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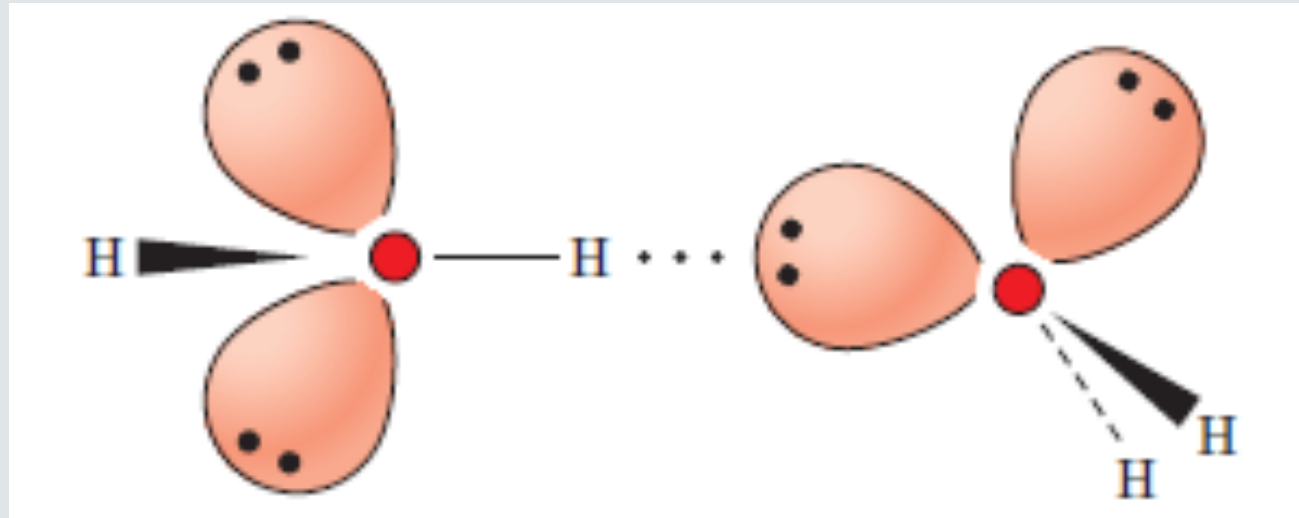
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TOPIC-2: Properties of Water, pH, Buffer



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Hydrogen bond between two water molecules: The strength of this interaction is maximal when the O-H covalent bond points directly along a lone-pair electron cloud of the oxygen atom to which it is hydrogen bonded.



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2.2 pH, Sorenson 1909

The values of $[H^+]$ for most solutions are inconveniently small and difficult to compare. A more practical quantity, which was devised in **1909** by **Søren Sørensen**, is known as the pH:

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

If two solutions differ in pH by one unit, they differ in $[H^+]$ by a factor of 10. The pH of a solution may be accurately and easily determined through electrochemical measurements with a device known as a **pH meter**.



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Henderson–Hasselbalch equation

$$[H^+] = K \left(\frac{[HA]}{[A^-]} \right)$$

and substituting it into Eq. [2.5]

$$pH = -\log K + \log \left(\frac{[A^-]}{[HA]} \right)$$

Defining $pK = -\log K$ in analogy with Eq. [2.5], we obtain the **Henderson–Hasselbalch equation**:

$$pH = pK + \log \left(\frac{[A^-]}{[HA]} \right) \quad [2.6]$$



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2.3 Buffers

When $[HA]=[A^-]$, the pH of the solution is relatively insensitive to the addition of strong base or strong acid. Such a solution, which is known as an acid–base buffer, is resistant to pH changes because small amounts of added H^+ or OH^- , respectively, react with the A^- or HA present without greatly changing the value of $\log([A^-]/[HA])$.