Unit 2: Biochemistry

Content Outline: Chemistry of Life (2.1)– Part 1

1. **Matter** 
   1. Anything that takes up *space* and has *mass* to it.
2. **Element**
   1. The simplest *form of a substance* that cannot be broken apart and still have the properties of that element.
3. **Compound** 
   1. *Two or more elements bonded together* resulting in *new* chemical properties to emerge for the compound.
   2. An example: Water (H20) – a stable liquid and can sometimes be used to out a fire. Hydrogen by itself is a flammable gas; Oxygen by itself is also a flammable gas.
4. CHNOPS (The *most common* elements in all life forms.) and **Trace** **elements** (present in *small* amounts)
5. **Atom**
   1. The smallest*unit of matter* with set chemical properties. Atoms *maintain* theiroriginal properties because the subatomic parts are all present.
6. **Subatomic Particles** (Small parts that *make up* atoms.)(“*sub*” means “below” or “lower”)
   1. **Proton** (These particles carry a *positive* charge. They are located in the *nucleus* of an atom.)
      1. The number of protons never changes in an element. (This allowed the **Periodic Chart** to be created.)
   2. **Neutron** (These particles carry *no* charge, which is called **neutral**. They are also located in the *nucleus* of

an atom.)

* + 1. The number of neutrons can change. (Atoms with *different numbers of neutrons* than the normal amount for that element are called **Isotopes**.)
  1. **Electrons** (These particles carry a *negative* charge. They are located *outside the nucleus* in the “Electron cloud”. The electrons *moving*, which is called **kinetic energy**, is why they are associated with energy and batteries. It is **potential energy** when they are *bonded*.
     1. The number of electrons can change. (Atoms with *different numbers of electrons* than the normal amount for that element are called **Ions.**)
     2. The cloud is divided into *energy levels*. The first energy level holds *two* electrons. The second and third hold *eight* electrons.
  2. Atoms are *weighed* in units called **Daltons** or **Atomic Mass Units (AMU”S).**
     1. Each proton or neutron (these are the *largest* sub-atomic particles) is equal to **1** Dalton or 1AMU. (Electrons are basically 1/1000 of a Dalton.)

1. **Molecule**
   1. Two or more atoms bonded together. (They maybe the *same* type of atom or they maybe *different* atoms.)
2. **Atomic Number**
   1. This is usually shown as *subscript* on the Periodic Table.
   2. It refers to the *number of protons only in that element***.**
3. **Mass Number**
   1. Usually shown as *superscript* on the Periodic Table. (“Super*”* means “above” or “greater”)
   2. It basically refers to the number of*protons and neutrons together in that element or molecule.*
      1. These are the two subatomic particles that have “*significant mass or weight*” associated with them. Remember electrons have very little mass, so you can just add protons and neutrons.
      2. It can also be referred to as **Atomic Weight**.
4. **Isotopes**
   1. Atoms that possess *different numbers of neutrons* than the *normal* amount for that element and thereby have different *mass* numbers.
   2. These usually have *the same chemical properties* as the normal element, but the *physical properties maybe different.*
   3. Most isotopes are *radioactive.*

**Chemistry of Life – Part 2**

1. **Energy** (represented by the symbol “E”)
   1. Energy comes from the *rapid movement of electrons (e-) normally*, but it could be neutrons too.
   2. **Potential Energy (PE)** – Energy of *position*. (Usually refers to electrons “locked” in a chemical bond.)
   3. **Kinetic Energy (KE)** – Energy of *movement*. (Usually refers to electrons that can move freely.)
2. Chemical Properties
   1. An element’s or molecule’s properties are usually associated with the *number of electrons* it has.
   2. **Periods** (Run *horizontally* on the Periodic Table. **Horizontal**  is “side to side”)
      1. Elements behave *differently* as you go *across* a period.
      2. Think of it as a sentence, different words convey different things. Also what is usually at the end of a sentence… a period.
   3. **Columns or Families** (Run *vertically* on the Periodic Table. **Vertical** is “up and down”)
      1. Elements behave *similarly* as you go down a column or family.
3. Chemical Bonds (These occur between elements or molecules.)
   1. **Covalent Bonds**
      1. This type is the *strongest* type of chemical bond.
         1. Results from *sharing electrons* between elements or molecules to fill both outer shells.
      2. They always create a molecule. (The *size* of the molecule may differ though.)
         1. Two or more atoms together of *any kind.*
      3. **Polar** molecules *carry an electrical charge* at opposite poles(poles refers to the “ends” of the molecule) and **non-polar** molecules *do not have an electrical charge.*
   2. **Structural Formula** (Used to show the shape of the molecule)
   3. **Molecular Formula** (*Tells* the elements, and *number* of atoms of each, that make up a molecule)
      1. A.K.A. **Chemical Formula**
   4. **Ionic Bonds** 
      1. These are *fairly strong* *bonds while dry* – but are *weak in water* so they *dissolve* into **ions.**
      2. These bonds are created by *gaining or losing electrons* between elements so that each element can fill its’ outer most shell.
      3. When dissolved in water Ions are created. (Gatorade is an ion loaded drink.)
         1. **Cations** – possess a *positive charge* because it has more protons than electrons.
         2. **Anions** – possess a *negative charge* because it has more electrons than protons.
         3. *These love water* *because water is a polar molecule too.*
      4. **Ionic Compounds**
         1. A cation *bonded to* an anion to make a salt when dry.
   5. **Hydrogen Bonds**
      1. *Fairly weak* bonds. (It is “like” a magnet) (A positive Hydrogen attracted to a negative “Substance”…*usually* oxygen.)
      2. *These are the most important biological bonds.*
4. Chemical Reactions
   1. To *make* a bond *requires* energy to be consumed. (The bond requires “catching” an electron.)
   2. To *break* a bond *gives off* energy. (The electrons are “released” to move again.)
   3. **Reactants** (Located on the *left side* of an equation.); **Products** (Located on the *right side* of an equation.)
      1. Demonstrates the **Law of the Conservation of Mass**
         1. *Matter is neither created nor destroyed just transferred or transformed.*
      2. If an element is on one side of an equation it must be on the other side too!
      3. Equilibrium ( ↔ )

a. Chemical reaction is going both ways at *equal* rates.