~pH~

Showing how acidic or basic a solution is by expressing the [H$^+$] is cumbersome, so the _____ more widely used.

The pH scale is a way to represent the _hydrogen ion · conc. in solution._

pH-> Power of Hydrogen

Runs __0 - 14__ . (Numbers can occasionally be negative example: assuming 100% ionization of the very strong acid HCl, the pH of a 10M solution is -1.00)

Shortcut...

** ___1.0×10^{-11} pH = 11___

** __a pH of 6 is represented by a [H$^+$] of 1.0×10^{-6}__

This only works when it is __the number is $1.0 \times$___ .

Definition: __pH = -log [H$^+$]__

• in neutral pH = ___7___   [H$^+$] = 1×10^{-7}

• in acidic solution __the pH will be less than 7.__

• pH < -log(10^{-7}) . ACIDIC

• pH < 7 __acidic   [H$^+$] > 10^{-7}__

• in base, pH > 7 ___[H$^+$] < 10^{-7}___   7-14pH is in basic range.

Significant Digits

The number of digits after the decimal in the pH is equal to the number of significant digits in the concentration.

Example: pH of 3.0 means [H$^+$] of 1×10^{-3} (one place after decimal means 1 s.d. for [H$^+$])

[H$^+$] of 1.72×10^{-10} pH = 9.764 (3 places after dec. as there are 3 s.d.)

To convert [H+] to a pH value...

Take the negative log...

2.7 x 10^{-11} mol/L =[H$^+$] $-\log [2.7 \times 10^{-11}] = 10.57$ basic.

3.55 x 10^{-1} mol/L =[H$^+$] $-\log [3.55 \times 10^{-1}] = 0.450$ acidic

4 x 10^{-8} mol/L =[H$^+$] $-\log [4 \times 10^{-8}] = 7.4$ basic.

<u>We can go backwards from pH to [H⁺] as well.</u>
<u>To convert a pH value to [H+] ...</u>
Take the negative inverse log...
ex: pH = 9.63

$$10^{-pH} \qquad 10^{-9.63} = 2.3\times10^{-10}$$

pH= 4.554

$$10^{-4.554} \qquad 2.79 \times10^{-5}\, \frac{mol}{L}$$

pOH
pOH is basically the same but conveys the [OH⁻] instead.

- pOH = $-\log [OH^-]$
- $K_w = [H^+][OH^-]$
- $pH + pOH = 14.00$
- Thus, a solution with __pOH less than 7 is basic pOH greater than 7 is an acid.__
- Not greatly used like pH is.

What is the pOH of a solution if the pH is 4?   10!

Practice:
1.   Food scientists and dieticians measure pH of foods when they devise recipes and special diets.

Food	[H⁺] (mol/L)	[OH⁻] (mol/L)	pH	pOH
Oranges	5.5x10⁻³	1.8x10⁻¹²	2.26	11.74
Asparagus				5.6
Olives		2.0x10⁻¹¹		
Blackberries				10.60

b) Based on pH only, which foods would taste more sour?

2. To clean a clogged drain, 26 g of sodium hydroxide is added to water to make 150mL of solution. What are the pH and pOH values for the solution?

3. What mass of potassium hydroxide is contained in 500 ml of solution that has a pH of 11.5

4. If the concentration of hydrogen ions is 4.2 x 10⁻³M, what is the pH?

5. If the concentration of hydrogen ions is 4.4 x 10⁻⁷M, what is the pH?

6. IF the pH of the solution is 10.33, what is the hydrogen ion concentration?

7. If the pH of the solution is 4.56, what is the concentration of hydrogen ions?