Review

Acids: donate H^+ (lose)
Base: accept H^+ (gain)

1. $OH + HCN \longrightarrow H_2O + CN$
   BB BA CA CB
2. $HPO_4^{2-} + H_2O \longrightarrow OH^- + H_2PO_4$
   BB BA CB CA
3. $HF + H_2O \longrightarrow H_3O^+ + F^-$
   BA BB CA CB

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pH:

- pH = -log [H+]
- acids have a pH < 7 (less than)
- bases have a pH > 7 (more than)
- neutral has a pH = 7
- Increases by a factor of 10 between numbers on the pH scale
  - pH of 3 has ten times the [H+] of pH 4

pH scale
0 ..... 7 14
acidic ↑ basic ↑
[H+] ↑ [OH-] ↑

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pH and pOH:

14 = pH + pOH

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pH Practice

- Calculate the pH of solutions having the following ion concentrations at 298K.
  - > $[H^+] = 1.0 \times 10^{-2}$ M
    $pH = -\log[H^+]$
    $pH = -\log(1.0 \times 10^{-2})$
    $-$ LOG (1.0 2nd EE) (-2) $= 2$
  - > $[H^+] = 8.6 \times 10^{-6}$ M
    $pH = -\log(8.6 \times 10^{-6})$
    $pH = 5.1$

Which of the solutions is more acidic?
#1

x10

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pH Practice

- Calculate the pH of solutions having the following ion concentrations at 298K.
  - > $[H^+] = 3.75 \times 10^{-6}$ M
    $pH = -\log[H^+]$
    $pH = -\log 3.75 \times 10^{-6}$
    pH = 5.43
  - > What is the pH of a solution with a pOH of 12.5?
    $pH + pOH = 14$
    $pH + 12.5 = 14$
    $14 - 12.5 = 1.5$

Which of the solutions is more acidic?

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Finding Ion Concentration

$[H^+] = 10^{-pH}$

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

$14 = pH + pOH$

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Practice

[ ] = concent. (M)

- Calculate the $[H^+]$ in a solution with a pH of 2.37.

$[H^+] = 10^{-pH}$

$[H^+] = 10^{-2.37}$

$[H^+] = .004\ M$

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Practice

- Calculate the $[H^+]$ of a solution with a pOH of 8.5.

$[H^+] = 10^{-pH}$ ←

$14 = pH + pOH$

$14 - 8.5 = 5.5 = pH$

$[H^+] = 10^{-5.5}$

$[H^+] = 3.2 \times 10^{-6}\ M$

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Strength of Acids and Bases

- Dilute and Concentrated: refer to the # of moles of acid or base dissolved in a volume of solution
- Weak and Strong: refers to degree of ion formation
  - > Strong acids and bases completely ionize (also called strong electrolytes)
    - ex: $HCl \rightarrow H^+ + Cl^-$ $NaOH \rightarrow Na^+ + OH^-$
  - > Weak acids and bases have incomplete ionization (establish equilibrium)
    - ex: $HC_2H_3O_2 \leftrightarrow H^+ + C_2H_3O_2^-$

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Strength of Acids and Bases

- Strong Acids: HCl, HI, HBr, HNO_3, H_2SO_4, $HClO_4$
- Strong Bases: LiOH, NaOH, KOH, RbOH, $Ca(OH)_2$, $Sr(OH)_2$, $Ba(OH)_2$
- Any acids or bases not on this list are weak!

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Calculating the pH of Strong Acids and Bases

- For all strong monoprotic acids, the concentration of the acid is the concentration of the H^+
- For all strong bases, the concentration of the base is the concentration of the OH^-

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Strong Acids and Bases Practice

- Calculate the pH of the following solutions:
  - > 0.10 M HI = $[H^+] = 0.10\ M$

$pH = -\log[H^+]$ $pH = 1$

$= -\log(.10)$

  - > 2.4 x 10^{-5} M H_2SO_4

$[HI] = 2.4 \times 10^{-5} M$ $pH = 4.6$

$pH = -\log(2.4 \times 10^{-5})$

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Measuring pH

- pH paper: will change the color depending on the hydrogen ion concentration in solution, the color is then compared to a standard scale
- pH meter: more accurate than pH paper, contains electrode that are immersed in solution, will give a digital readout

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