Welcome AP Biology students!

It will be important to buy your textbook over the summer as a summer assignment is mandatory to allow us the proper time to completely prepare for the AP Exam come next May. The course text is "Principles of Life" (**2nd Edition**) and is needed in order to complete the AP Bio summer assignments. The ISBN # is 978-1464109478. Consequently, we will not include this text in the school's order for your textbooks for the coming year. You'll already have it by then.

In preparation for the coming year you have the following assignments to complete for the first day of class:

- AP Biology Textbook Assignment (Chapter 1, 2 and 3)
    - Matter #1 worksheet
    - Matter #2 worksheet
    - Biochemistry Basics worksheet
    - Protein Structure worksheet
    - Chapter 1, 2, and 3 Vocabulary List

You will be responsible for this information and will be tested on it in the first week of class. You must **pass** this test to show your preparedness and dedication to taking AP Biology this year, as we will spend little time reviewing this information, before starting Chapter 4 during the first week of class.

See each specific assignment for details.

Good luck!

"Nothing in biology makes sense except in the light of evolution."
-- Theodosius Dobzhansky

"Industrial opportunities are going to stem more from the biological sciences than from chemistry and physics. I see biology as being the greatest area of scientific breakthroughs in the next generation."
-- George E. Brown, Jr.

"If this book has a lesson, it is that we are awfully lucky to be here--and by 'we' I mean every living thing. To attain any kind of life in this universe of ours appears to be quite an achievement. As humans we are doubly lucky, of course: We enjoy not only the privilege of existence but also the singular ability to appreciate it and even, in a multitude of ways, to make it better. It is a talent we have only barely begun to grasp."
-- Bill Bryson, A Short History of Nearly Everything

"Love: Before I heard the doctors tell
the dangers of a kiss;
I had considered kissing you
The nearest thing to bliss.

But now I know biology
And sit and sigh and moan;
Six million mad bacteria
and I thought we were alone!"
--Anonymous

AP BIOLOGY TEXTBOOK ASSIGNMENT: CHEMISTRY OF LIFE NOTES

- *READ CHAPTERS 1, 2 and 3 in your textbook. These chapters will go into greater depth than the notes provided below.*
- *You are expected to complete 4 packets in regards to the material and to create a word document to track the vocabulary and definitions from the reading. They are listed below.*
    - *Matter #1-for this worksheet and the next one, there is an optional Prezi to go through that helps you to answer the questions*
    - *Matter #2*
    - *Biochemistry Basics*
    - *Protein Structure*
    - *Chapter 1, 2, and 3 Vocabulary List*
        - *As you read the textbook, you should build a word document, and write and define each bold term you come across with in the chapter. We will continue to add to this throughout the year.*

Principles of Life Vocabulary Word Tracker-You may use this as a template or just create your own word document, but for each vocab word you come across in each chapter just jot down the word and then define it.

Example

Biology-the study of life…

Chapter 1

- *The notes below should be familiar to you from previous biology coursework. If any of it is not or you are out practice, watch the videos and reference your textbook.*
- *You will be responsible for this information and will be tested on it in the first week of class. You must **pass*** this test to show your preparedness and dedication to taking AP Biology this year, as we will spend little time reviewing this information, before starting Chapter 4 during the first week of class.
- *No book questions will be required to be completed, but if you want good questions to use as review, all of the "Do you understand concept x?" at the end of every section in your book would be good to be familiar with.*

1. **Nature of Mater**
    a. Matter: anything that occupies space. Ex: Desk, Human, Air, ect.

    b. Atom: Smallest part of matter. It **can not** be broken down into smaller pieces. Composed of 3 particles: Protons (+), Electrons (-), and Neutrons (n)

    c. Element: Substance that is only made of one kind of atom. Ex: Hydrogen, Oxygen, etc.
        i. C, H, N, O. P, S

    d. Compound: Two of more different atoms or elements joined together. Ex: Salt =

    e. Covalent Bond: Two or more atoms sharing electrons to form a molecule. Covalent bonds make molecules, ex: Water, Carbon Dioxide, and Oxygen Gas

    f. Hydrogen Bond: A weak chemical attraction between **polar** molecules. Ex: Two water molecules

    g. Ionic Bond: Gain or Loss of electrons that create a molecule

    h. Ion: An atom that has gained (-) electrons or (loss) electrons (+)

    Watch the following video on covalent vs. ionic bonding:
    https://www.youtube.com/watch?v=7DjsD7Hcd9U

2. **Water and Solutions**
    a. How does water help maintain homeostasis?
        i. Heats slowly
        ii. Retains hear

iii. Carries Heat away through water vapor (sweating)
iv. Universal solvent (anything except for a polar substance can dissolve in it)

b. What is the difference between adhesion & cohesion?
   i. Adhesion: different substances
   ii. Cohesion: alike substances

c. What is the pH range for an Acid? Base?
   i. Acid = 0 – 6.9
   ii. Neutral = 7
   iii. Base = 7.1 – 14

d. What type of substance is an example of an acid? Of a base?
   i. Acids: Lemon, Vinegar, Milk
   ii. Bases: Household cleaning material

Watch the following video: http://www.bozemanscience.com/water-a-polar-molecule/

3. **Chemistry of Cells**
   a. Carbohydrates: Organic substances, made up of carbon, hydrogen and oxygen atoms. Always in the ratio of 1:2:1. Key source of energy.
      i. They are made up of Monosaccharide: Single sugars (glucose)
      ii. Disaccharides are double sugars: Sucrose
      iii. Polysaccharides: Starch and cellulose

   b. Lipids: Nonpolar substances that are not soluble in water
      i. Include: Fats, phospholipids, steroids, and waxes
      ii. Make up the outside of cell membranes
      iii. Store energy
      iv. Fats can be saturated or unsaturated

   c. Proteins: A chain of molecules called amino acids linked together
      i. There are 20 different aa in proteins
         1. 10 of those your body can make on your own, the other 10 you need to consume in your diet
      ii. Promote chemical reactions in your body = enzymes
      iii. Collagen
      iv. Hemoglobin

   d. Nucleic Acids: a long chain of nucleotides (sugar, base, and phosphate group)
      i. 2 types:

1. DNA: Double stranded, found in your chromosomes, helps make proteins
2. RNA: Single stranded, also helps make proteins

Another important molecule in your body: ATP: Adenosine triphosphate: Main energy unit of cells

Watch the following video: https://www.youtube.com/watch?v=QWf2jcznLsY

4. **Energy and Chemical Reactions**
    a. Energy: Ability to move or change matter. Exists in many forms:
        i. Light, Hear, Chemical, Mechanical, Electrical

    b. Activation energy: The energy needed to start a chemical reaction. (Chemical "Push")

    c. Enzymes: Substances that speed up a chemical reaction
        i. Act as a catalysts, meaning they reduce the amount of activation energy required to start the reaction
        ii. Help maintain homeostasis
        iii. Enzymes can be affected or "denatured" by two different things:
            1. extreme pH
            2. extreme Temperature

    d. Substrate: A substance an enzyme has to bind to in order to work

    e. Active site: The location where the enzyme and substrate combine

    Watch the following video on enzymes:
    https://www.youtube.com/watch?v=ok9esggzN18

AP Biology Reading Discussion Questions: Matter #1- Chemistry, Water, Carbon

Topic Presentation:

https://prezi.com/4hefv2hk2bhq/ap-bio-matter-1-atoms-water-carbon/

Textbook Reading:

- Principles of Life:
    - Pre-Reading: Chapter 1-ALL Sections
    - Part 1: Chapter 2- Section 2.1
    - Part 2: Chapter 2- Section 2.2
    - Part 3: Chapter 2- Section 2.2

Part 1: Chemistry

1. How common are the elements that living systems are made out of?

2. Explain the relationship between matter and energy.

3. Why do atoms bond?

4. What is the cause of molecular polarity?

5. How does the type of bonds present in a substance influence the chemical and physical properties of that substance?

6. If the breaking of bonds requires an input of energy (which it always does), how is it possible that some chemical reactions (like the burning of gasoline, for instance) can release energy into the environment?

7. How do the properties of a compound like H_2O or NaCl illustrate the concept of emergent properties?

8. Why are radioactive elements useful for the study of biological systems?

Things you should make sure you understand:

(feel free to ask questions about them in class)

- The periodic location, atomic number, number of valence electrons, and biological utility of S,P,O,N,C,H, along with Ca, K, Na, & Cl.
- How energy interacts with atoms.
- The differences between ionic and covalent bonds.
- How to identify if a substance is covalent (molecular) or ionic.
- Basic differences between covalent and ionic substances
- How to identify if a molecule is polar or non-polar.
- How to determine the intermolecular forces that will exist in a substance.
- The cause of radioactivity.

Part 2: Water

1. Why are living things mostly made of water?

2. Draw a water molecule and indicate its polarity.

3. Explain how the structure of water molecules account for each of the following properties:
    a. Cohesion

    b. Adhesion

    c. High Specific Heat

d. Floating Ice

e. Good Solvent Properties

f. Dissociation of water molecules

4. Explain one way that each of the above properties are useful for living systems.

5. Explain the relationship between the dissociation of water and the pH of a particular aqueous solution.

Things you should make sure you understand:

(feel free to ask questions about them in class)

- The absolute need for water in terrestrial living systems.
- How the properties of water demonstrate the concept of emergence.
- How to determine the pH of a solution if given the concentration of hydronium or hydroxide ions.

Part 3: Carbon

1. Why is carbon central to the structure of all biological molecules?

2. Explain the concept of an isomer. As the number of carbon atoms in a molecule increases, what happens to the number of possible isomers of that molecule?

3. Why is it significant that all biological systems use L-amino acids and D-sugars?

4. Draw each of the following functional groups:
    a. hydroxyl
    b. carbonyl (ketone)
    c. carbonyl (aldehyde)
    d. carboxyl
    e. amino
    f. sulfhydryl
    g. methyl
    h. phosphate

5. Why are molecules that contain carboxyl groups acidic?

6. Why are molecules that contain amino groups basic?

7. How large a change to the structure of an organic molecule has to be made for that molecule to have a major difference in its effect on a living system?

Things you should make sure you understand:

(feel free to ask questions about them in class)

- Why carbon is such a versatile atom.
- The different types of isomers that can exist.
- The properties of all of the functional groups in question #4.

AP Biology Reading Discussion Questions: Matter #2- Biological Molecules

Topic Presentation:

https://prezi.com/-r8c-fscmffx/ap-bio-matter-2-macromolecules/

Textbook Reading:

- Principles of Life:
  - Part 1: Chapter 2- Section 2.3 & 2.4 (whole sections)
  - Part 2: Chapter 3- Section 3.1 & 3.2 (whole sections)

Part 1: Background, Carbohydrates, & Lipids

1. How are macromolecule polymers assembled from monomers? How are they broken down?

2. How can you tell a biological molecule is a carbohydrate?

3. Explain the relationship between monosaccharides, disaccharides, and polysaccharides.

4. Why are starch and glycogen useful as energy storage molecules, while cellulose is useful for structure and support? Why isn't cellulose easily broken down?

5. How do herbivores solve the problem of cellulose digestion?

6. How can you tell a biological molecule is a lipid?

7. Chemically, what is the difference between a saturated fat and an unsaturated fat? How does this difference affect the properties of the molecules?

8. How are triglycerides, phospholipids, and steroids similar? How do they differ?

Things you should make sure you understand:

(feel free to ask questions about them in class)

- The chemical differences between the carbohydrates and lipids described in this presentation.
- The roles played by carbohydrates and lipids in biological systems.

Part 2: Proteins & Nucleic Acids

1. Why are proteins the most complex biological molecules?

2. Draw the structure of a general amino acid. Label the carboxyl group, the amino group, and the variable ('R') group.

3. Draw the formation of a peptide bond between two amino acids.

4. How does the structure of the 'R' group affect the properties of a particular amino acid?

5. Define each of the following levels of protein structure and explain the bonds that contribute to them:

    a. Primary

    b. Secondary

    c. Tertiary

    d. Quaternary

6. How can the structure of a protein be changed ("denatured")?

7. Draw a nucleotide. Label the phosphate, sugar, and nitrogenous base.

8. Explain the three major structural differences between RNA and DNA.

Things you should make sure you understand:

(feel free to ask questions about them in class)

- How the structure of proteins and nucleic acids allow for their biological functions.
- How both protein structure and nucleic acid structure illustrate the concepts of emergence and combinatorial complexity.
- Why directionality and sequence are crucial for the structure and function of proteins and nucleic acids.
- How nucleic acids and proteins function in storage and expression of biological information.