

# Logs

## Math Review

Definition:  $\log (10^x) = x$

antilog  $(x) = 10^x$

## Properties of logs

$$\log (a^b) = b \log (a) \quad (x^a)^b = x^{a \cdot b}$$

$$\log (a \cdot b) = \log (a) + \log (b) \quad (x^a)(x^b) = x^{a+b}$$

$$\log (a/b) = \log (a) - \log (b) \quad (x^a)/(x^b) = x^{a-b}$$

# pH

## pH & pOH

### Definitions:

$$\text{pH} = -\log [\text{H}^+]$$

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

$$\text{pOH} = -\log [\text{OH}^-]$$

# pH

## Things to notice:

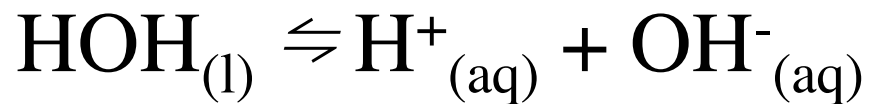
pH comes from the hydrogen ion, pOH comes from the hydroxide ion.

In both cases it is lower case **p** and upper case for either **H** or **OH**.

[ ] have a very specific meaning in chemistry - the numbers used in the calculations where these brackets appear **must** have units of molarity (moles of solute per liter of solution).

$\text{H}^+_{(\text{aq})}$  is the same as  $\text{H}_3\text{O}^+_{(\text{aq})}$  which is also a “proton in solution”

# Water Self Ionization

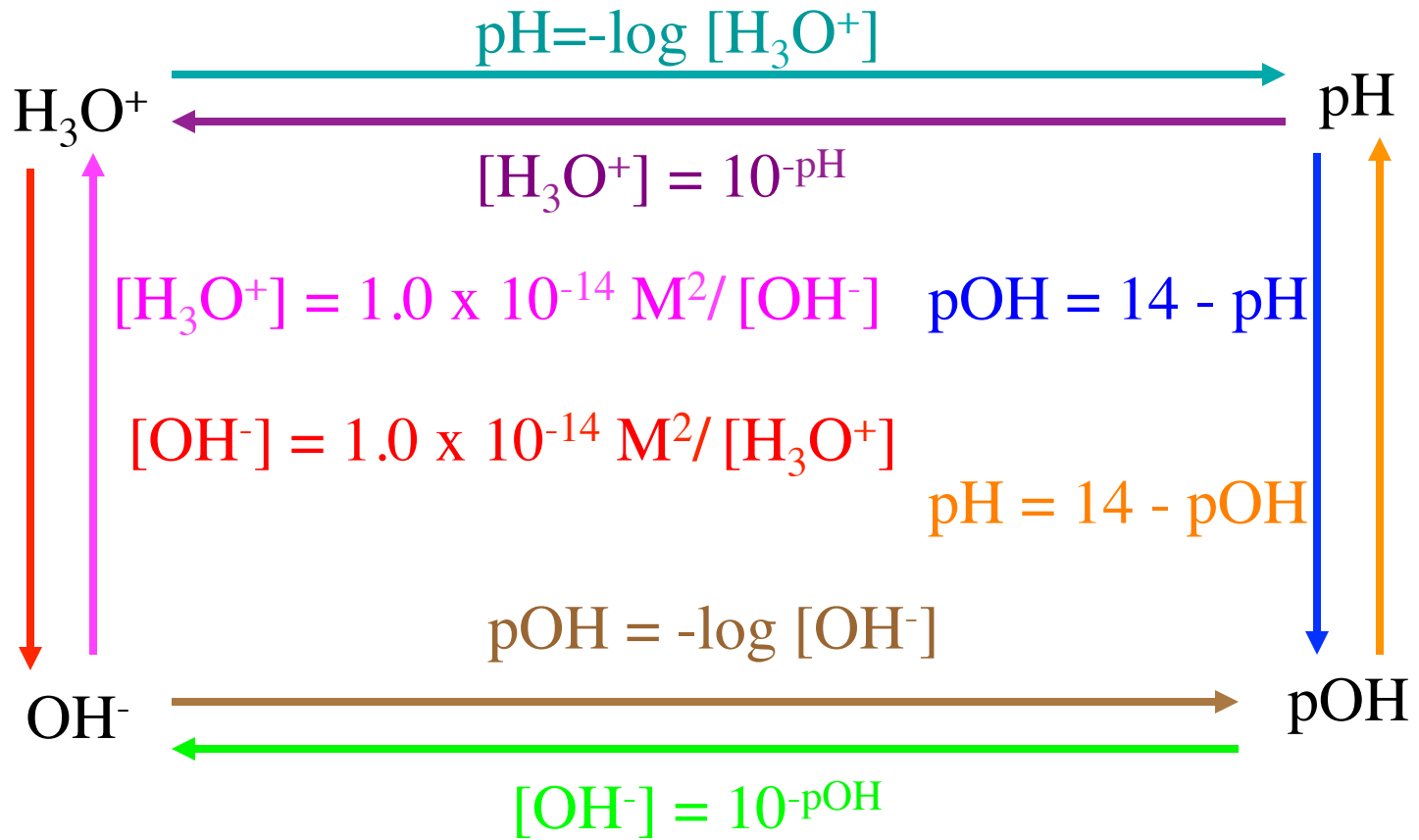


$$K_w = [\text{H}^+] [\text{OH}^-]$$

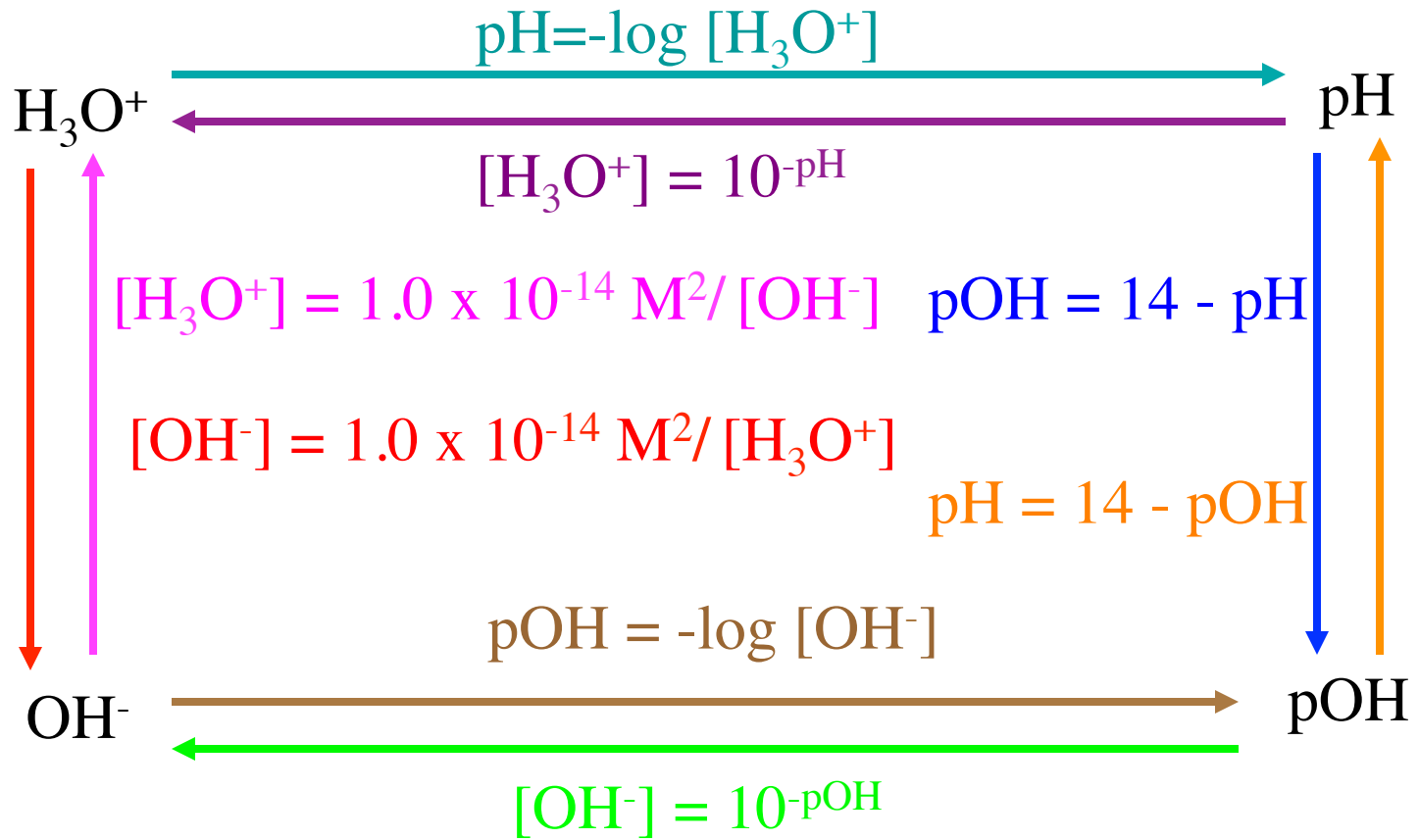
$K_w = 1.0 \times 10^{-14} \text{ M}^2$  at room temperatures.

$$\text{pH} + \text{pOH} = 14$$

# pH Loop



# pH Loop



# Samples

If the hydrogen ion concentration is  $2.67 \times 10^{-4}$  M what is the pH, pOH and hydroxide concentration?

$$\text{pH} = -\log [\text{H}^+] \quad \text{pH} = -\log[2.67 \times 10^{-4}]$$

$$\text{pH} = 3.57$$

$$\text{pOH} = 14 - \text{pH} \quad \text{pOH} = 14 - 3.57$$

$$\text{pOH} = 10.43$$

$$[\text{OH}^-] = \text{antilog } -\text{pOH} \text{ or } [\text{OH}^-] = 10^{-\text{pOH}} \quad [\text{OH}^-] = 10^{-10.43}$$

$$[\text{OH}^-] = 3.75 \times 10^{-11} \text{ M}$$