AP BIOLOGY SUMMER ASSIGNMENT 2014

Welcome to the world of Advanced Placement Biology! The attached summer assignment is required for all AP Biology students for the 2014-2015 school year. The assignment consists of two parts – an annotated course outline and AP Free Response Questions. If possible, please type your answers in a word document, though handwritten responses will be accepted the first week of school. The graphs can be done on paper or submitted electronically.

Suggested Timeline: Intro, Section I and II by July 31. Section III and FRQs - by Aug 30

You can send me sections attached to an email (see below) as you complete them. **The assignments are due NO LATER than the first week of school, if not submitted earlier.** Note that the summer assignment will be your first <u>summative</u> grade for the class

Purpose of assignment: At a minimum, you will review freshman level biology and begin to teach yourself new material. The outline provided presents as questions the major themes and topics covered in an AP Biology course. You must create a completed outline of your own by answering the questions for each topic. Ideally you will also generate additional information about the topics. Don't write an essay for each; just pick out the big ideas. This outline will allow you to bring a scaffolding of information to the course and you will be able to attach more information to the concepts as the year goes on. Use any information source possible to answer the questions, but you must work independently. You will be graded, not on being completely comprehensive but on your ability to address one or two key points correctly and clearly for each topic. Keep in mind two things: 1) If you do not do the summer assignment, you will start behind in the course.

2) Don't get overwhelmed. Read the material about each question and answer each one to the best of your ability using available resources. You can combine questions within each subtopic.

AP Free Response Question. You will also complete your first AP Free Response Questions. A real AP exam would allow you 20 minutes to complete a long FRQ and 6 minutes to complete a short FRQ; DO NOT write like an essay, just write clear complete responses to each part. Identify a, b, c when answering multiple parts

The AP Biology course.

The AP Biology course is rigorous. It is a college level course. Expect to do homework every night. You will get out what you put in to the course. You will be given the tools needed to get a 4 or 5 on the AP Biology exam by taking this course, but it will be up to you to use them and employ them. The text we use is Raven-Johnson Biology 8th ed. 2008. During the year we will complete the 8 required AP labs as well as many additional labs and activities. You will gain practice in writing AP essays, and in answering AP level objective questions. The year concludes with study of the systems of the Pig

I STRONGLY SUGGEST that you invest in an AP Biology study guide (revised version) such as Cliff's AP biology or Princeton review. Students who regularly use a study guide on their own beyond class work greatly increase their chances of getting a 5 on AP exam.

If you have questions about this assignment, or to send me completed sections, you may contact me at <u>dclark@longbranch.k12.nj.us</u> I will check email regularly during the summer. Don't wait until the week before school to find out what you need to do!

Have a great summer!

Mr. D. Clark

Introduction: The Science of Biology - Basic Foundation Information

- 1. List and briefly explain the 7 characteristics that define life
- 2. For each biological level below, write a sentence that describes the level by referring to the smaller level "below" it. An example is given to start you off.
 - a. Macromolecules: Macromolecules are built of smaller molecules bonded together.
 - b. Organelles:
 - c. Cells:
 - d. Tissues:
 - e. Organs:
 - f. Organ Systems:
 - g. Organisms:
 - h. Populations:
 - i. Species:
 - j. Community:
 - k. Ecosystem:
- 3. Explain the role of <u>controlled experiments</u> in scientific inquiry
- 4. Contrast the use of the term "theory" in science to its use by the general public.

The following 3 units cover the basics of biology in outline form, each part has a key question or questions you should answer.

I. Molecules and Cells: Cells are the structural and functional units of life; cellular processes are based on physical and chemical changes.

A. Chemistry of Life

- 1. Water
 - How do the unique chemical and physical properties of water make life on earth possible?
- 2. Organic molecules in organisms What are the biologically important molecules (carbohydrates, lipids, proteins, nucleic acids) and the function of each?
- 3. *Free energy changes* How do the laws of thermodynamics relate to the biochemical processes that provide energy to living systems?
- 4. Enzymes

How do enzymes regulate the rate of chemical reactions? How does the specificity of an enzyme depend on its structure?

B. Cells

- Prokaryotic and eukaryotic cells What are their similarities and differences?
 Membranes What is the current model of the molecular architecture of membranes?
 - What are various mechanisms by which substances cross membranes?
- Subcellular organization What are the organelles that compartmentalize and organize a cell's functions? What factors limit cell size?
- Cell cycle and its regulation What is the cell cycle? How does mitosis allow for the even distribution of genetic information to new cells?

C. Cellular Energetics

- 1. Coupled reactions What is the role of ATP in coupling the cell's anabolic and catabolic processes? What is chemiosmosis?
- Fermentation and cellular respiration
 What are the 2 main pathways of breaking down sugar?
 What is the role of oxygen in energy-yielding pathways?
 How do cells generate ATP in the absence of oxygen?
- 3. *Photosynthesis* How does photosynthesis convert light energy into chemical energy? What interactions exist between photosynthesis and cellular respiration?

II. Heredity and Evolution: Hereditary events control the passage of structural and functional information from one generation to the next.

A. Heredity

- 1. *Meiosis and gametogenesis* What features of meiosis are important in sexual reproduction? How is meiosis related to gametogenesis?
- 2. *Eukaryotic chromosomes* How is genetic information organized in the eukaryotic chromosome?
- 3. *Inheritance patterns* What are Mendel's principal patterns of inheritance?

B. Molecular Genetics

- RNA and DNA structure and function What are the two types of nucleic acids and the structure and function of each? What are the similarities and differences between prokaryotic and eukaryotic DNA?
- 2. *Gene regulation* What are some mechanisms by which gene expression is regulated in prokaryotes and eukaryotes?
- 3. Mutation In what ways can genetic information be altered? What are some effects of these alterations?
- 4. Viral structure and replication What is the structure of viruses?
 What are the major steps in viral reproduction? How do viruses transfer genetic material between cells?
- Nucleic acid technology and applications
 What are some current recombinant technologies?
 What are some practical applications of nucleic acid technology?

C. Evolutionary Biology

- 1. *Evidence for evolution* What types of evidence support an evolutionary view of life?
- Mechanisms of evolution
 What is the role of natural selection in the process of evolution?
 How are heredity and natural selection involved in the process of evolution?
 What mechanisms account for speciation and macroevolution?
 What different patterns of evolution have been identified

III. Organisms and Populations: The relationship of structure to function is a theme that is common to all organisms; the interactions of organisms with their environment is the major theme in ecology.

A. Diversity of Organisms

- Survey of the diversity of life What are representative organisms from the Monera, Fungi, and Protista? What are representative members of the major animal phyla and plant divisions?
 Shula and plant divisions?
- Phylogenetic classification What are the distinguishing characteristics of each group (kingdoms and the major phyla and divisions of animals and plants)?
- 3. *Evolutionary relationships* What is some evidence that organisms are related to each other? How is this information used in classification of organisms?

B. Structure and Function of Plants and Animals

- Structural, physiological, and behavioral adaptations
 How does the organization of cells, tissues, and organs determine structure and function in
 plant and animal systems?
 How are structure and function related in the various organ systems?
 How do the organ systems of animals interact?
- 2. *Response to the environment* What are the responses of plants and animals to environmental cues, and how do hormones mediate them?

C. Ecology

- 1. *Population dynamics* What models are useful in describing the growth of a population? How is population size regulated by abiotic and biotic factors?
- Communities and ecosystems
 How is energy flow through an ecosystem related to trophic structure (trophic levels)?
 How do elements (e.g., carbon, nitrogen, phosphorus, sulfur, oxygen) cycle through
 ecosystems?

How do biotic and abiotic factors affect community structure and ecosystem function? 3. *Global issues*

In which ways are humans affecting biogeochemical cycles?

AP Biology Free-Response Questions:

Question 1 is a long free-response question that normally should require about 20 minutes each to answer. Questions 2-4 are short free-response questions that normally should require about 6 minutes each to answer. Read each question carefully and write your response. Since this is prior to taking the course, you should take time to research the key terms and concepts in order to answer the questions. Note, that if you have trouble answering a question, you should research it to at least attempt it and write down what you find out for significant partial credit. Also note that on the regular AP Biology exam you will have 2 long FRQS and 6 short ones.

1. Plants lose water from their aboveground surfaces in the process of transpiration. Most of this water is lost from stomata, microscopic openings in the leaves. Excess water loss can have a negative effect on the growth, development, and reproduction of a plant. Severe water loss can be fatal. Environmental factors have a major impact on the rate of plant transpiration.

Temperature (°C)	20	23	27	28
Transpiration rate (mmol/m21	.5	3	5	4.5

- (a) Using the data above and the axes provided, draw a graph showing the effect of temperature change on the rate of transpiration. Explain the shape of the curve from 23 degrees to 28 degrees.
- (b) Humidity is an environmental factor that affects transpiration rate. Using the axes provided, draw a curve that illustrates what you predict would be the rate of transpiration with increasing humidity and constant temperature. Justify the shape of the curve based on your prediction.
- (c) The curve below illustrates the rate of transpiration related to the percent of open stomata on the leaf of a particular plant. **Explain** why the curve levels off with increasing percentage of open stomata per area of the leaf.



OPEN STOMATA VERSUS RATE OF TRANSPIRATION

(d) The data below show the density of stomata on the leaf surfaces of three different species of plants. **Describe** the environments in which each plant most likely evolved. **Justify** your descriptions.

	Stomata Density (#	of stomata/mm ₂)
Plant	In Upper Epidermis	In Lower Epidermis
Anacharis	0	0
Water lily	420	0

Black walnut	0	465
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Graph for part (a) showing the effect of temperature on the rate of transpiration.

Graph for part (b) showing the predicted effect of humidity on the rate of transpiration.



Short FRQs-

- 2. Populations of a plant species have been found growing in the mountains at altitudes above 2,500 meters. Populations of a plant that appears similar, with slight differences, have been found in the same mountains at altitudes below 2,300 meters.
- (a) **Describe** TWO kinds of data that could be collected to provide a direct answer to the question, do the populations growing above 2,500 meters and the populations growing below 2,300 meters represent a single species?
- (b) **Explain** how the data you suggested in part (a) would provide a direct answer to the question
- 3. Fruit flies (Drosophila melanogaster) with a wild-type phenotype have gray bodies and red eyes. Certain mutations can cause changes to these traits. Mutant flies may have a black body and/or cinnabar eyes. To study the genetics of these traits, a researcher crossed a true-breeding wild-type male fly (with gray body and red eyes) with a true-breeding female fly with a black body and cinnabar eyes. All of the F1 progeny displayed a wild-type phenotype. Female flies from the F1 generation were crossed with true-breeding male flies with black bodies and cinnabar eyes. The table on the next page represents the predicted outcome and the data obtained from the cross. Explain the difference between the expected data and the actual numbers observed.

F2 Generation Ph	enotypes		
Body Color	Eye Color	Number Predicted	Number Observed
Gray	Red	244	455
Black	Cinnabar	244	432
Gray	Cinnabar	244	42
Black	Red	244	47

4. A population of microscopic eukaryotic organisms growing in a large flask had the growth pattern shown.



In one paragraph, **explain** the biological factors that determine the shape of the growth pattern shown above in both period 1 and period 2.