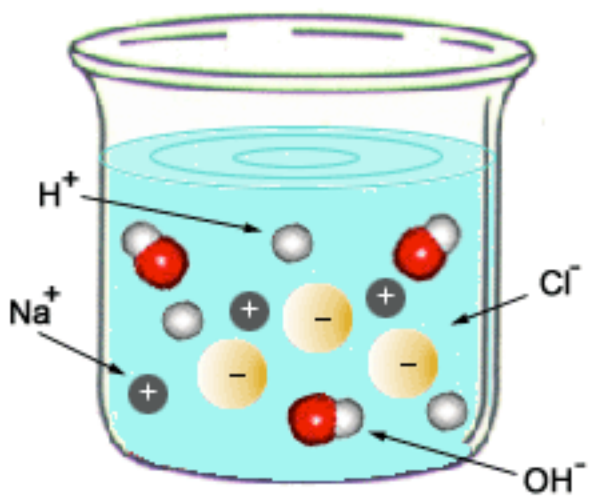
pH Acid & Base



Auto ionization of water

- $H_2O_{(l)}$ <----> $H^{+1}_{(aq)}$ + $OH^{-1}_{(aq)}$

Terms and such

- H_3O^{+1} is the Hydronium ion also represented as the Hydrogen ion H^{+1}
- $H_3O^{+1} = H^{+1}$
- OH^{-1} is the hydroxide ion
- K_w is always 1.0×10^{-14}

$$[H_3O^+] \times [OH^-] = 1.0 \times 10^{-14}$$

$$[H_3O^+] \times [OH^-] = K_w$$

The pH scale

- The product of hydronium ion and the hydroxide ion
- Instead of exponents we use a scale of whole numbers pH scale is 0 to 14
- Each unit of pH is X10 greater, so pH is a logarithm scale (thus the lower case p)

PH scale

- 0   to   14
- pH of 7 is neutral $[H^{+1}] = [OH^{-1}]$
- Below 7 is acidic
- Above 7 is basic

Acidic characteristics

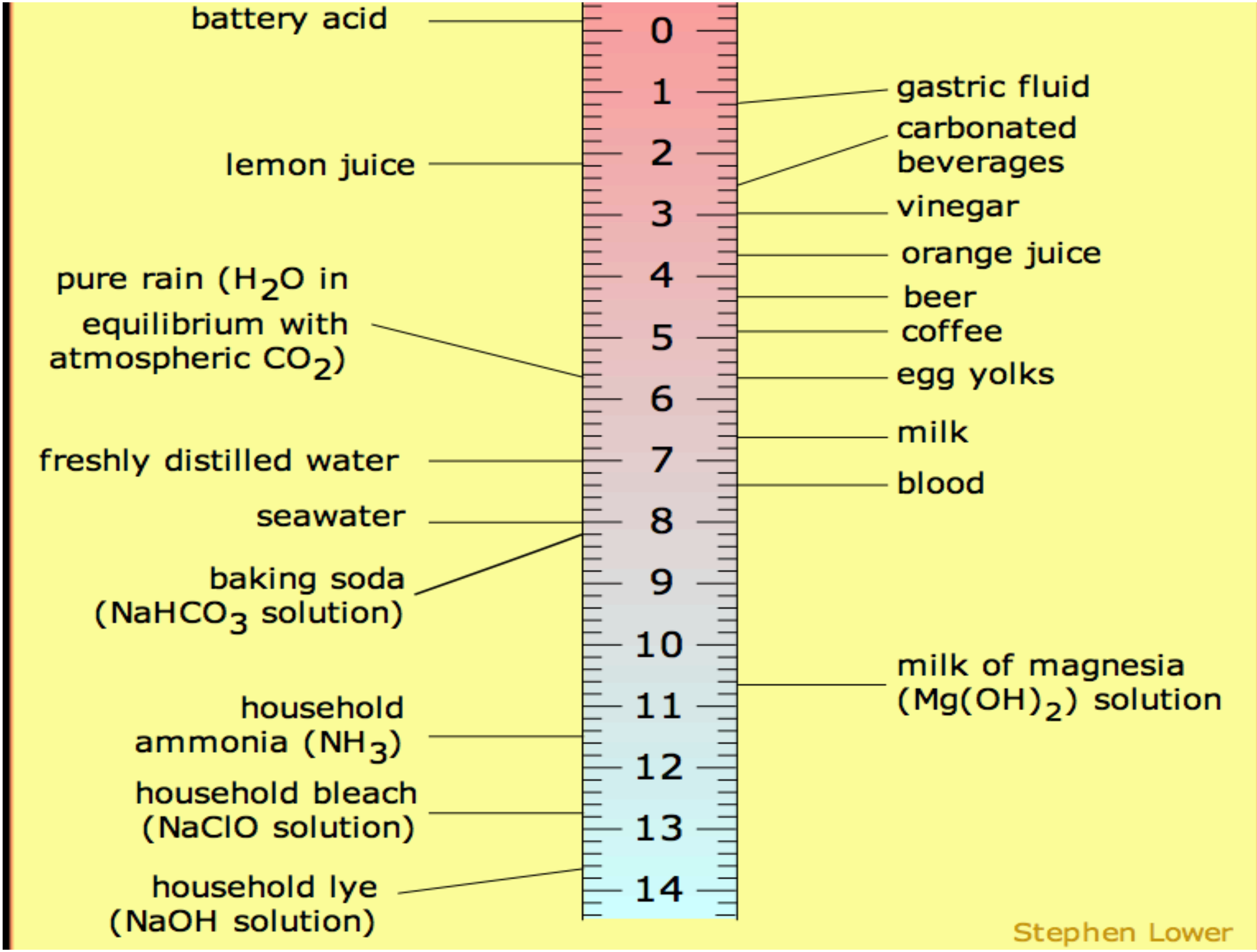
- React with metals
- Sweet or sour taste

pH arithmetic

- $pH = -\log [H^{+1}]$
- $pOH = -\log [OH^{-1}]$
- $pH + pOH = 14$
- $1.00 \times 10^{-14} = [H^{+1}] [OH^{-1}]$
- $[H^{+}] = 10^{-(pH)}$
- $[OH^{-}] = 10^{-(pOH)}$

Calculating pH

- If H^{+1} = 5.6 x 10 $^{-5}$ find the pH
- -log[5.6 x 10^{-5}]= 4.3
- If the pH is 8.7 what is the H^{+1} concentration?= 2.0 x 10^{-9}


battery acid
lemon juice
pure rain (H2O in equilibrium with atmospheric CO2)
freshly distilled water
seawater
baking soda (NaHCO3 solution)
household ammonia (NH3)
household bleach (NaClO solution)
household lye (NaOH solution)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
gastric fluid
carbonated beverages
vinegar
orange juice
beer
coffee
egg yolks
milk
blood
milk of magnesia (Mg(OH)2) solution
Stephen Lower

Types of Acids

- Monoprotic - having only one H^+ ion dissociate
- Diprotic - having two H^+ ions dissociate
- Triprotic - having three H^+ ions dissociate

- H^+ ions come off one at a time
- Same reasoning applies to bases like $Ba(OH)_2$
- 2 OH^{-1}

Examples

- Monoprotic
  - $HCl \text{ ----->} H^+ + Cl^{-1}$
- Diprotic
  - $H_2SO_4 \text{ ----->} H^+ + HSO_4^{-1}$
  - $HSO_4^{-1} \text{ ----->} H^+ + SO_4^{-2}$
- Triprotic
  - $H_3PO_4 \text{ ----->} H^+ + H_2PO_4^{-1}$
  - $H_2PO_4^{-1} \text{ ----->} H^+ + HPO_4^{-2}$
  - $HPO_4^{-2} \text{ ----->} H^+ + PO_4^{-3}$

Problem

- Find the Molarity of Sulfuric acid if 25.00 ml of 0.10 M NaOH is used to neutralize 15.0 ml the acid.
- $M_bV_b \quad = \quad M_aV_a$
- 25.00 ml x 0.10 M = M_a x 15.0 ml
- = 0.17 M (diprotic divide by 2) = 0.085 M

Acid Rain

- NO_x & SO_x
- SO_x Industrial sources From coal (high sulfur coal)
- NO_x These gases form from
  Automobiles exhaust

Gases dissolve in water producing acid rain

- NO_3 $+H_2O$ -----> HNO_3