HONORS CHEMISTRY: pH DATE:_____

Learning Activities: **SWBAT. . .**

…define amphoteric.
…apply the ion-product constant to water.
…calculate $[H_3O^+]$,$[OH^-]$, pH and pOH.

WATER IS AMPHOTERIC:

ex) $H_2O(l) + H_2O(l) \rightleftarrows H_3O^+(aq) + OH^-(aq)$

- Water will **auto-ionize** into_____________ and______________ ions, but only to a very small degree.
- At pH 7, 25ºC, the concentrations are… $[H_3O^+] = [OH^-] = 1.0\text{x}10^{-7}$ *M* [brackets indicate concentration]

The product of the concentrations of water is a constant known as $\mathbf{K_w}$

K_w = ion-product constant = $[H_3O^+][OH^-] = 1.0\text{x}10^{-14}$ @25ºC (units are dropped)

This means that as one concentration increases, the other must…

- In neutral solutions,
- In acidic solutions,
- In basic solutions,

Note: $[H_3O^+]$ often written as just $[H^+]$

But no matter what, the product of these two concentrations must equal K_w!

Try this… given one concentration, calculate the other. Then determine if acidic, basic, or neutral.

$[H^+] = 2.1\text{x}10^{-5}$ M **$[OH^-] = 8.5\text{x}10^{-3}$ M** **$[OH^-] = 1.0\text{x}10^{-7}$ M**

THE ACIDITY OF SOLUTIONS ARE MEASURED ON A LOGARITHMIC SCALE.

THE CONCEPT OF A LOGARITHM =

ex) 100 = ∴ logarithm of 100 is ∴ log(100) =

ex) 1000 = ∴ logarithm of 1000 is ∴ log(1000) =

ex) 0.1 = ∴ logarithm of .1 is ∴ log(0.1) =

- The log of a number like 457 will be in between…
- A change of one unit in a log scale represents a___________change in the numerical value.
- This allows us to see…
- Small changes in a log scale mean…
- Since the concentrations of $[H^+]$ and $[OH^-]$ can be small values, a log scale makes sense.

Since the log of numbers less than one are negative, $[H^+]$ is measured as…

$$pH = -\log [H^+] \quad \text{and} \quad pOH = -\log [OH^+]$$

Since strong acids and bases completely dissociate…

ex) **2.0 *M* HCl = *M* H^+**

2.0 *M* H_2SO_4 = *M* H^+

Logs have a special rule for significant figures. The number of decimal places for a log equals the sig.figs of the original number! ie. 1.0×10^{-1} *M* H^+ =

Try this… determine the pH and pOH of the three prior examples.

Notice: pH + pOH =

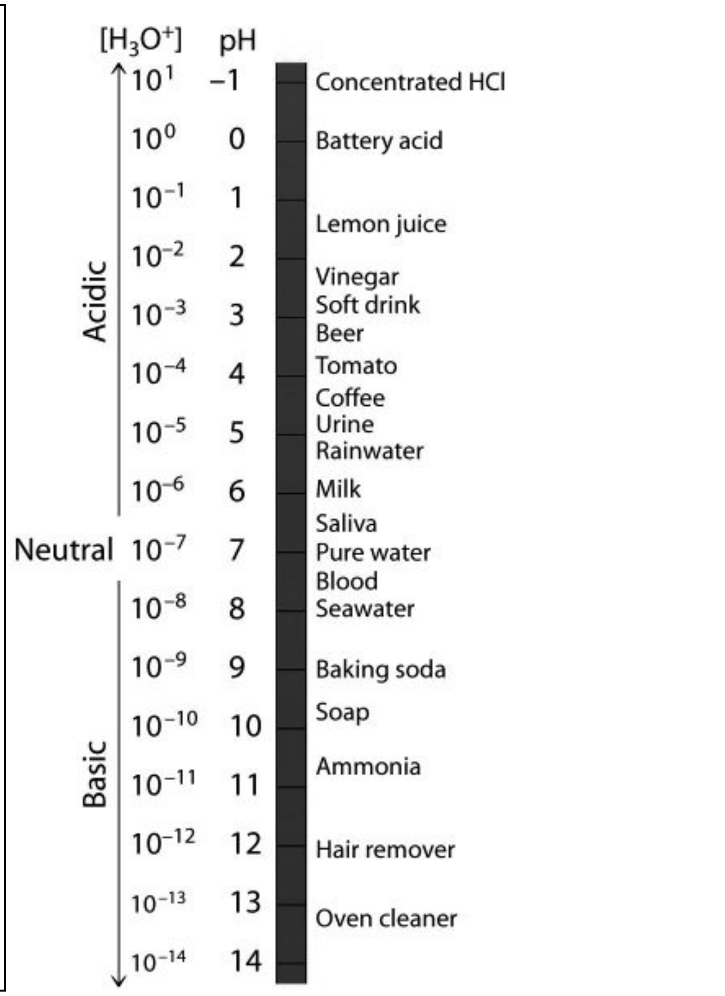
DID YOU KNOW… "…In solution at 25 °C, a pH of 7 indicates neutrality. Pure water, when exposed to the atmosphere, however, will take in carbon dioxide, some of which reacts with water to form carbonic acid, thereby lowering the pH to about 5.7.

…Neutral pH 25 °C at is not exactly 7. The value is consistent, however, with neutral pH being 7.00 to two significant figures, which is near enough for most people to assume that it is exactly 7.

…The pH of water gets smaller with higher temperatures. For example, at 50 °C, pH of water is 6.55±0.01. This means that a diluted solution is neutral at 50 °C when its pH is around 6.55 and that a pH of 7.00 is basic..

…Extremely acidic or extremely basic substances may have pH less than 0 or greater than 14. An example is acid mine runoff, with a molar concentration of 3981 M and a pH of - 3.6.

~www.wikipedia.org



"Fear secretes acids; but love and trust are sweet juices." ~ Henry Ward Beecher