HW will post this afternoon
due Wednesday 1:00

extra credit lab - red cabbage
- egg
- 5 pts X each
- turn in reports during final

Ch 15 Acids & Bases

Acids latin word “acidus” = sour

1. have sour taste
2. turn litmus red
3. react w/ some metals to form $\text{H}_2 (g)$

Bases

1. have bitter taste
2. turn litmus dark blue
3. solutions slippery to touch

Litmus = cn acid/base indicator

(changes color under acidic or basic conditions)

Neutral: compound that’s neither acidic nor basic
Arrhenius definitions of acids & bases

Acid: substance that creates \( H_3O^+ \) when dissolved in water

\[
\text{HCl} + H_2O \rightarrow H^+ + Cl^- \\
\text{Proton combines with water molecule}
\]

\[
H^+ + H_2O \rightarrow H_3O^+
\]

\[
\text{HCl} + H_2O \rightarrow H_3O^+ + Cl^- \\
\text{balanced equation}
\]

Hydronium produced so HCl is an acid

Arrhenius base: creates \( \text{OH}^- \) (hydroxide ion) when dissolved in water

\[
\text{NaOH} + H_2O \rightarrow Na^+ + \text{OH}^- \\
\text{Sodium hydroxide}
\]

Hydroxide ions produced so NaOH is a base,

\[
\text{NH}_3 \text{ is a base too}
\]
Brønsted-Lowry definitions

B-L acid: proton donor
B-L base: proton acceptor

\[
\text{HCl} + \text{NH}_3 \rightarrow \text{Cl}^- + \text{NH}_4^+
\]

proton donor \hspace{1cm} proton acceptor
\[ \text{ACID} \hspace{2cm} \text{BASE} \]

\[
\text{CH}_3\text{CO}_2\text{H} + \text{CH}_3\text{OH}^- \rightarrow \text{CH}_3\text{CO}_2^- + \text{CH}_3\text{D}^+\text{H}
\]

H⁺ donor \hspace{1cm} H⁺ acceptor
\[ \text{ACID} \hspace{2cm} \text{BASE} \]

Which reactant is an acid? Which is a base?

\[
\text{H}_2\text{SO}_4 + \text{OH}^- \rightarrow \text{HSO}_4^- + \text{H}_2\text{O}
\]

acid \hspace{1cm} base

Strength of acidic or basic solutions

solution
determination of acidity

- A solution that is very strongly acidic (battery acid) has high concentration of \( \text{H}_3\text{O}^+ \) (conc. sulfuric acid)

- A solution that is only weakly acidic (apple juice) has lower concentration of \( \text{H}_3\text{O}^+ \)

- A solution that is basic has very low concentration of \( \text{H}_3\text{O}^+ \)
\[ \text{high H}_3\text{O}^+ \text{ conc} \quad \text{low OH}^- \text{ conc} \]
\[ = \left[ \text{H}_3\text{O}^+ \right] > \left[ \text{OH}^- \right] \quad \text{hydroxide concentration} \]

\[ \text{H}_3\text{O}^+ \text{ and OH}^- \text{ in equal concentration} \]
\[ \left[ \text{H}_3\text{O}^+ \right] = \left[ \text{OH}^- \right] \]

\[ \text{low H}_3\text{O}^+ \text{ conc} \quad \text{high OH}^- \text{ conc} \quad \text{basic} \]

\[ \text{acidic} \]

\[ \text{neutral} \quad \text{pH scale} \]
\[ \text{low pH = acid} \]
\[ \text{high pH = base} \]

\[ \text{pH} = -\log \left[ \text{H}_3\text{O}^+ \right] \]

\[ \log \text{ on calc} \]
\[ \left[ \text{H}_3\text{O}^+ \right] = 1.0 \times 10^{-1} \ M \]
\[ \text{pH} = -\log (1.0 \times 10^{-1}) = 1 \]

\[ \left[ \text{H}_2\text{O}^+ \right] = 1.0 \times 10^{-13} \ M \]
\[ \text{pH} = -\log (1.0 \times 10^{-13}) = 13 \]

\[ \log 10^4 = 4 \]
\[ \log 10^{20} = 20 \]
\[- \log 10^9 = -4\]
\[- \log 10^{-17} = 17\]

\[\left[ H_3O^+ \right] = 2.86 \times 10^{-8}\]

pH = \(- \log (2.86 \times 10^{-8})\)