WATER CHEMISTRY - pH

Water Recreation Program
What is Water?

H₂O

H⁺ + OH⁻
What is pH?

\[ \text{pH} = -\log[\text{H}^+] \]
Acid or Base?

pH Scale

0.0  7.0  14.0

ACID   BASE
pH

The pH scale was invented in 1909 by AP L Sorenson

pH is:
the negative logarithm of the hydrogen ion concentration in an aqueous solution

The “p” in pH is never capitalized

pH roughly stands for the “power of hydrogen”
What is pH?

Aqueous Solution

Hydrogen Ion Concentration

NEGATIVE Logarithm
Negative Logarithm

- Logarithms are mathematical shorthand for writing very big or very small numbers

\[10^2 = 100\]

\[10^{-2} = .01\]
Negative Logarithm of the Hydrogen Ion Concentration

\[ 10^{-7} = 0.00000001 \]

\[ 10^{-7.5} = 0.0000000316227 \]
Why is this important?

1. Small changes in pH are actually big changes

2. Damage to the pool – Corrosion or Scaling

3. Swimmer discomfort / possible harm

4. Big changes in the disinfecting power of Chlorine –
   1. Disease / cloudy water / algae / $$$
The pH Range

Ideal pH
7.4 – 7.6

Allowed Range
7.2 – 8.0
Controlling pH

Test with your test kit

pH testing uses phenol red reagent. This reagent can change color within the normal pH operating range of pools and spas. **But it will not test beyond the range that the test kit manufacture specifies.**

Phenol red is sensitive to Chlorine and Bromine. If these levels are very high, your pH test may show a purple color. This is not a very high pH reading it is a chemical reaction the changes the reagent to chlorophenol red or bromophenol red.
Test and adjust total alkalinity – retest pH then, if needed:

Perform a base demand test – follow the instructions in your kit and add:

**Soda Ash – Na$_2$CO$_3$**

Using the dosing chart that should come with your test kit
Test and adjust total alkalinity – retest pH then, if needed:

Perform an Acid demand test – follow the instructions in your kit and add:

**Muriatic acid (HCL)**

**Or**

**Sodium bisulfate (NaHSO₄)**

Use the dosing chart that should come with your test kit
Pool chemicals can be very dangerous. pH adjusting chemicals can be very harsh and pool operators should take care to understand the hazards of these chemicals:

Read the SDS
Read the label
Follow all instructions
Use PPE
Store according to label instruction
Always add chemical to water never the other way around
Be careful with other chemicals – serious and fatal reactions are possible if accidentally mixed.
Questions?

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