**Biology Basics: Chemistry**

- *You will find a periodic table infinitely useful for this exercise.

- What is matter? mass?
- What is matter made of?
- What is an element?
    - What is the structure of an element?
    - What is the charge of the 3 subatomic particles?
    - Where are electrons found in an element?
    - What is the mass of an atom? Determine the mass of C,H,N,O, P and S
    - How many protons are in an atom? Determine the protons in CHNOPS
    - How many neutrons are in an atom? Determine the neutrons in CHNOPS
    - How many electrons are there in neutral atom? Determine the electrons in CHNOPS
    - How is the periodic table arranged? Why does this arrangement matter?
        - What is group numbers of CHNOPS
    - What is an isotope?
    - How are electrons arranged in an atom? How many in each division?
        - Draw the electron configuration of CHNOPS
    - What is special about the outermost layer of electrons? Compare the number of the outermost electrons to the group number of CHNOPS
    - How many electrons would be necessary to make the following molecules "happy" (to fulfill the octet rule): CHNOPS?
    - What is a cation? and anion?
- What does it mean when we say "bonding?"
    - How does ionic bonding occur (3 steps)? What types of atoms form ionic bonds?
        - Determine bonding for: sodium and chlorine
        - Determine bonding for: potassium and iodine
        - Determine bonding for: (only) calcium and bromine
        - Determine bonding for: (only) magnesium and chlorine
    - How does nonpolar covalent bonding occur? What types of atoms form nonpolar covalent bonds?
        - Determine bonding for: (only) carbon and hydrogen
        - Determine bonding for: carbon and carbon (use exactly 6 H's)
        - Determine bonding for: carbon and carbon (use only 4 H's)
        - Determine bonding for: carbon and carbon (use only 2 H's)
    - How does polar covalent bonding occur? What types of atoms form polar covalent bonds? [May use hydrogen to fill in missing bonds]
        - Determine bonding for: carbon and nitrogen (single bond)
        - Determine bonding for: carbon and oxygen (single bond)
        - Determine bonding for: carbon double-bonded to oxygen
        - Determine bonding for: water
    - What is electronegativity? What atoms are electronegative?
    - How does a hydrogen bond occur? What types of atoms are involved in hydrogen bonding?
- What makes water so special?
    - What are the properties of water?
    - What is a solvent? solute? solution? Determine for the following:
        - Table salt is dumped into a glass of water.
        - Sugar is placed in a pot of water.
        - Vegetable oil placed in water.
    - How do you determine concentration of a solution? Determine for the following:

        - 50 g of table salt is dissolved in 100 mL of water.
        - 25 g of table salt is dissolved in 50 mL of water.
        - 50 g of table salt is dissolved in 50 mL of water.
    - What is an acid? a base? a salt? Examples would be good here.
    - What makes a particular solution acidic or basic?
        - If you had 0.000001 hydrogen ions ($H^+$) dissolved in 1 Liter water, is this acidic, basic or neutral? How many hydroxides ($OH^-$) are there?
        - If you had 0.00000000001 $H^+$ dissolved in 1 liter of water, is this acidic, basic or neutral? How many hydroxides ($OH^-$) are there?
        - If you had 0.0000001 $H^+$ dissolved in 1 liter of water, is this acidic, basic or neutral? How many hydroxides ($OH^-$) are there?
    - What are the pH and the pOH of a solution?
        - Determine the pH and the pOH of the above 3 solutions.
    - What does a buffer do? How does it work?
        - What is the buffering capacity of $HCO_3^-$
        - What is the buffering capacity of $H(PO4)_2^-$
- What is an organic molecule?
    - What is meant by a carbon backbone/skeleton?
    - How does one carbon backbone differ from another?
    - What is the difference between hydrophobic and hydrophilic? Which molecules do which?
        - A carbohydrate? A protein? A nucleic acid? A triglyceride? A phospholipid? A steroid? A wax?
    - What is an isomer? Give an example.
- How are biomolecules synthesized?
    - How are biomolecules degraded?
    - What is a catalyst? An enzyme?
    - What are the 4 basic biomolecules common to ALL cells?
- What is a carbohydrate? How is it built? Degraded?
    - What is the difference between a monosaccharide, a disaccharide and a polysaccharide? Give examples of each.
- What is a lipid? How is it built? Degraded?
    - What is a lipid's relationship to water?
    - What is a triglyceride? What are the types of triglycerides?
    - What is a phospholipid? What is the characteristics of a phospholipid?
    - What are steroids? What are the 4 major steroids in a human?
    - What are waxes? What are their properties and where might you find them in nature?
- What are proteins? How is it built? Degraded?
    - What is an amino acid?
    - There is something special about the bonding between amino acids, characterize and name the bond.
    - What are the 4 basic structures of proteins?
- What are nucleic acids? What is their structure?
    - Draw and label a nucleotide and indicate the carbons on the pentose sugar.
    - What function is performed by DNA, rRNA, tRNA and mRNA?
    - What are the major differences between DNA and RNA?
    - How are nucleic acids synthesized? Degraded?
    - Where might you find the following in eukaryotic and prokaryotic cells: DNA, rRNA, tRNA, mRNA?
- There is a special nucleic acid called adenosine triphosphate (ATP). What is its structure? Function?