AP Biology Summer Assignment

Welcome to AP Biology! This course is designed to be the equivalent of a two-semester introductory biology course usually taken in the first year of college. In other words, it's a little like drinking from a fire hose. It will be a rewarding experience, but as with most things that are, it will also be challenging. Throughout the course, you will become familiar with major recurring ideas that persist throughout all topics and material.

The 4 Big Ideas of AP Biology
Big Idea 1: The process of evolution drives the diversity and unity of life. **Big Idea 2:** Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis. **Big Idea 3:** Living systems store, retrieve, transmit and respond to information essential to life processes. **Big Idea 4:** Biological systems interact, and these systems and their interactions possess complex properties.

AP BIOLOGY EXAM – Monday, May 11, 2020 @ 8:00AM

On the pages that follow, you'll find detailed instructions of the three assignments that comprise your summer work for AP Biology. The first assignment is related to learning essential pre-knowledge that will help you become successful this year in AP Biology. The second part deals with collecting, through photography, examples of biological terms or concepts and creating a photo website of your collection, and finally our third assignment will help you with this year's lab format...

AP Biology students are expected to design many of their own experiments instead of the traditional "cook-book" type labs. This is more of an inquiry based approach to science. We will work throughout the year developing the skills necessary to design inquiry based experiments. However, you will get started with this during the summer by designing your own plant experiment.

My suggestion is that you do NOT leave these until the last week in the summer to complete!

Assignment #1 – Due September 4, 2019
Assignment #2 – Due September 5, 2019
Assignment #3 – Due September 5, 2019

In addition, you will need the following for this class:

- Lab Notebook (A non-spiral bound composition book works well for this)
- AP Biology study guide (highly recommended – look on Amazon for best price)
- AP Biology study flash cards (highly recommended – look on Amazon for best price)

For digital copies of summer homework, and all other classroom content, please visit...

http://apbio.smitkascience.com

Assignment #1 – Khan Academy Chemistry/Biochemistry Review – due September 4, 2019

A basic understanding of the world of chemistry and biochemistry is **ESSENTIAL** to doing well in AP Biology. In order to get you off to a head start this year, we are going to be utilizing Khan Academy to review and re-teach many lessons. Over the summer you will be responsible for covering the following lessons that have already been assigned to your account...

Unit = Chemistry of Life

- Structure of Water and Hydrogen Bonding
- Elements of Life
- Introduction to Biological Macromolecules

Each unit will have sub-lessons and review questions at the end that MUST be completed for full credit.

Your credentials to log into Khan Academy are as follows...

www.KhanAcademy.com

Username _____

Password _____

Assignment #2 – Biological Photo Collection – due September 5th, 2019

For this assignment, you will "collect" 25 photographic examples of biological terms/concepts and post them on a website that you will create. I recommend using a FREE website building engine like Weebly or Wix. Select any of the items from the Biological Collection List to include in your website. This will introduce you not only to the language of biology, but also emphasize that biology is something that's *DONE* not just memorized. Please see your teacher if access to the needed technology is an issue.

Directions for the Biological Collection Photo Website:

1. "Collect" an item by taking a picture of it. **Define**, in your own words, the biological term/concept. Also within a couple of statements, **explain** how the picture represents the term or concept. Use the attached Biological Collection List to select terms/concepts for your website. Page 6 will give you examples of what entries should include.
2. Upload the photo, definition, and explanation to a website that you create for the class. Again, Weebly or Wix are free and really easy to use.
3. Email Mr. Smitka with the URL of your website. Mr. Smitka's email is...
   rsmitka@rosevillepride.org
4. Be creative. If you choose an item that is internal to a plant or animal, like phloem, you could submit a photograph of the whole organism or a close up of one part, and then explain on the website *what* phloem is and specifically *where* phloem is in the specimen.
5. Use original photos ONLY. You cannot use an image from any publication or from the internet. You must take the photo yourself. The best way to prove that the photo is your work is to have something in your picture that represents you. This could be a key chain, pen, bracelet, small toy, etc. Submit a picture of you with your proof object when you hand in your summer work.
6. You should only use natural items. Take a walk in your neighborhood, go to the zoo, go for a hike in the woods, etc. Humans are natural items and may be used, but only for a few entries.
7. This is an individual project. While brainstorming, discussing, and even going on collecting adventures together is welcome, your items and photos are to be unique. With over 90 concept choices, probability says there is a very slim chance that any two students will have the same items chosen from their list.
8. Be careful and respectful! Never touch plants or animals you are unfamiliar with. Don't kill or hurt any organisms. Don't remove any organisms from the natural environment.

Rubric for Biological Collection Photo Website			
Points	Biological Collection Photo Website Entry (per photo)	Points	
1	Original photo posted to website	3	Website URL emailed to teacher
1	Biological term/concept identified	2	Picture of you with your proof object submitted
1	Biological term/concept defined in own words	10	Website is easy to follow and neatly presented
2	Biological term/concept and photo relationship explained fully		
* Points in this selection are awarded in an all or none format. If the guideline is not fully met, **no points will be awarded**.			

Scientific Processes

- Chi-Square
- Control
- Dependent Variable
- Independent Variable
- Scientific Method
- Hypothesis

BioChemistry

- Amino Acid
- Amphipathic
- Denaturation
- Hydrogen Bonding
- Polar
- Non-Polar
- Nucleic Acid
- Carbohydrate
- Cellulose
- Chitin
- Covalent
- Disaccharide
- Enzyme
- Fermentation
- Glycogen
- Ionic
- Keratin
- Lipids
- Protein
- Saturated Fatty Acid
- Unsaturated Fatty Acid
- Hydrophilic
- Hydrophobic

Environment

- Autotroph
- K-Strategist
- r-Strategist
- Littoral zone
- Mutualism
- Niche
- Parasite
- Commensalism
- Symbiotic Relationship
- Keystone Species
- Detritivore
- Taxis
- Kenesis

Evolution

- Analogous Structure
- Homologous Structure
- Batesian mimicry
- Mullarian mimicry
- Adaptation
- Allopatric
- Sympatric
- Coevolution
- Convergent Evolution
- Gene Pool
- Phenotype
- Postzygotic Isolating Mechanism
- Prezygotic Isolating Mechanism
- Vestigial Structure
- Hardy-Weinberg Equilibrium

Biological Diversity

- Archaea
- Bacteria
- Cladistics
- Phylogeny
- Species
- Taxon
- Cladogram

Cells

- Active Transport
- Amphipathic
- Apoptosis
- Cell Wall
- Chloroplast
- Diffusion
- Endocytosis
- Hypertonic
- Hypotonic
- Isotonic
- Membrane
- Endocytosis
- Exocytosis
- Osmosis
- Passive Transport
- Active Transport
- Turgor
- Plasma Membrane

Cell Division

- Cancer
- Cell Cycle
- Prophase
- Metaphase
- Prometaphase
- Anaphase
- Telophase
- Cytokinesis
- Crossing Over
- Chromosome
- Dipolid
- Haploid
- Independent Assortment
- Mitosis
- Meiosis
- Somatic Cell

Molecular Genetics

- Anticodon
- Base-Pair Rules
- Codon
- DNA
- Gel Electrophoresis
- RNA
- Mutation
- Polymerase Chain Reaction
- Replication Fork
- Replication
- Transcription
- Translation
- Protein
- Helicase
- DNA Ligase
- DNA Polymerase

Mendelian Genetics

- Allele
- Autosome
- Codominance
- Dihybrid Cross
- Dominant
- Recessive
- F1/F2 Generations
- Genotype
- Phenotype
- Non-Disjunction
- Segregation
- Pedigree

Metabolism

- ATP
- Autotroph
- Heterotroph
- Glycolysis
- Krebs Cycle
- Electron Transport Chain
- Light Dependent Reactions
- Light Independent Reactions
- NAD+ / NADP
- Photosynthesis
- Cellular Respiration
- Fermentation
- Activation Energy
- Mitochondria
- Chloroplast
- Thylakoid Membrane

Ecology

- Abiotic
- Biotic
- Biodiversity
- Carbon Cycle
- Hydrologic Cycle
- Climate Change
- Community
- Environment
- Density Dependent Limiting Factor
- Density Independent Limiting Factor
- Food Web
- Global Warming
- Imprinting
- Interspecific Competition
- Intraspecific Competition
- Primary Consumer
- Secondary Consumer
- Carrying Capacity
- Rule of 10%
- Ecological Pyramid
- Endangered Species
- Exponential Growth
- Logistic Growth
- Trophic Level
- Primary Productivity
- Ecological Succession
- Species Diversity
- Pollution
- Population
- Habitat

Example Entries for Photo Website

Notice the toy giraffe in the pictures below. This is a proof object and is used to demonstrate that the photographs in the website entries are indeed their original. **Make sure you have a proof object in each of your photos.**

4. Detritovore

This is a picture of an earthworm. The earthworm represents a *detritivore*. A detritivore, also called a decomposer, is an organism that consumes non-living organic materials (corpses, fallen plant material, and wastes) to obtain its energy and nutrients. They can be found in many different areas (land and water). They can also be found in many different types, for example, fungi, bacteria, and protists, as well.

10. Modified Leaf

This is a picture of pine needles. Pine needles are an example of a *modified leaf of a plant*. A modified leaf is one that has adapted to perform another function, other than photosynthesis and transpiration. A pine needle's shape functions to retain moisture, which is helpful in dry and windy areas.

Assignment #3 – Experimental Design – due September 5th, 2019

As mentioned above, the new curriculum encourages students to design and conduct their own experiments. You will design an experiment using plants. You will run the experiment and collect data. During the first few weeks of school you will be responsible for creating a mini-poster (more details to come later). *You may partner with one other person only*, however each person is responsible for keeping their own lab notebook. Additional details below.

Inquiry Based Plant Experiment Details:

- Design and conduct an experiment about plants. This may be done alone or with a partner. You may choose to investigate something to do with plant growth, light, fertilizer, root development, pollination etc... Any topic about plants is okay.
- Go online and search for ideas. Don't stress about this, instead have fun while learning! It is okay if everything doesn't turn out "right". This assignment is supposed to get you to think like a scientist, ask questions, and try to find answers.
- I suggest that you use plants that you can commonly find at a local nursery or Home Depot or Lowes.
- Some suggestions are: beans, tomatoes, peppers, impatients, petunias or marigolds. Try to choose something hardy and easy to grow. You could also use plants growing in your yard, but this may make it more difficult to control the variables.

Lab Notebook:

You are **required** to keep a **Lab Notebook** with the following in it...

_____All entries are dated and organized (all stages of experiment, multiple entries for data)
_____ Background research about plant topic is included; you may print some things or include web links
_____Question / problem is clearly stated
_____Hypothesis is clearly stated
_____ Independent and dependent variables are clearly stated
_____Controls are described
_____ Materials needed are listed
_____Procedures are clearly listed; drawings included as needed
_____Data has been recorded in a student designed chart or table
_____Analysis of data is described
_____ Errors or problems encountered are indicated throughout the lab journal
_____Conclusions are clearly stated

Follow these guidelines for your plant experiment. You will need to document all work by taking pictures of your materials, location, and plants at all stages of the experiment. You will create a mini-poster presentation (based on the guidelines given in class) that documents your experiment and monitoring. We will be presenting these in class during the first week of school.

If you are working with a partner, ONE mini-poster presentation will be created during the first week of school but EACH person needs to keep their own lab notebook.

EXPERIMENTAL DESIGN

An experiment is an organized series of steps used to test a theory or an idea. Experimental design is a specific set of steps that is organized such that the results are as valid as possible. The purpose of experimental design is to eliminate experimental error and to ensure that the results are due to the factor or factors being tested. The experiment, based on a testable hypothesis that was inferred from research, must be repeatable.

Student Objectives for AP Biology Labs:

- Choose which variables to investigate
- Design and conduct experiments
- Design their own experimental procedures
- Collect, analyze, interpret, and display data
- Determine how to present their conclusions

Steps for the Plant Experiment

Step 1: Stating the Purpose/Problem
What do you want to find out? Write a statement that describes what you want to do. It should be as specific as possible. Often, scientists read relevant information pertaining to their experiment beforehand. The purpose/problem will most likely be stated as a question such as:
"What are the effects of_____ on_____?"

Step 2: Defining Variables
INDEPENDENT VARIABLE (IV) (also called the manipulated variable) — the variable that is changed on purpose for the experiment; you may have several levels of your independent variable.

DEPENDENT VARIABLE (DV) (also called the responding variable) — The variable that acts in response to or because of the manipulation of the independent variable.

CONSTANTS (C) — All factors in the experiment that are not allowed to change throughout the entire experiment. Controlling constants is very important to assure that the results are due only to the changes in the independent variable; everything (except the independent variable) must be constant in order to provide accurate results.

CONTROL GROUP - For some experiments, a control (standard of comparison for checking or verifying the results of an experiment) is necessary. All variables must be held constant in the control group.

EXPERIMENTAL GROUP — The group(s) being tested with the independent variable; each experimental group has only one factor different from each other, everything else must remain constant.

REPEATED TRIALS — The number of times that the experiment is repeated. The more times you repeat the experiment, the more valid your results will be.

Step 3: Forming a Hypothesis

A hypothesis is an inferring statement that can be tested. The hypothesis describes how you think the independent variable will respond to the dependent variable. It is based on research and is written prior to the experiment...never change your hypothesis.

For example: The rate of the reaction will increase when the temperature increases.

Never use "I" in your hypothesis (i.e. I believe that...)

It is OK if the hypothesis is not proven by the experiment as long as an explanation is given in the conclusion.

The hypothesis is usually written in an "If…, then..., because..." format.

Step 4: Designing an Experimental Procedure

Select only one thing to change in each experimental group (independent variable).

Change a variable that will help test the hypothesis.

The procedure must tell how the variable will be changed (what are you doing?).

The procedure must explain how the change in the variable will be measured.

The procedure should indicate how many trials would be performed (usually a minimum of 3-4).

It must be written in a way that someone can replicate (copy) your experiment, in step by step format.

Step 5: Results/Data

Qualitative Data is comprised of a **description** of the experimental results (i.e. larger, faster....).

Quantitative Data is comprised of **numbers** results (i.e. 5 cm, 10.4 grams)

The results of the experiment will usually be compiled into a table/chart for easy interpretation.

A graph of the data (results) may be made to more easily observe trends.

Step 6: Conclusion

What have you discovered from this experiment?

What conclusions can be made?

How does the data support your conclusion?

You should indicate any flaws in the research and/or errors or problems that were encountered.

How could this experiment be improved?

Any ideas for future study?