Biology and chemistry go hand in hand, for instance all organisms are made of matter, and matter is considered as anything that has mass and takes up space. All matter is composed of elements, which are substances that cannot be broken down by chemical reactions. When two or more elements are put together, a compound is formed. A common compound that can be found in most American households is sodium chloride, known as table salt. Compounds have emergent properties, which are physical and chemical properties that are different from the elements that they are composed of. Some elements are required for organisms to live out a healthy life and achieve biological fitness, these elements are referred to as essential elements. Different organisms do share the need for a lot of the same essential elements, however there is still some differences in needs depending on the organism.

Nearly all of living matter is made up of carbon, oxygen, hydrogen, and nitrogen. These four elements make up 96% of all living matter, leaving the remaining 4% to consist of elements like sulfur, calcium, phosphorus, and potassium. Elements that are needed in small amounts are known as trace elements. Not all elements are good, some are toxic in certain amounts, however through adaptation these toxic elements can be tolerated by a species over time.

Every element possesses unique atoms that differ from other elements atoms. Atoms are the basic units of matter that still have the properties of the element they belong to. Atoms are made up of subatomic particles, the three focused on in our chapter are protons, neutrons, and electrons. Protons are positively charged, and electrons are negatively charged. Neutrons have no charge and are referred to as neutral. The protons and neutrons of an atom can be found tightly compacted in the atom's atomic nucleus located in the middle of the atom. Around the atomic nucleus, the electrons make up a negatively charged cloud. Protons and neutrons are similar in mass, and due to their small size they are measured in a unit referred to as a dalton. All atoms, subatomic particles, and molecules are all measured in daltons. Atoms of different elements do not have the same amount of subatomic particles, so each element has an atomic number to show how many protons are contained in the elements atoms. How many neutrons are in an element's atom can be identified by the mass number, which is the total of protons and neutrons added together. To find out the specific total of neutrons, take the atomic number and subtract it from the mass number. The amount of protons and electrons should be the same in the atom. Sometimes an element's atoms can have more neutrons than atoms of the same element, when this occurs and an isotope is formed.

When an isotope has the tendency of losing particles, the isotope is radioactive. The losing of the particles is caused by a decaying atomic nucleus. Sometimes radioactive isotopes can be used by biologist, for instance, when trying to date a fossil an isotope can be used. The chemical reaction between atoms consist directly between the electrons of the atoms. Electrons are dependent on how much energy they have, energy is known as the ability for change to occur. The energy that matter has because of there it is located or how it is formed is called potential energy. The distance that an electron has from the nucleus it surrounds has to do with how much energy the electrons contains. Electrons are located in electron shells, that each have a different distance away from the nucleus and energy level. The outermost electron shell is called the valence shell, and the electrons contained in it are valence electrons. An atom's chemical behavior relies on the amount of valence electrons it has. When atoms share or transfer the outermost electrons the atoms normally stay close to one another due to a chemical bond. Two more common different types of chemical bonds exist, known as covalent and ionic bonds. Covalent bonds are when the sharing of valence electrons occurs. Molecules are two or more atoms the have a covalent bond. When an atom gives away or takes an electron, an ionic bond is formed. Another type of bond is known as a hydrogen bond occurs when a partially positively charged hydrogen atom has an attraction with an electronegativity charged atom. Hydrogen bonds are weak chemical bonds, like Van der Waals interactions. Van der Waals interactions take place when molecules and atoms are very close together. Chemical bonds can be broken by chemical reactions, which alter reactants and change them into products. When the rate of reverse and forward reactions balance out, chemical equilibrium is achieved.

Water is essential to life, and has many unique overlooked qualities. Water molecules are polar molecules, due to the charge of the molecules being unequally distributed. The hydrogen bonds link the water molecules together causing the molecules to hold a cohesion, as well as cause water's surface tension. Water helps moderate air temperature by absorbing heat from warmer air, and putting heat into cooler air.

Objects and organisms that are in motion have kinetic energy, and atoms as well as molecules have constant kinetic energy because they are always in motion. The more speed a molecule has in its movement, the more kinetic energy it has. The average kinetic energy of a group of molecules is represented by temperature. Thermal energy is the kinetic energy that has to do with the movement of molecules or atoms. When thermal energy is moved from one body of matter to a different body of matter it is referred to as heat. A calorie is a unit of heat. Specific heat is the total amount of heat that must be lost or taken in by a substance before that substance can have a change in temperature. Water’s specific heat is high, and when the breakage of hydrogen bonds occur heat can be absorbed by water. On the other hand, water releases heat when hydrogen bonds form. The breaking and forming of hydrogen bonds keeps water temperatures constant. When a liquid is heated high enough it turns into a gas that is released into the air, this occurrence is referred to as evaporation. The amount of heat a liquid needs to absorb before turning into a gas is known as the heat of vaporization, evaporative cooling is also based on this. Evaporative cooling is caused when the liquid evaporates and the surface of the non evaporating liquid cools down.

Water is a solvent,as is sometimes referred to as “The Solvent of Life” because it can dissolve many solutes. The ability of water to be such a versatile solvent is due to the polarity of water molecules. Some substances are attracted to water, any substance that is can be considered as hydrophilic, in turn suvsanced that are repelled by water are hydrophobic. To measure a solute concentration in a solution, molarity is used. Moles are a specific amount of molecules of a substance. Molarity is the quantity of moles of solute in a liter of solution. The molecular mass in daltons should always be the same as the mass of a mole of a substance measured in grams.

Sometimes, a hydrogen atom in a hydrogen bond between two water molecules moves from one of the molecules to the other. This causes the hydrogen atom to leave an electron behind, and transfer a hydrogen ion. The water molecule that had lost the proton is turned into a hydroxide ion, and the molecule that gained it is now a hydronium ion. To reduce the hydrogen ion concentration of a solution, a base is needed. Bases are anything on the pH scale that are rated above seven, anything below seven is an acid, leaving anything right at seven to be considered neutral. A buffer can be used to minimize changes of H+ and OH- in solutions, by taking in hydrogen ions from the solution when there are too many of them and giving hydrogen ions to the solution when they are needed.