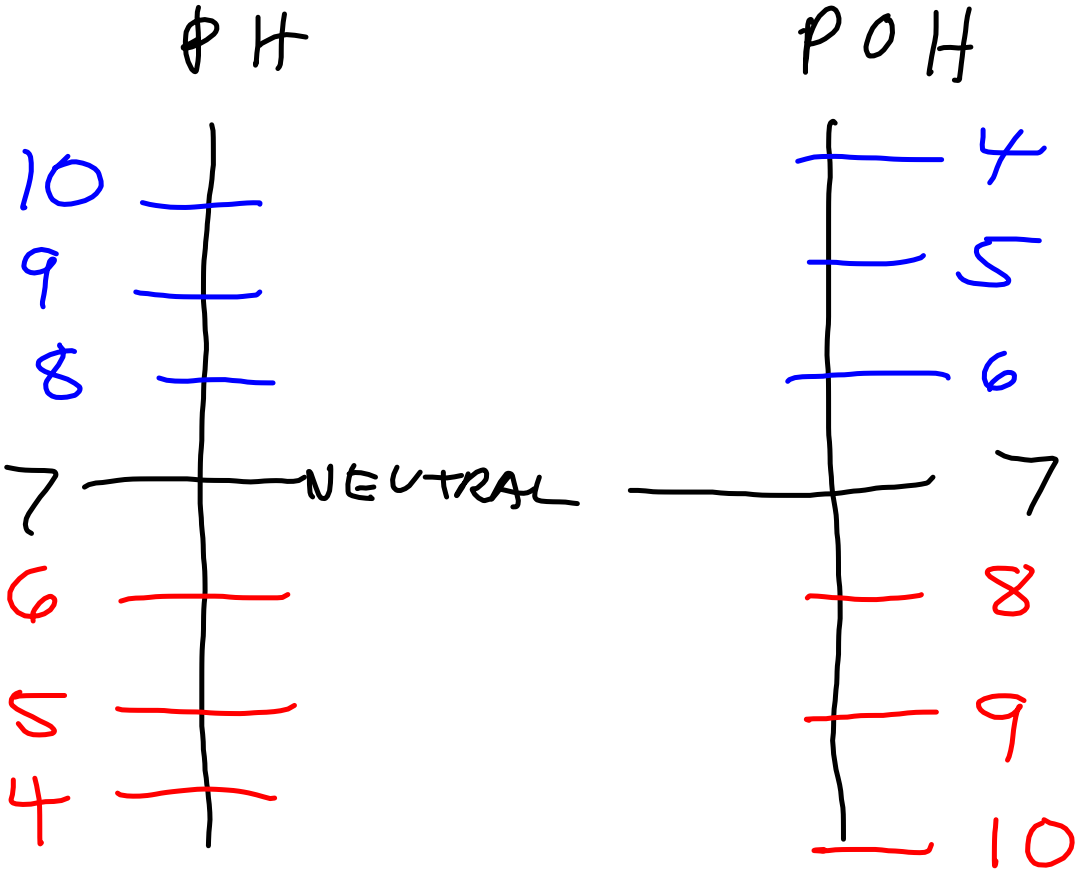
$$-\log K_w = -\log[H_3O^+] + (-\log[OH^-])$$

$$pK_w = pH + pOH$$

At 25°C $K_w = 1.0 \times 10^{-14}$

$$pK_w = -\log(1.0 \times 10^{-14})$$

$$= -(-14.00) = +14.00$$


pH
10
9
8
7
NEUTRAL
6
5
4
pOH
4
5
6
7
8
9
10

The 4 quantities you must be able to calculate:

1. $[H_3O^+]$
2. $[OH^-]$
3. pH
4. pOH

$[H_3O^+]$ $[H_3O^+][OH^-] = K_w$ $[OH^-]$

$$[H_3O^+] = \frac{K_w}{[OH^-]}$$

$$[OH^-] = \frac{K_w}{[H_3O^+]}$$

$$pH = -\log[H_3O^+] \qquad pOH = -\log[OH^-]$$

$$[H_3O^+] = 10^{-pH} \qquad [OH^-] = 10^{-pOH}$$

$$pH + pOH = pK_w$$

$$pH = pK_w - pOH$$

pH $pOH = pK_w - pH$ pOH

$$HC_2H_3O_2(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + C_2H_3O_2^-(aq)$$

$$K_a = \frac{[H_3O^+][C_2H_3O_2^-]}{[HC_2H_3O_2]}$$

	$[HC_2H_3O_2]$	$[H_3O^+]$	$[C_2H_3O_2^-]$
I	2.88	~ 0	0
C	$-X$	$+X$	$+X$
E	$2.88-X$	$\sim X$	X

$$K_a = \frac{[H_3O^+][C_2H_3O_2^-]}{[HC_2H_3O_2]} = \frac{(X)(X)}{2.88-X}$$

$$= \frac{X^2}{2.88-X} = 1.8 \times 10^{-5}$$

$$\frac{x^2}{2.88 - x} = 1.8 \times 10^{-5}$$

$$x^2 = 1.8 \times 10^{-5}(2.88 - x)$$

$$x^2 = 5.184 \times 10^{-5} - 1.8 \times 10^{-5} x$$

$$x^2 + 1.8 \times 10^{-5} x - 5.184 \times 10^{-5} = 0$$

$$ax^2 + bx + c = 0$$

$$a = 1 \quad b = 1.8 \times 10^{-5} \quad c = -5.184 \times 10^{-5}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$