Acid Bases and pH

Warm Up
What does pH measure?

Properties of Acids

- Acids are proton (hydrogen ion, H^+) donors
- Acids have a pH lower than 7
- Acids taste sour
- Acids effect indicators
  - Blue litmus turns red
  - Methyl orange turns red
- Acids react with active metals, producing H_2
- Acids react with carbonates
- Acids neutralize bases

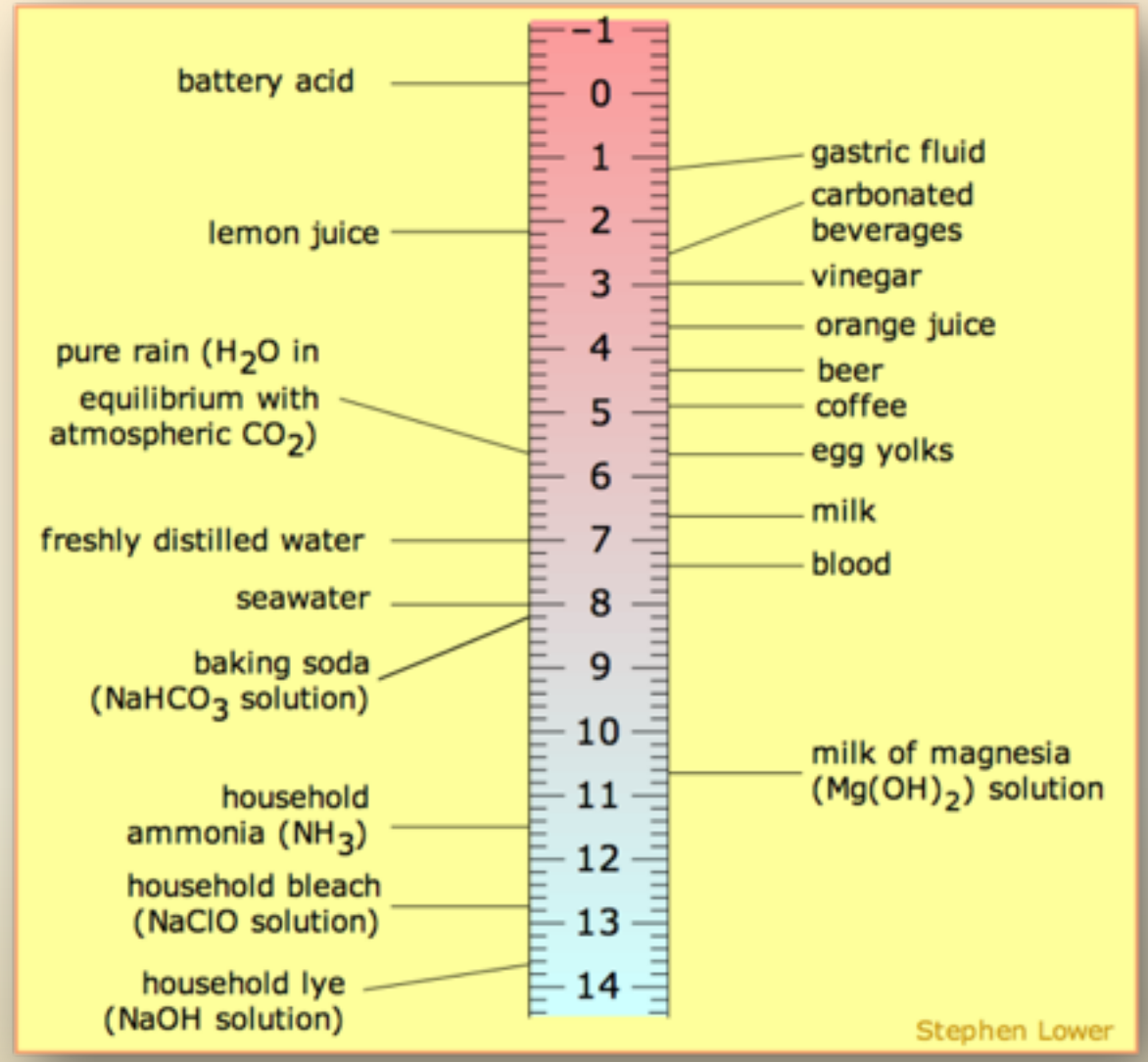
Acids are Proton (H^+ ion) Donors

Strong acids are assumed to be 100% ionized in solution (good H^+ donors).

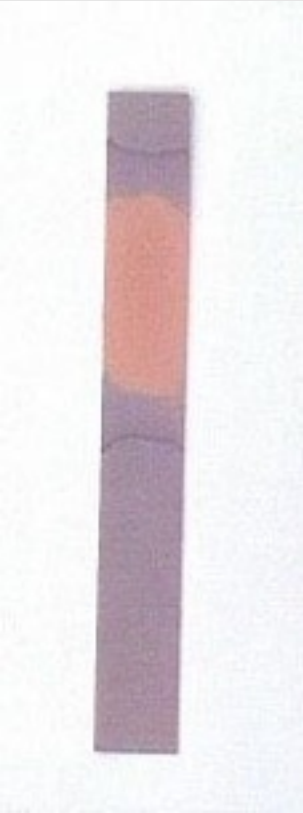
HCl H_2SO_4 HNO_3

Weak acids are usually less than 5% ionized in solution (poor H^+ donors).

H_3PO_4 $HC_2H_3O_2$ Organic acids



Acids Have a pH less than 7



Acids Effect Indicators

Blue litmus paper turns red in contact with an acid.

Methyl orange turns red with addition of an acid

Acids Neutralize Bases

Neutralization reactions ALWAYS produce a salt and water.

$$HCl + NaOH \rightarrow NaCl + H_2O$$

$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$$

$$2HNO_3 + Mg(OH)_2 \rightarrow Mg(NO_3)_2 + 2H_2O$$

Properties of Bases

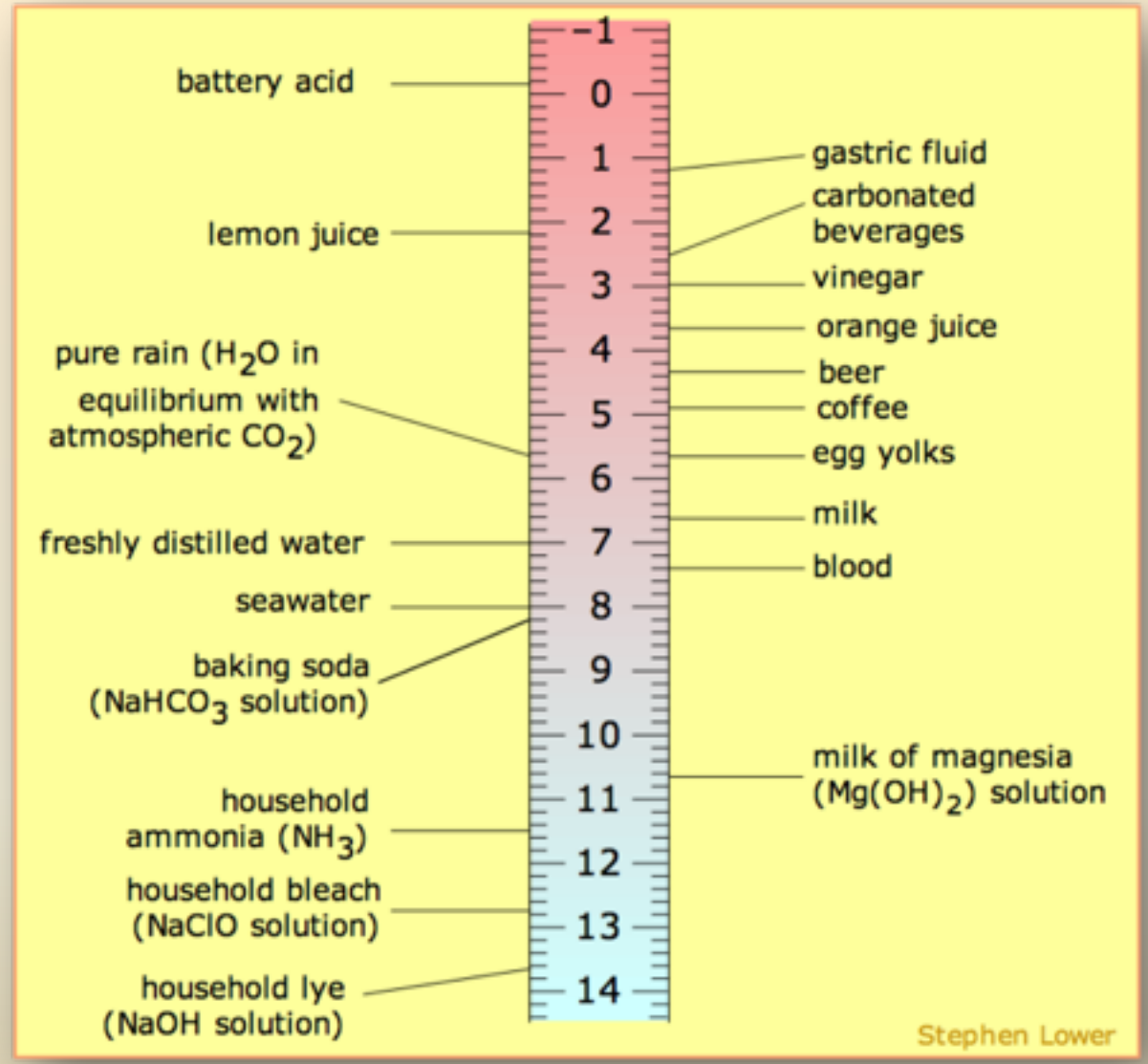
- Bases are proton (hydrogen ion, H^+) acceptors
- Bases have a pH greater than 7
- Bases taste bitter
- Bases effect indicators
  - Red litmus turns blue
  - Phenolphthalein turns purple
- Solutions of bases feel slippery
- Bases neutralize acids

Bases are Proton (H^+ ion) Acceptors

- Sodium hydroxide (lye), $NaOH$
- Potassium hydroxide, KOH
- Magnesium hydroxide, $Mg(OH)_2$
- Calcium hydroxide (lime), $Ca(OH)_2$

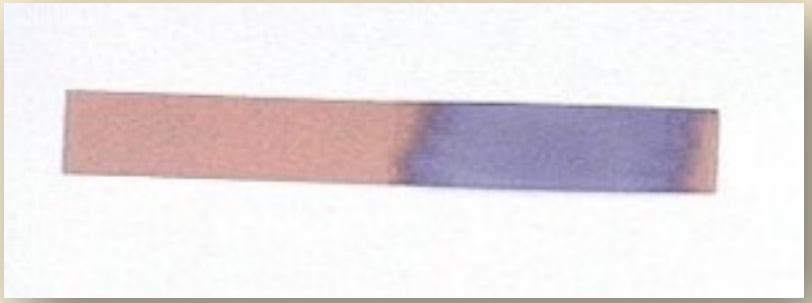
OH^- (hydroxide) in base combines with H^+ in acids to form water

$$H^+ + OH^- \rightarrow H_2O$$



Bases have a pH greater than 7

Bases Effect Indicators

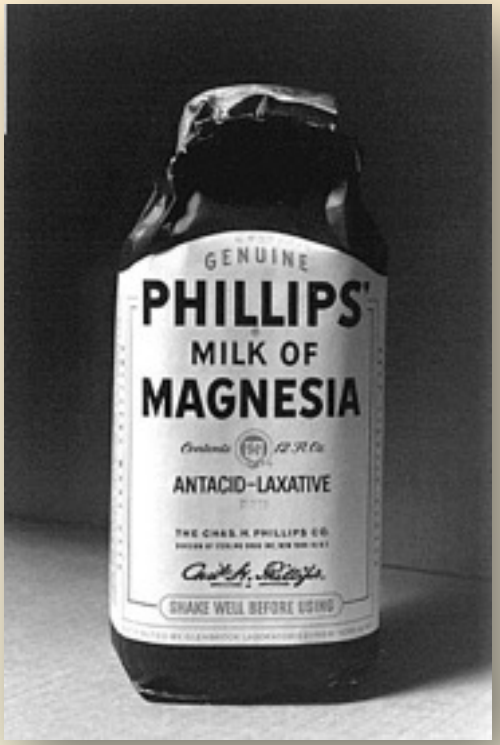


Red litmus paper turns blue in contact with a base.

Phenolphthalein turns bright pink in a base.

Bases Neutralize Acids

Milk of Magnesia contains magnesium hydroxide, $Mg(OH)_2$, which neutralizes stomach acid, HCl.



$$2\ HCl + Mg(OH)_2 \longrightarrow MgCl_2 + 2\ H_2O$$

Logarithims - the pH scale

$10^y = x$ is equivalent to $y=\log_{10}x$

A **logarithm** is an exponent, and **log** $\boldsymbol{x}$ is the exponent to which **10** must be raised in order to obtain x. The value of x will always be positive.

Calculating Acidity - the pH scale

- calculated using the negative log $[H^+]$ M

A solution of HCl has a molarity of 0.00047M, what is the pH?

HCl is a strong acid so it completely dissociates

0.00047M

H Cl

Calculating Acidity - the pH scale

- calculated using the negative log $[H^+]$ M

A 10g of HCl is dissolved in 1L of water. What is the pH of the solution?

HCl is a strong acid so it completely dissociates