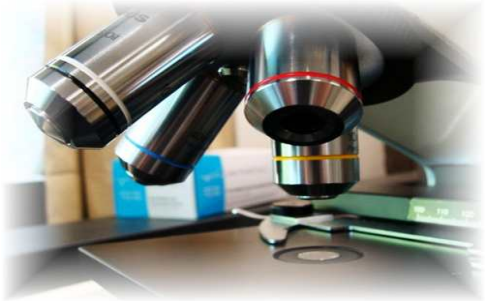

About Science Prof Online PowerPoint Resources

• Science Prof Online (SPO) is a free science education website that provides fully-developed Virtual Science Classrooms, science-related PowerPoints, articles and images. The site is designed to be a helpful resource for students, educators, and anyone interested in learning about science.

• The SPO Virtual Classrooms offer many educational resources, including practice test questions, review questions, lecture PowerPoints, video tutorials, sample assignments and course syllabi. New materials are continually being developed, so check back frequently, or follow us on Facebook (Science Prof Online) or Twitter (ScienceProfSPO) for updates.

• Many SPO PowerPoints are available in a variety of formats, such as fully editable PowerPoint files, as well as uneditable versions in smaller file sizes, such as PowerPoint Shows and Portable Document Format (.pdf), for ease of printing.

• Images used on this resource, and on the SPO website are, wherever possible, credited and linked to their source. Any words underlined and appearing in blue are links that can be clicked on for more information. PowerPoints must be viewed in *slide show mode* to use the hyperlinks directly.

• Several helpful links to fun and interactive learning tools are included throughout the PPT and on the Smart Links slide, near the end of each presentation. You must be in *slide show mode* to utilize hyperlinks and animations.

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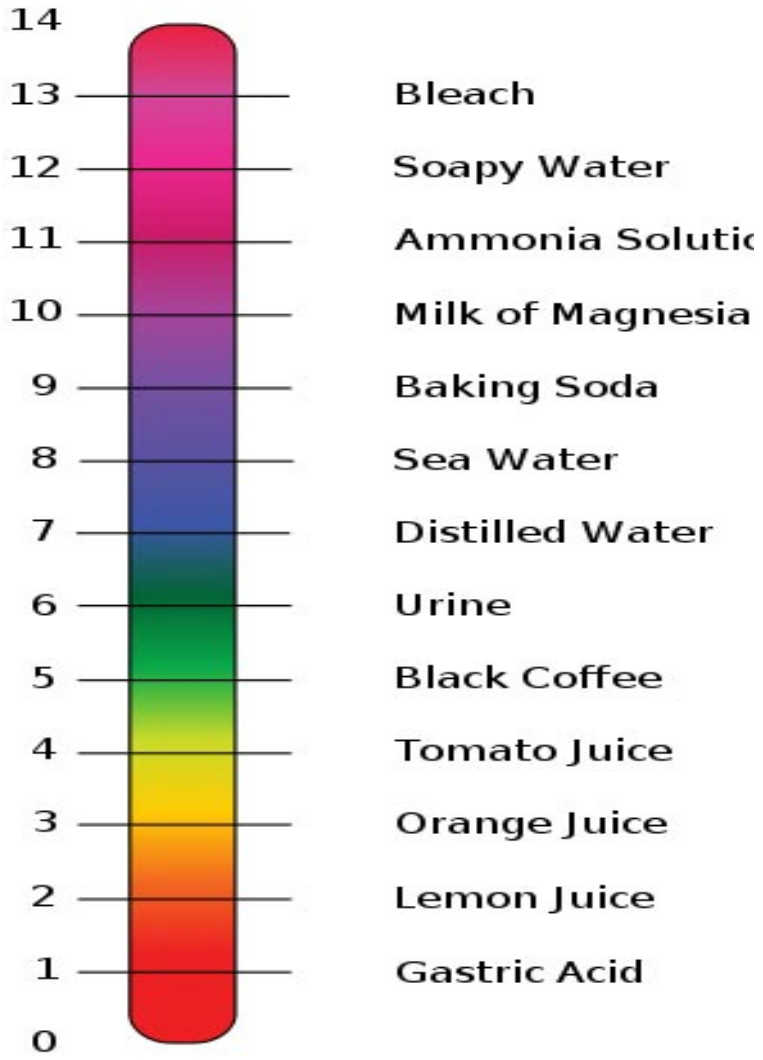
Image: Compound microscope objectives, T. Port

Acids, Bases & Buffers

Importance of The pH Scale in Biology



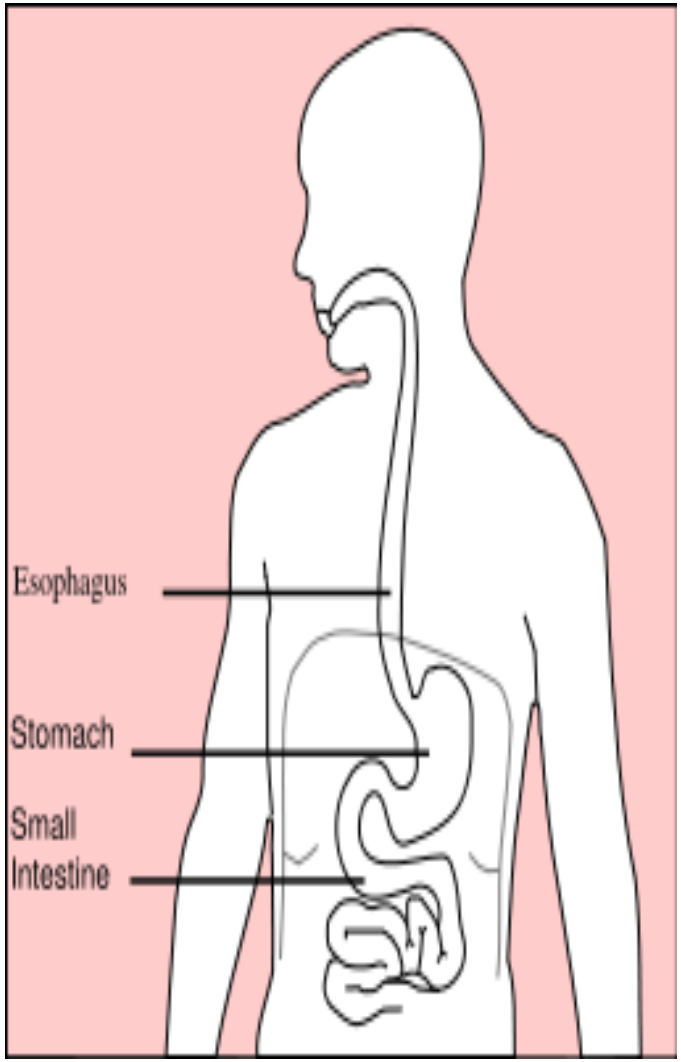
Images: pH scale, Edward Stevens, Wiki

Everyday Science

Q: *Where is the most acidic area of your body?*

Q: *What would be the purpose of having acidic gastric juices in the stomach?*

WATCH THIS!
Ever wonder how corrosive human stomach acid is?

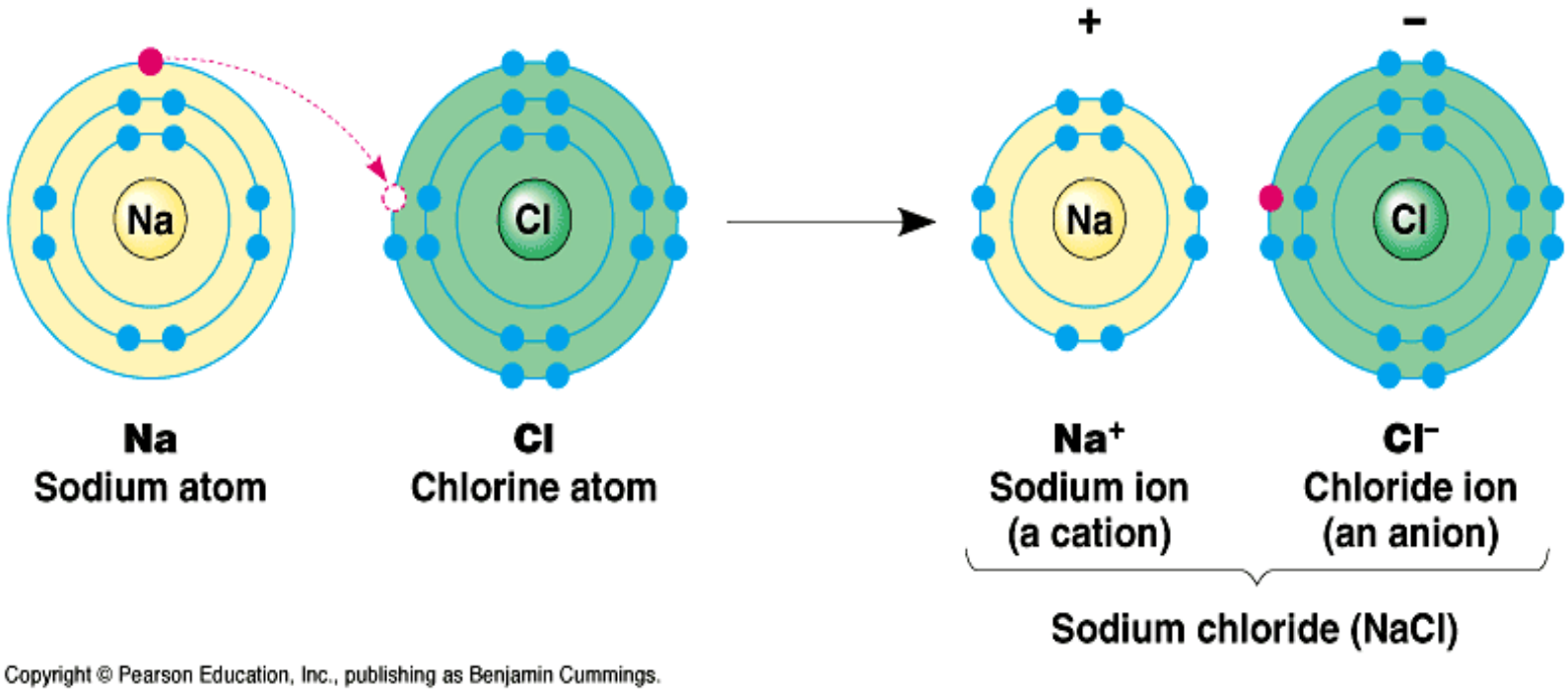


Images: Human digestive system, Wiki

Ionic Bonds

Involves transfer of electrons between two atoms.

Found mainly … inorganic compounds.



Ion = an atom or group of atoms which have lost or gained one or more electrons, making them negatively or positively charged.

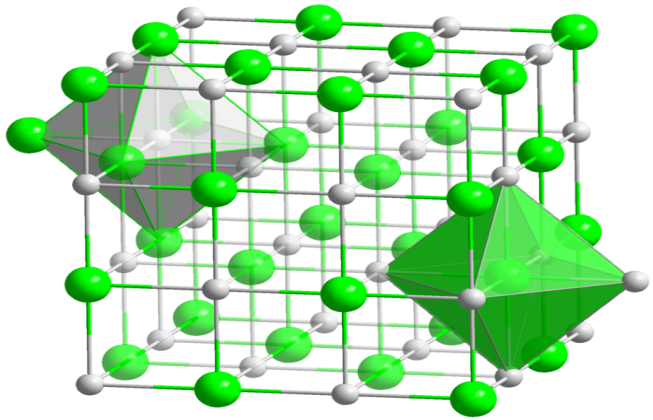
Q: What are positively charged ions (+) called?

Q: What are negatively charged ions (-) called?

Images: Sodium Chloride, University of Winnepeg

From the Virtual Cell Biology Classroom on ScienceProfOnline.com

Ionic compounds are made of oppositely charged ions



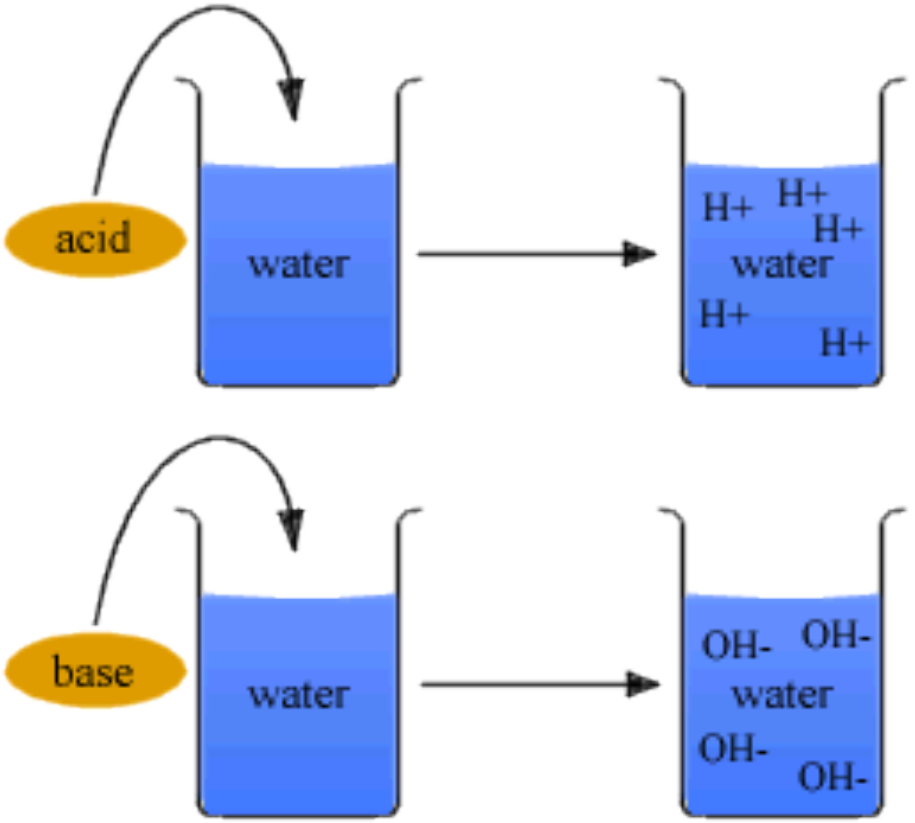
- Ionic Bonds are atoms held together by attraction between a **(+) and a (–) ion**
- **Compound is neutral overall,** but still charged on the inside.
- Makes solid crystals.

Images: Halit crystal, Crystal structure of NaCl, Wiki

Ions: Acids & Bases

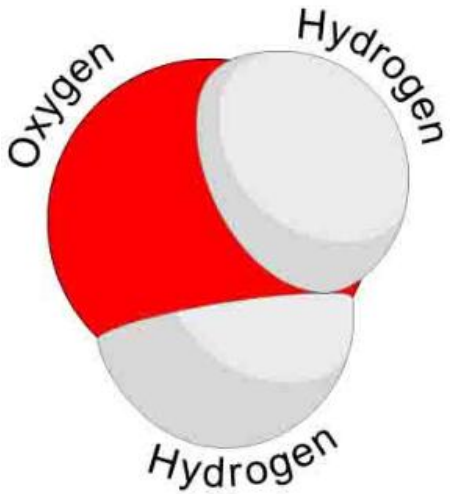
An **acid** is any ionic compound that releases **hydrogen** _____ (H^+) in solution.

A **base** is any ionic compound that releases **hydroxide** _____ (^-OH) in solution.



Another important characteristic of water…

Water can form acids and bases



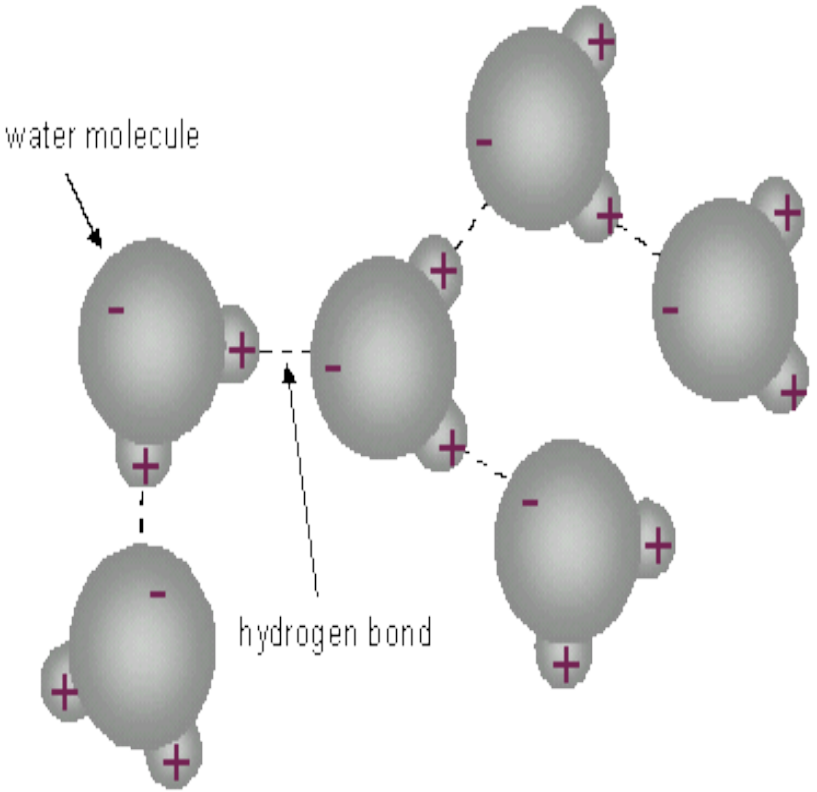
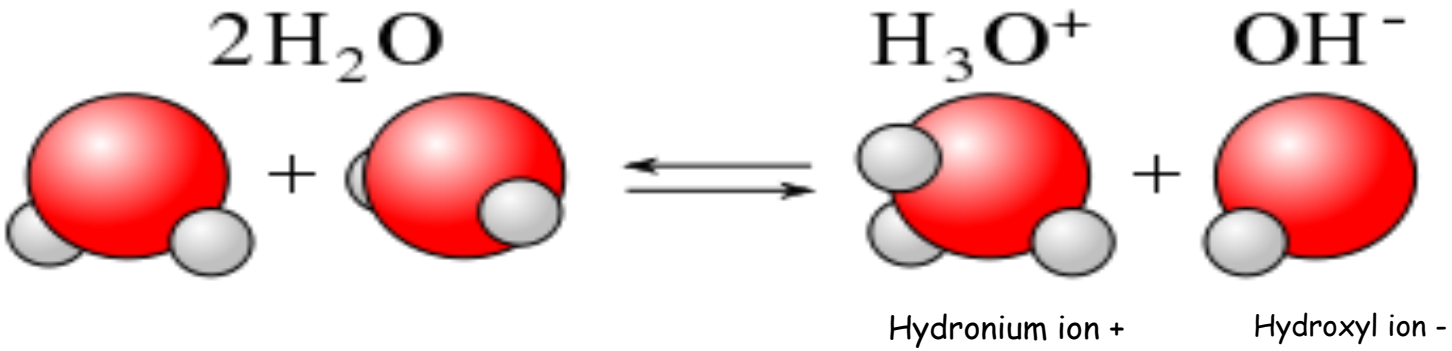


Image: Periodic Table of Elements; Water Molecule, Wiki

Dissociation of Water

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



Neutral water has equal amounts of H^+ and OH^-

Acids: Excess of H^+ in aqueous solution

Bases: Excess of OH^- in aqueous solution

Acids & bases neutralize each other.

Images: Dissociation of water, Wiki

Measurements of Acidity & Alkalinity (pH)

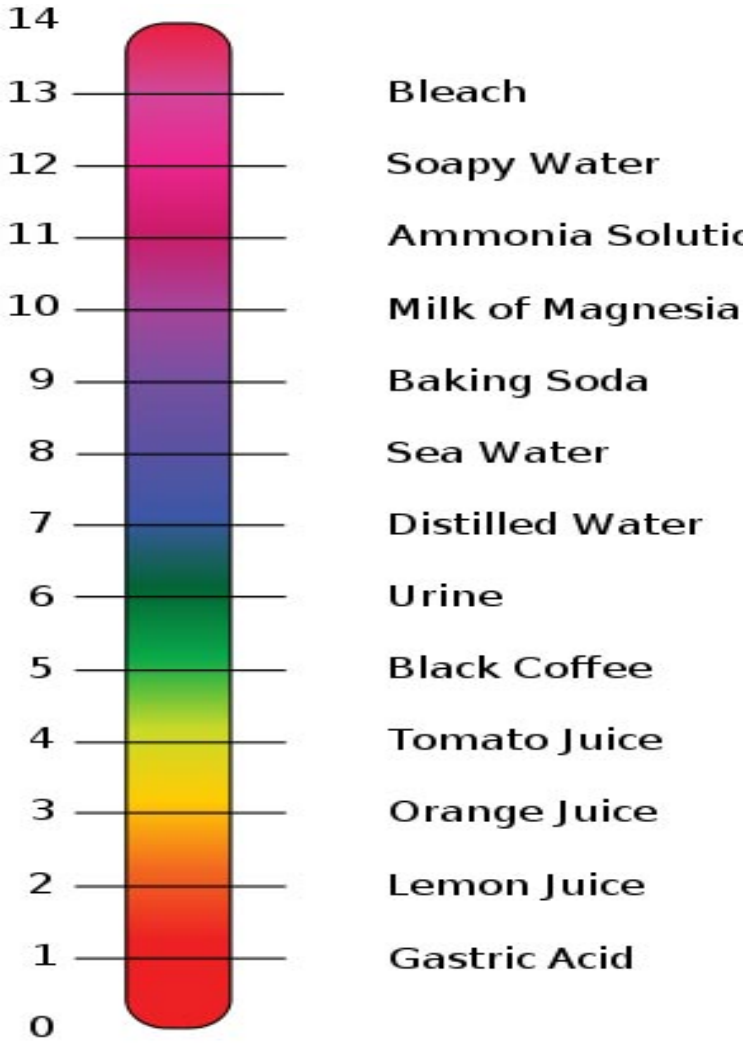
Acidity of a solution > measured by concentration of hydrogen ions (H+) vs. hydroxyl ions (OH-).

pH ranges: 0 (very acidic) to 14 (very basic).

pH scale is logarithmic.

Change in just one unit of scale = tenfold change in H+ concentration.

If concentration of H+ = OH - … neutral.



Images: pH scale, Edward Stevens, Wiki

pH scale is logarithmic

Change in just one unit of scale

= tenfold change in H+ concentration

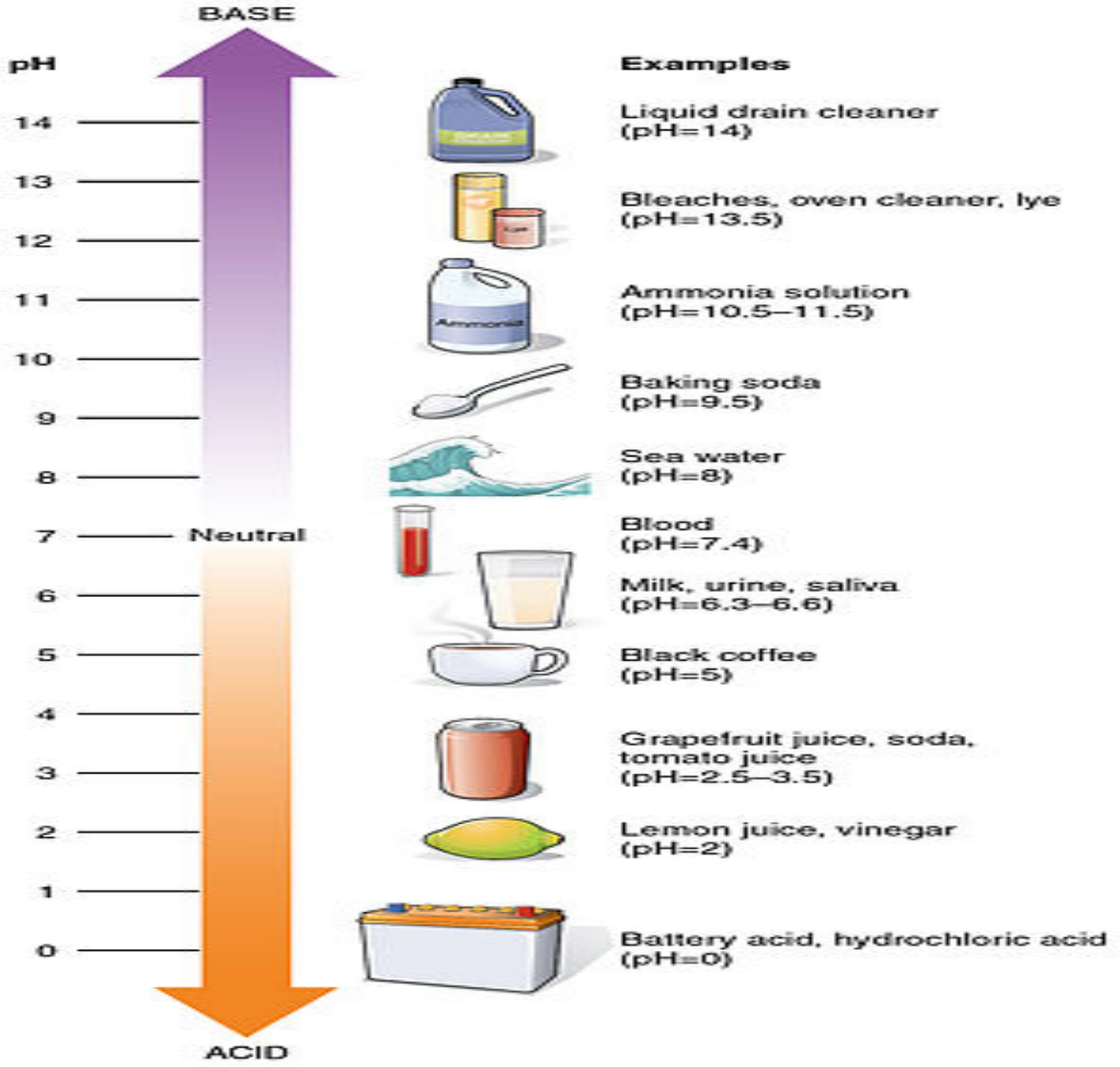
.

Table 1. Correlation of pH values and Hydronium ion concentrations

pH	Hydronium ion concentration (moles/L)
1	.1 (1×10^{-1})
2	.01 (1×10^{-2})
3	.001 (1×10^{-3})
4	.0001 (1×10^{-4})
5	.00001 (1×10^{-5})
6	.000001 (1×10^{-6})
7	.0000001 (1×10^{-7})
8	.00000001 (1×10^{-8})
9	.000000001 (1×10^{-9})
10	.0000000001 (1×10^{-10})
11	.00000000001 (1×10^{-11})
12	.000000000001 (1×10^{-12})
13	.0000000000001 (1×10^{-13})
14	.00000000000001 (1×10^{-14})

Image: pH & hydronium ion concentration, UBC Wiki

More Examples of pH from Daily Life



Images: pH scale, Wiki

Ions & Acids

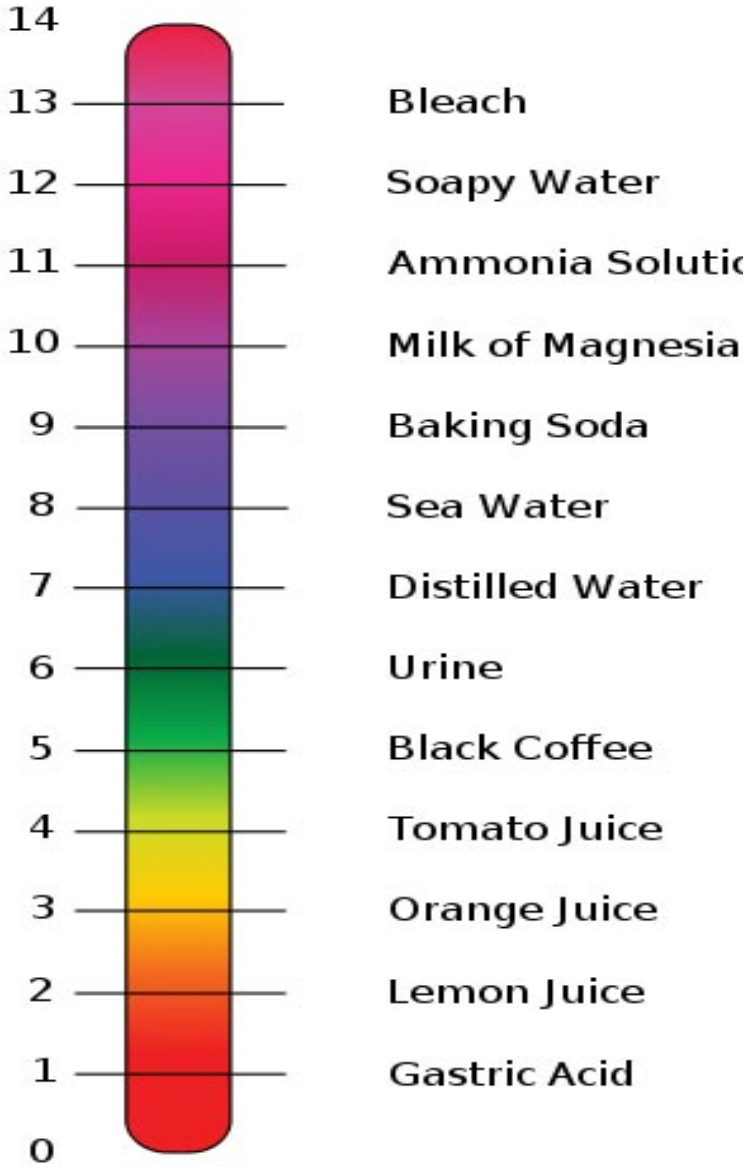
An **acid** is any ionic compound that releases hydrogen ions (H+) in solution.

Weak acids have a sour taste.

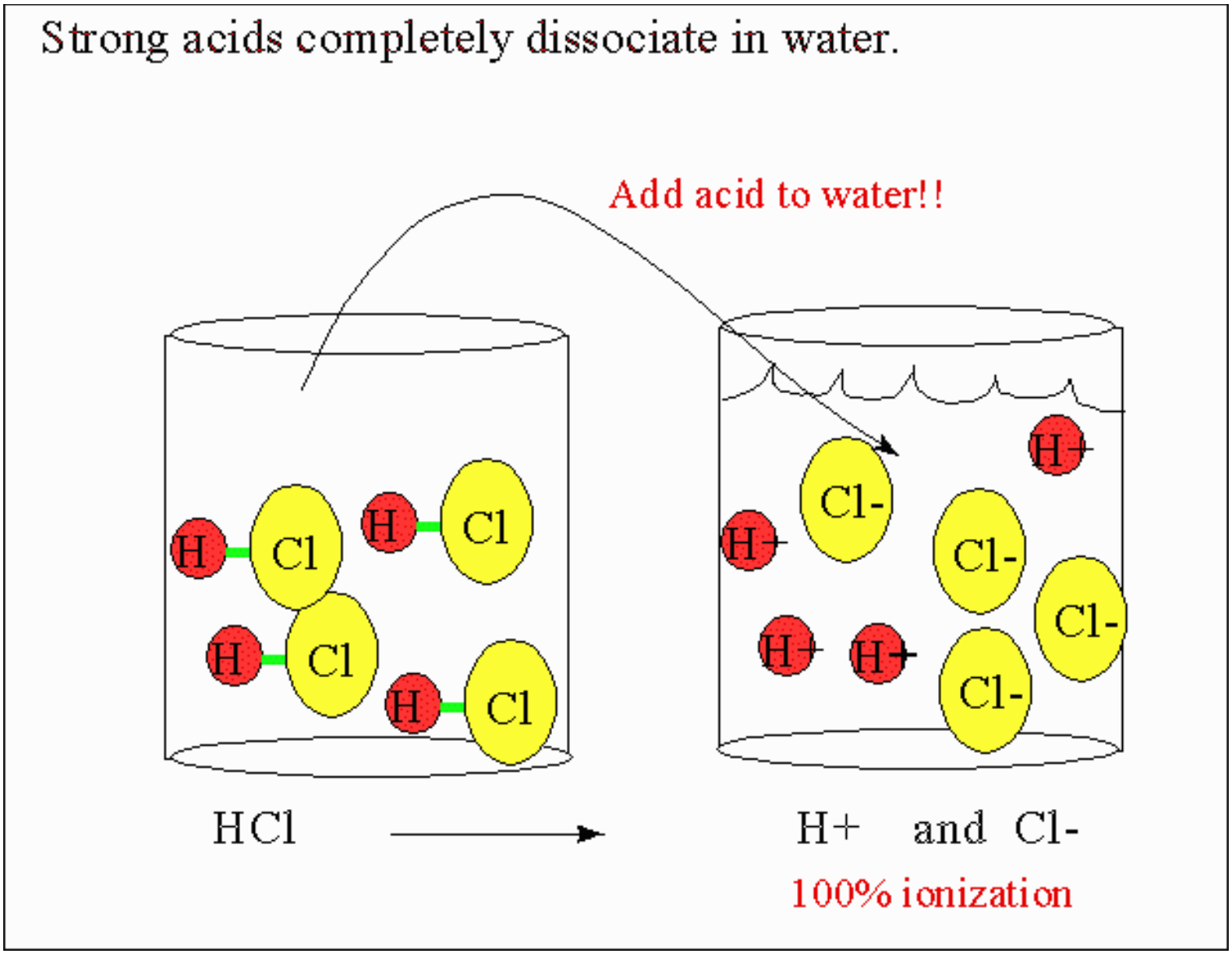
Strong acids are highly corrosive (So don't go around taste-testing acids.)

Examples:

- **Ascorbic acid** ($C_6H_8O_6$, Vitamin C)
- **Citric acid** ($C_6H_8O_7$, a weak organic acid in citrus fruits)
- **Phosphoric acid** (H_3PO_4, in pop…this stuff is also used to remove rust…hmmm)

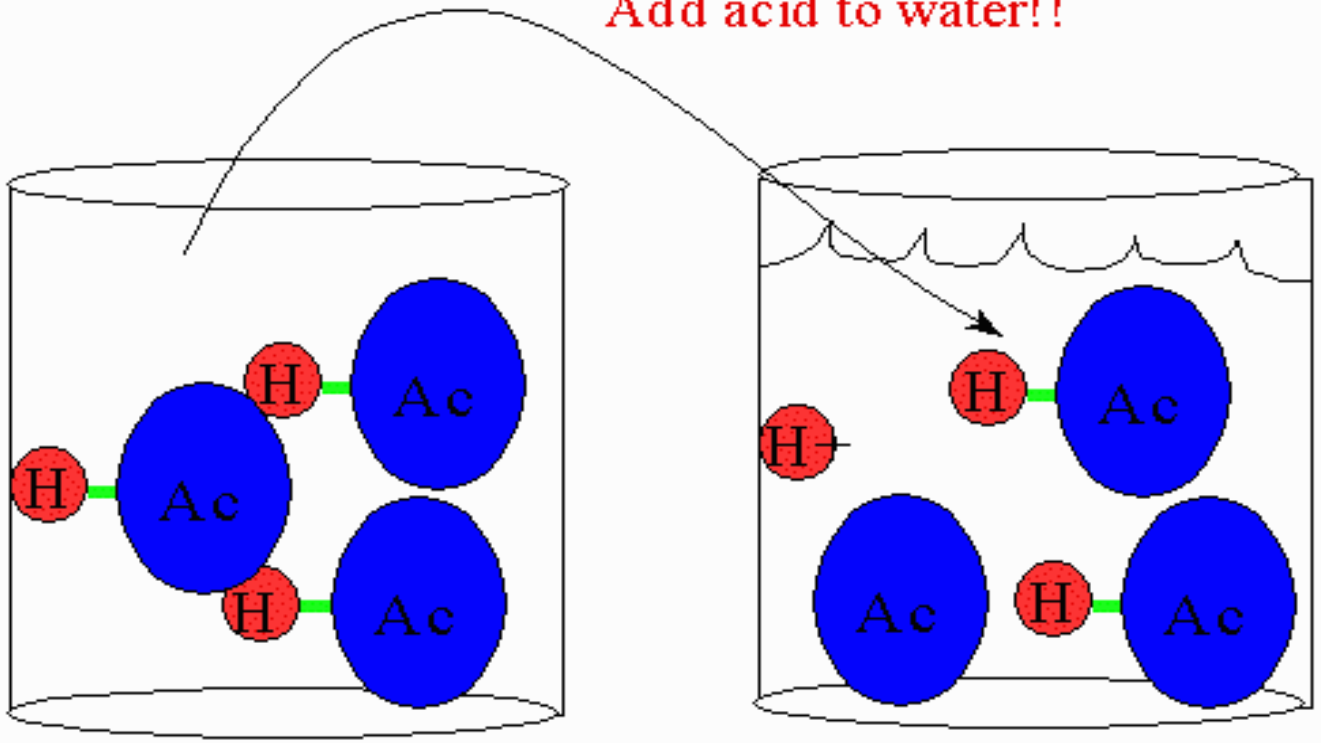


Images: pH scale, Edward Stevens, Wiki



Images: Strong Acids, Department of Chemistry, CSU

Weak acids DO NOT completely dissociate in water.



HAc → H+ and Ac and HAc

partial ionization

HAc = acetic acid = H-O-C(=O)-CH_3

Ions & Bases

A **base** is an ionic compound that releases hydroxyl ions (OH-) in solution.

Bases are also called **alkaline** substances.

Some general properties of bases include:

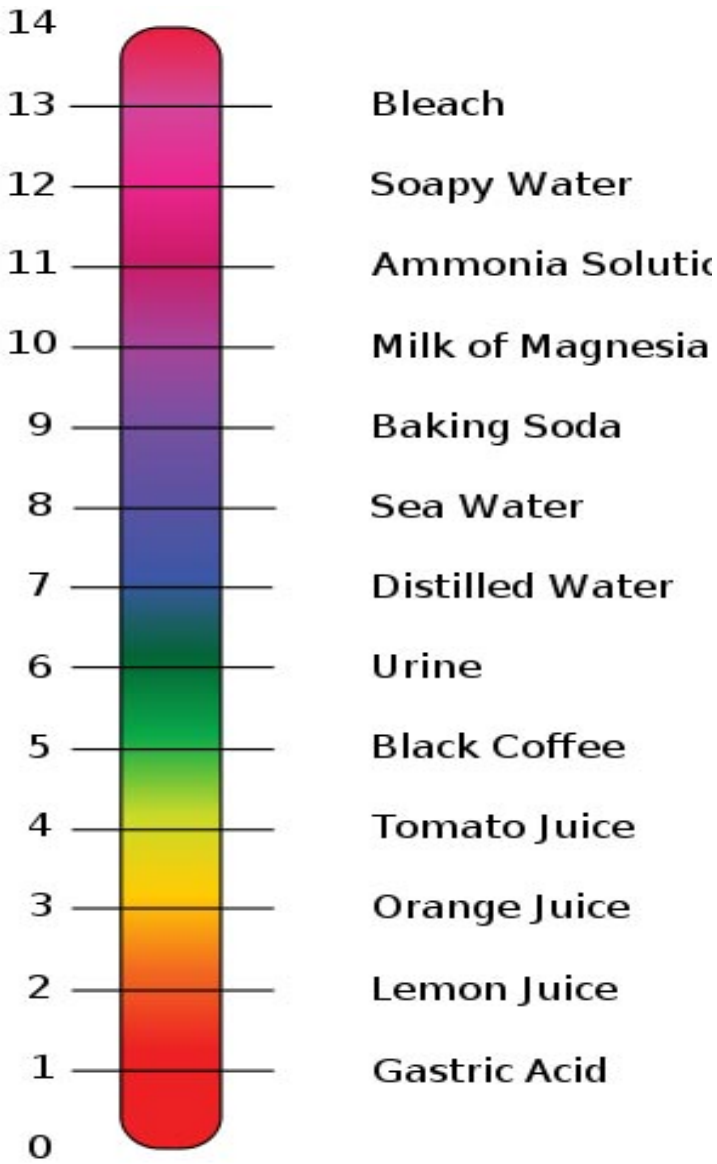
Taste: Bitter taste (opposed to sour taste of acids and sweetness of aldehydes and ketones).

Touch: Slimy or soapy feel on fingers.

Reactivity: Strong bases are caustic on organic matter, react violently with acidic substances.

Examples:

- **Sodium hydroxide**, NaOH, of lye or caustic soda used in oven cleaners.
- **Magnesium hydroxide**, $Mg(OH)^2$, also known as milk of magnesia, a weak base used in antacids and laxatives.



Images: pH scale, Edward Stevens, Wiki

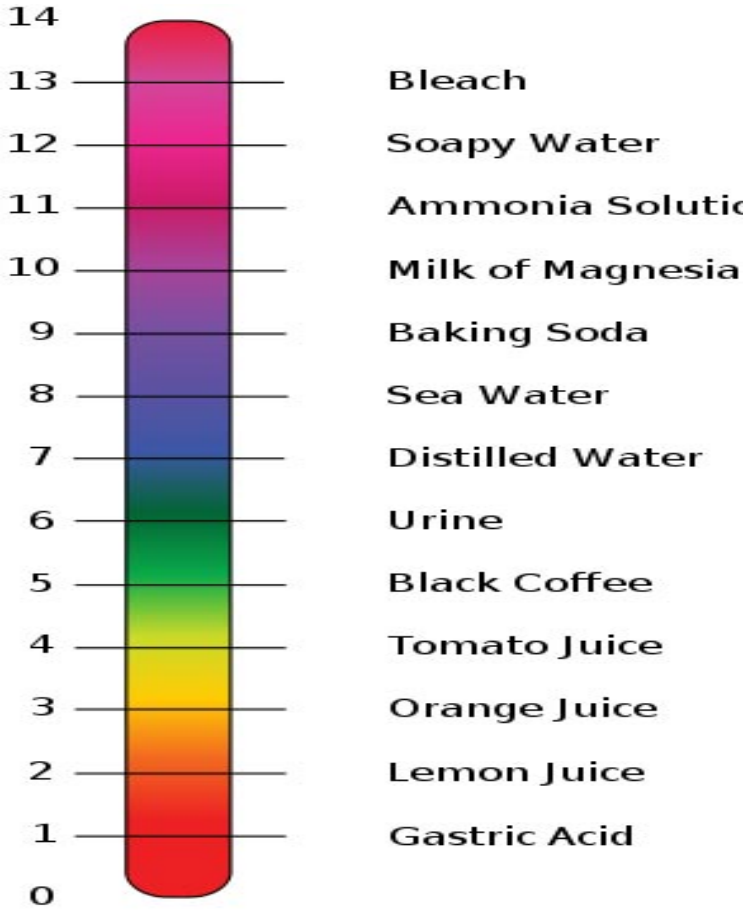
Acid/Base Balance in Biology

pH balance is important to homeostasis of organisms.

Homeostasis = tendency of the body to maintain a balanced internal environment, even when faced with external changes. Such as the body's ability to maintain an internal temperature around 98.6 degrees F, whatever the temperature outside.

Examples:

- Digestion needs acidic environment (pH 2-3)
- Urine is slightly acidic
- Blood must stay in neutral range near 7.35 to 7.45



Acids, Bases & You, and in-depth YouTube video.

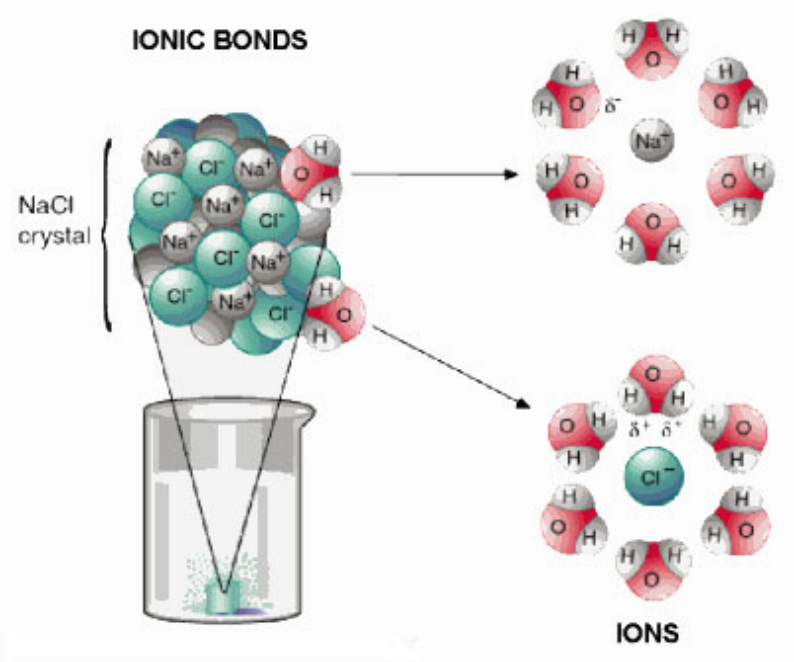
Images: pH scale, Edward Stevens, Wiki

Ions & Salts

- Compounds that dissociate in water and produce cations other than H+ and anions other than OH- are called **salts**.

- The most familiar salt is **sodium chloride**, the principal component of **common table salt**.

- **Other examples of salts:**
  - Baking soda (NaHCO3)
  - Epsom Salts (MgSO4)



Salts: The Role of Buffers

- Certain salts, called **buffers**, can combine with excess hydrogen (H+) or hydroxide (OH-) ions.

- Produce substances less acidic or alkaline.

- Act like a chemical sponge to soak up excess acid or base, keep pH constant.

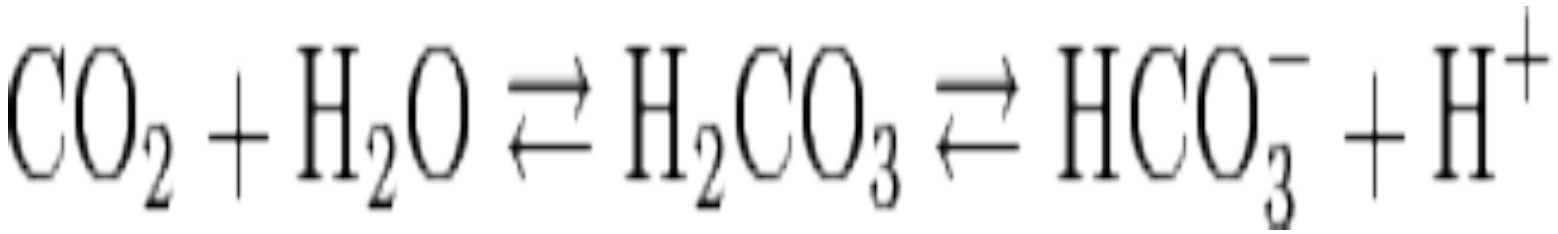
- Buffers can be "used up". Once used up, no longer help regulate pH.

- Buffers are vital to maintaining pH in organisms.

- ***Example:***
Antacids are buffers made of the salt calcium carbonate (CaCo3).

Images: Antacid Tablets, Wiki

Bicarbonate Buffer system is important in maintaining proper blood pH



Videos:

1. Bicarbonate Buffer System & pH imbalances
2. Bicarbonate Buffer System from John Wiley

Images: Bicarbonate Buffer System, Wiki

REVIEW!

Interactive animated lessons on

pH: Acids & Bases

and

Buffers

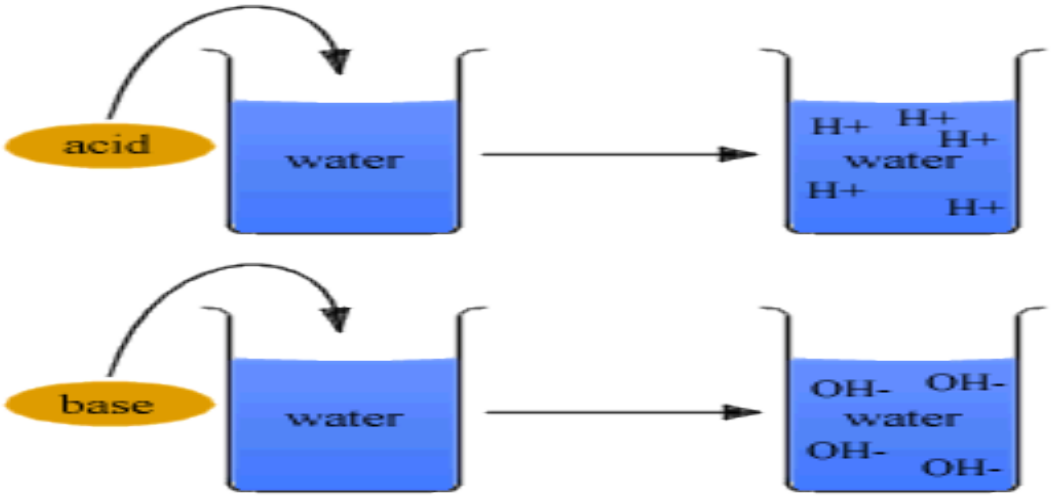


Image: Methane Covalent Bonds, Dynablast; Formation of ionic sodium fluoride,

Tools that can be used to measure pH:

Litmus Paper

- Litmus paper comes in two colors, red or blue.
- Acidic substances turn blue litmus paper red.
- Basic (alkaline) substances turn red litmus paper blue.

Image: Blue and Red Litmus Paper, Wiki

Tools that can be used to measure pH:

Hydrion Paper

- Hydrion paper is used to to measure pH to the nearest whole number.
- These "dip sticks" have colored squares (indicators) that change color in the presence of specific pH ranges.
- You can determine the pH value to the nearest whole number by matching the colors on the key to the hydrion paper after you dip it into a substance and wait a few seconds.

Tools that can be used to measure pH:

pH Meter

- A pH meter can be used to measure pH to the nearest tenth (0.1) or hundredth (0.01) depending on the insstrument.
- pH meters must be calibrated in pH 7 buffer solution before you can use them to measure pH.
- The meter should be rinsed in water after each use and kept in water when not in use.

Q: Which of the three pH measuring tools do you think is most accurate?

Image: pH meter, Wiki

Confused?

Here are some links to fun resources that further explain Chemistry:

Smart Links

- Acids & Bases Are Everywhere from Chem4Kids website by Rader.
- Acid & Bases, an Introduction by Vision Learning
- Acids, Bases & You, and in-depth YouTube video.
- Buffer System YouTube video.
- Bicarbonate Buffer System & pH imbalances YouTube video.

(You must be in PPT slideshow view to click on links.)