

Biochemistry

The study of chemical processes in living organisms.

- Introduction to Chemistry
- Properties of Water
- Acids and Bases
- [Chemistry Of Life](#)

Matter

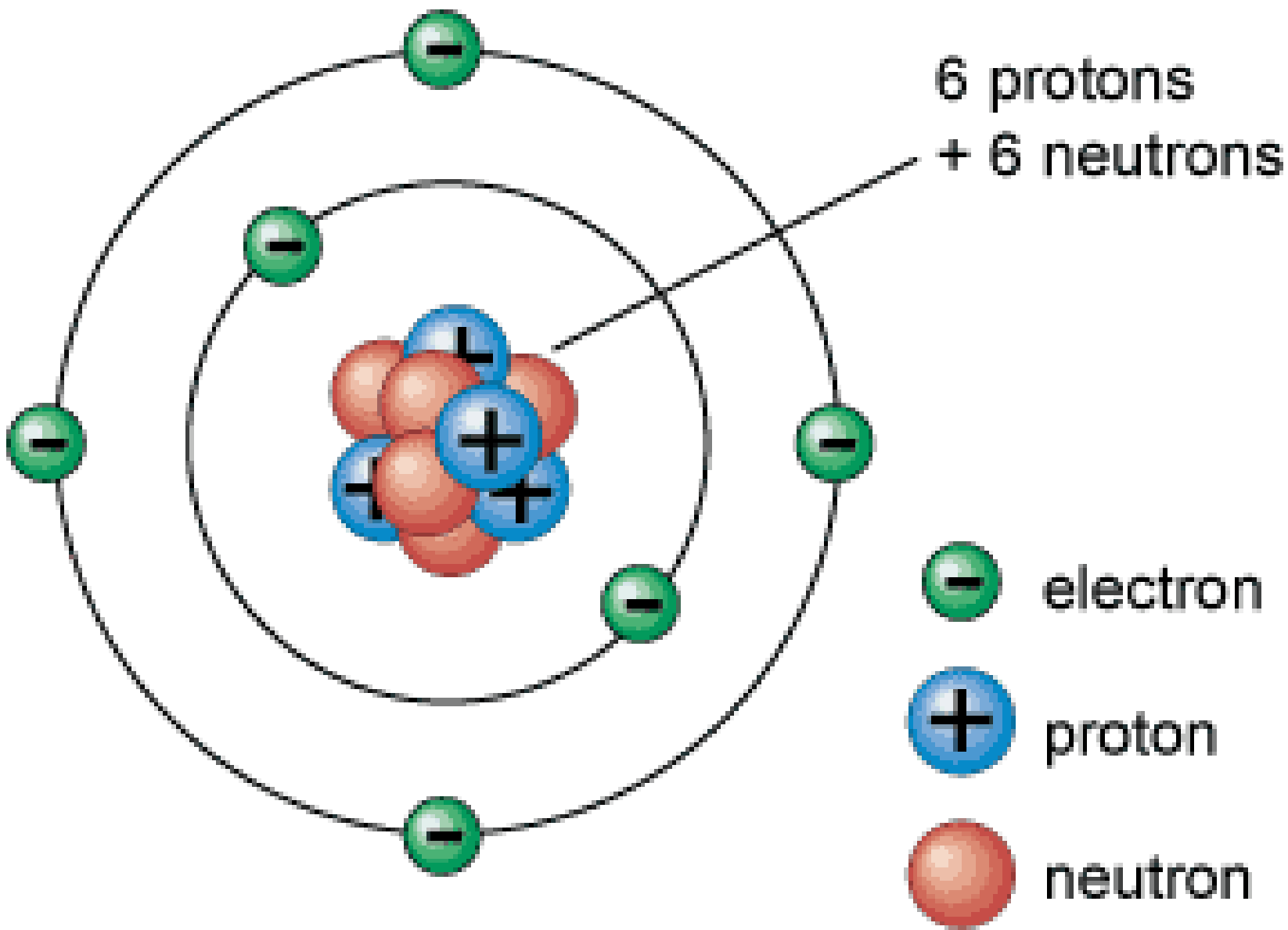
Everything living AND non living is made up of matter.

Matter is made up of **ATOMS**:

Atoms are the smallest unit of matter

Atoms have 3 subatomic particles: a positively charged center (nucleus) with a negatively charge outer region (electron cloud region)

- » Protons: Found in the nucleus, positively charged
- » Neutrons: found in the nucleus, neutral in charge
- » Electrons: found in the electron cloud region, negatively charged



6 protons
+ 6 neutrons

- electron
- proton
- neutron

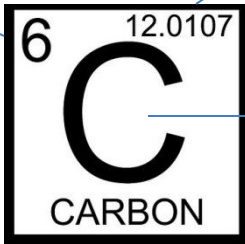
Carbon atom

Atomic Structure

- **Nucleus**: the center of the atom, contains the protons and neutrons
- **Electron Configuration**: the arrangement of electrons in orbitals around the nucleus.
 - Inner most shell/orbital- 2 electrons
 - Outer shells – up to 8 electrons
 - Atoms are more stable when their outer most shell has 8 electrons.
 - Outer most electrons are known as valence electrons.

Atomic Number=
of protons




Atomic Mass=
Protons + Neutrons

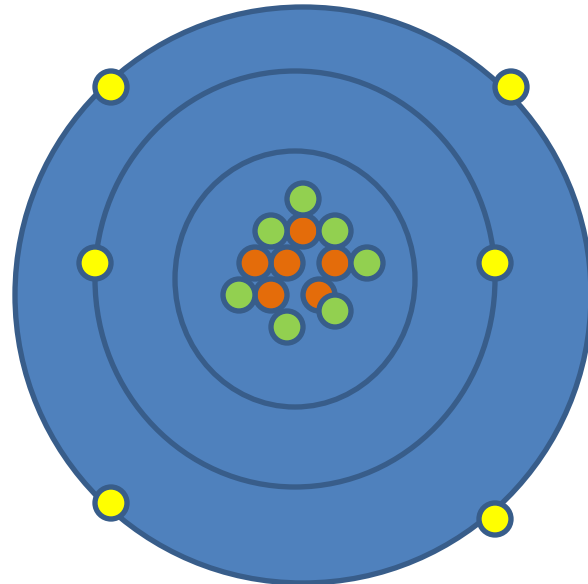


Element Symbol

Element Name

How to draw an atom!

of Protons: 6 
of Neutrons: $12-6=6$ 
of Electrons: 6 



Elements

- **Elements: made up of atoms with the same number of protons**
 - » Organized in the periodic table by Atomic Number
 - » Atomic Number: number of Protons
 - » Atomic Mass: Number of Protons + Neutrons
 - » Elements have a neutral charge therefore the number of protons equals the number of electrons
 - » Isotopes: an atom that has the same number of protons as other atoms but has a different number of neutrons.

The periodic table is organized into blocks based on the subshell being filled:

- s-block:** Groups 1 (IA) and 2 (IIA).
- p-block:** Groups 13 (IIIA) to 18 (VIIIA).
- d-block:** Groups 3 (IIIB) to 10 (VIII).
- f-block:** Lanthanide and Actinide series.

Key features of the table include:

- Atomic Number:** Located in the top left of each element's cell.
- Symbol:** The chemical symbol for each element.
- Name:** The full name of the element.
- Atomic Mass:** Located in the bottom right of each element's cell.
- Phases:** Indicated by a small box in the bottom right corner of the table, showing Solid, Liquid, or Gas.
- Mass Numbers in Parentheses:** These are the most stable or common isotopes for many elements.

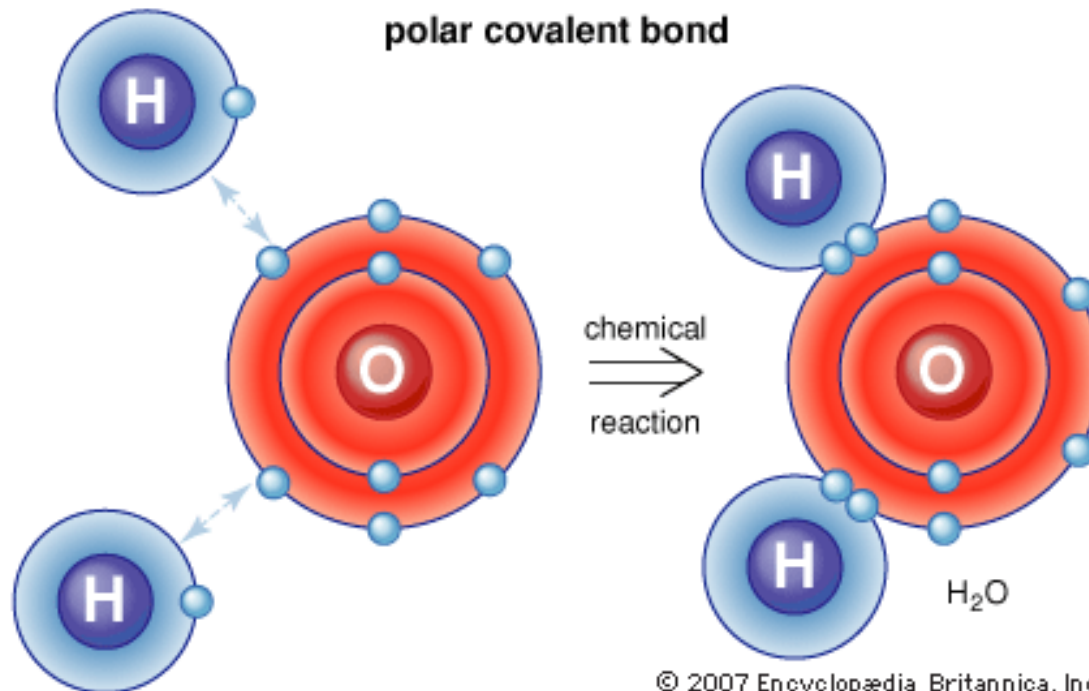
- [Meet the Elements](#)

Chemical bonds

- Atoms have a tendency to combine in order to fill their valence (outer) shells with 8 electrons.
- **A chemical bond is an attraction between two or more atoms!**
 - Two types of bonds: Covalent and Ionic

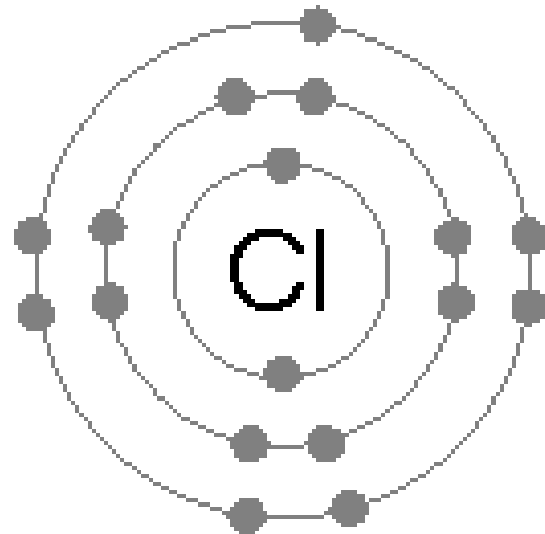
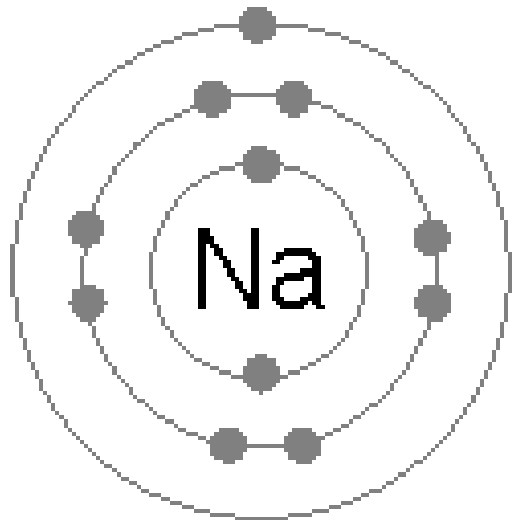
Covalent Bonds

- When atoms share electrons to fill their valence shells. Bonds between nonmetal atoms.
 - Example: Water



Ionic Bonds

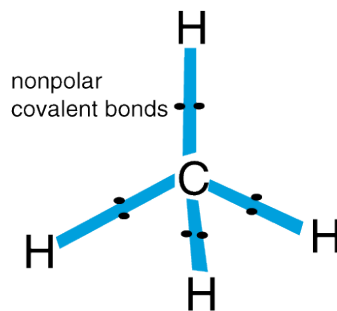
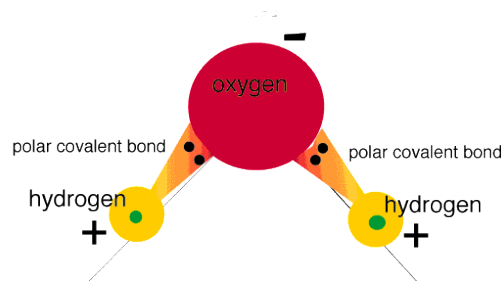
- **When an atom loses or gains electrons and transfers it to another atom. Bonds between metal and nonmetal atoms.**
 - This results in an ion: atom with an electric charge because it has lost or gained electrons.
 - The attractive force between the opposite charges



[What Kind
Of Bonds
Are These](#)

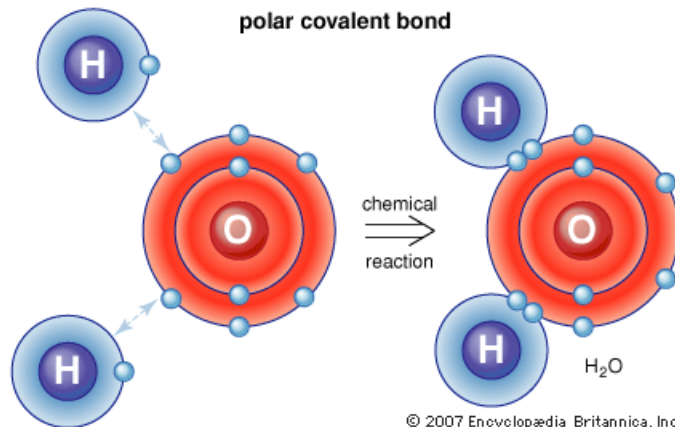
Polarity

- In some covalent bonds, **the shared electrons are more attracted to one atom than the other.**
 - One end becomes partially positive, the other becomes partially negative. (poles)
 - These molecules with partial charges are called polar.
 - Nonpolar covalent bonds: charge is equally shared



Hydrogen Bonds

- Hydrogen Bonds:
 - When hydrogen is bonded to certain elements (O,N, F) it has a **strong partial charge that attracts the negative pole of other molecules** resulting in a hydrogen bond.
 - Hydrogen bonds play very important roles in living organisms:
 - Water is held together by hydrogen bonds, DNA strands are held together by hydrogen bonds.



Properties of Water

- All of life depends on Water
 - Living organisms are made of approximately 70% water.



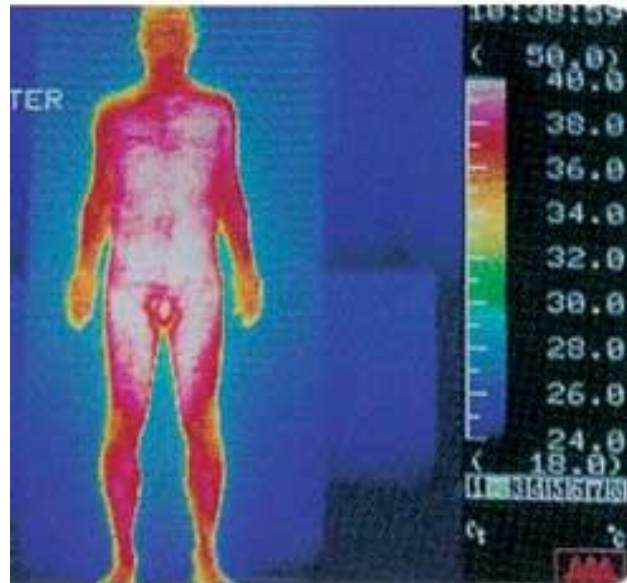
Different Densities

- Water has 3 states: liquid, solid, gas
 - Different densities at its different states allows water to be very versatile.
 - Frozen water is less dense than liquid water
 - When a lake, river, ocean freezes, the ice floats at the surface allowing living organisms to exist underneath the ice.



Heat Capacity

- Heat Capacity: the amount of heat required to increase something 1°C .
 - Water has a HIGH heat capacity
 - This property of water helps living organisms maintain a constant internal temperature (Homeostasis)



Cohesion and Adhesion

- Cohesion: the attraction of particles of the same substance
 - Hydrogen bonds hold water molecules together
 - Cohesion causes water to pull into a drop shape (dew drop on a leaf)



- Adhesion: attraction between particles of different substances
 - Allows water to move along a surface instead of being absorbed. Allows water to move upward through the stem from roots to leaves.

Surface Tension

- Inward force that minimizes the surface area of a liquid and causes the surface to behave as if it has a thin skin.
 - This allows objects with greater density than water to float on the surface
 - Surfactants: Surface tension can be broken by an objects or another liquid
 - Ex: A pulmonary surfactant reduces the surface tension of water in the lungs reducing the effort needed to expand the lungs.



Capillary Action

- The ability of water to defy gravity and travel through narrow spaces.
 - This allows water to travel up through plants and up through blood vessels carrying oxygen and nutrients.



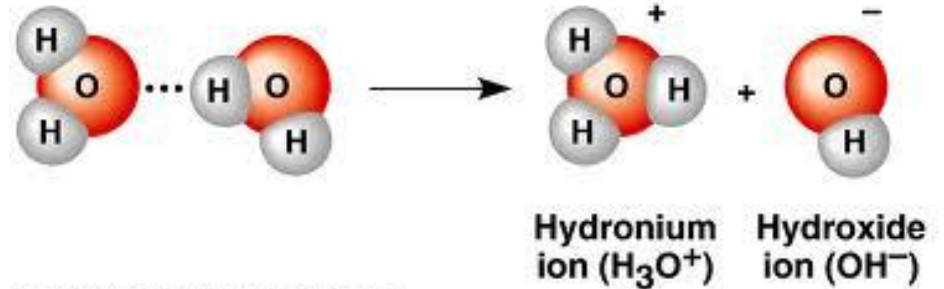
pH

When water molecules collide, some of the collisions are strong enough to cause a chemical change:



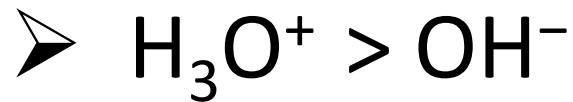
Hydronium ion: H_3O^+

Hydroxide ion: OH^-



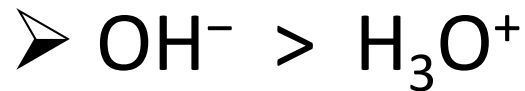
Acids and Bases

- **Acids:** when the # of H_3O^+ is greater than the # of OH^- .



– Acids usually taste sour and can be very corrosive.

- **Bases:** when the # of OH^- is greater than the # of H_3O^+



– Bases usually taste bitter and feel slippery.

Common Household Acids & Bases



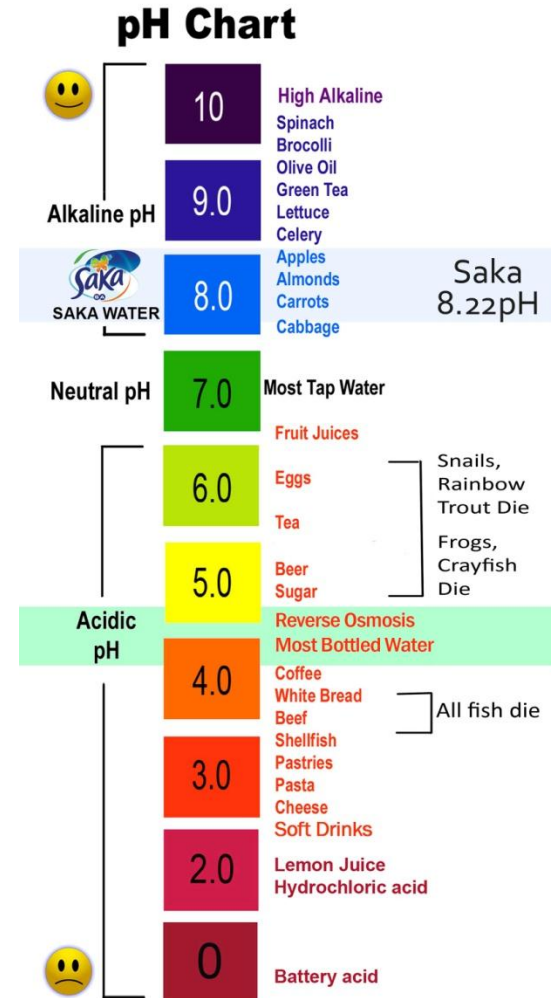
Acids



Bases

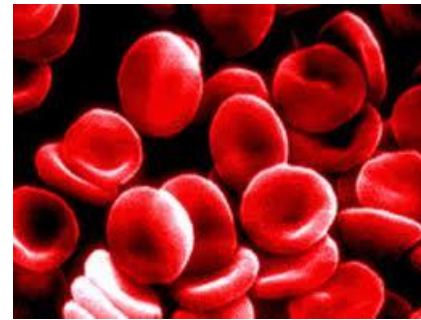
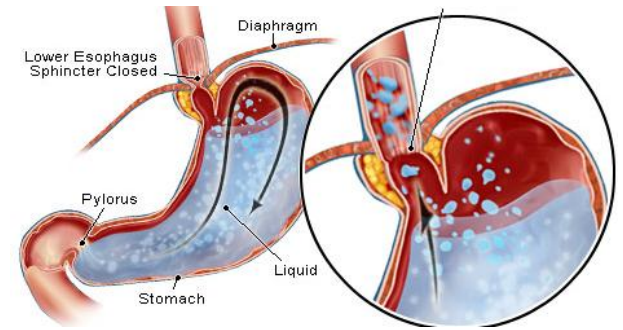
Tests

- The **pH scale** allows scientists to identify how basic or acidic a solution is.
 - The pH scale ranges from 0-14
 - 0-6 is acidic
 - 7 is neutral (pure water)
 - 8-14 is basic



Applications

- Certain body fluids are acidic:
 - Stomach acid and urine
- Some body fluids are basic
 - Intestinal Fluid and blood



– The body has a regulating system that maintains the pH values for a normal healthy body.

- Heartburn, acid reflux
- pH of water in lakes, ponds, etc.