

AP Biology Opening Letter

Dear AP Biology Student

Let me be the first to welcome you to Advanced Placement Biology! I'm sure you're thinking, "Isn't my summer vacation just beginning?" Well yes of course it is, but this year I want to put all of you in a starting position that will set everyone up for success in our course. Before I get to that please allow me to introduce myself.....

I'm a teacher that believes in making science fun and relatable for my students. My favorite part of science was bacteria and virus. I have done extensive study and research in Microbiology and Immunology in graduate school with an expertise in Herpes Virus. Here at LC I have taught all levels of Biology, Zoology, Biotechnology, and Anatomy. In my spare time I love to play games of any kind. But, I stay the busiest serving the role of Dad to 2 awesome boys.

I'm excited to meet you and prepare you for college Biology and the AP exam. This course is taught as an intensive entry level college course that requires an independent and motivated student for maximal success. In order to appropriately prepare you for the AP exam and maintain Advanced Placement certification from the College Board, I cover 52 Chapters and 12 AP Course Labs during one school year. This is a formidable challenge for both teacher and students.

The best way for me to effectively teach you and prepare everyone for the course is to make sure all students come in with a well-rounded foundation in Biology. Most of you have had Honors Biology, but you all will have had varying amounts of science electives and time since that Honors Biology class. So, I have put together a review packet of the material covered from the Honors Biology course. I would expect that by the start of class in August all students will have completed this material and have a general understanding of its concepts and principles. This is material that has already been covered previously, and will seem even redundant to some, but as a much needed refresher for others. Either way, this will allow us to start on the same page and make sure no one is left behind. There will be a test over this material at the end of the first week of classes.

I have put enormous amounts of time and planning into the best methods and techniques for preparing everyone for success on the AP exam and in college Biology. I do expect hard work in return from my students. Having said all that, I find this course to be the most rewarding to teach and in my opinion, the most rewarding for my students. Feel free to come to me with any questions (dverpoot@lcscmail.com), or to just simply introduce yourself before you leave for the summer. Looking forward to a great year!

Dr. Verpooten

Summer Review Packet Topic List/Questions

General Information: This is all material covered from the Honors Biology Course. In fact, these questions/topics have been taken from the final exam study guides from that class. It is expected that you will have this finished by the start of school next fall. We will take a class period for questions and clarifications of the material.

Directions: The beginning of the study guide starts out with a topic list, you can pretend these topics are questions, then we shifted to questions. Either way know this listed material and you will be in great shape for starting the year and your first exam.

The Basics

The study of Biology

Properties of Life

The relationship between the following terms:

species & reproduction

growth & development

stimulus & response

adaptation & evolution

Major differences between the evolutionary theories of Darwin and Lamarck

The general order of Scientific Processes/Methods

Parts of a well designed, controlled experiment:

Hypothesis

Control group

Experimental group

Independent variable

Dependent variable

The relationship between a hypothesis, theory, and scientific law

Qualitative and Quantitative Data

Chemistry

Basic structure of an atom—nucleus (protons & neutrons) and electron cloud (electrons in energy levels)

Atomic number vs. atomic mass

Valence electrons - know how to determine the number of valence electrons for groups 1A - 8A on the periodic table

Elements and compounds

Mixtures and solutions

Acids and bases - their definitions and relation to the pH scale

Types of Bonds...how they are formed and examples of each kind

Ionic bond

Covalent bond

Hydrogen bond

The difference between ions, isotopes, and isomers

Water:

why it is a polar molecule

The unique properties of water

why it is so important to living systems

Structure of a carbon atom, its ability to form bonds and organic compounds

The relationship between the following terms - polymer, condensation, dehydration synthesis, hydrolysis

The subunits (monomers) of the following biomolecules:

Carbohydrates

Lipids

Proteins

Nucleic Acids

The structure of an amino acid (carboxyl group, amino group, R group/variable group)

The formation of a polypeptide...

Primary structure

Secondary structure

Tertiary Structure

Quaternary Structure

The relationship between the type and sequence of amino acids and the formation of different proteins

Activation Energy

The function of enzymes/catalysts

The two writing methods for including catalysts in chemical equations

Factors that affect enzyme activity

The lock and key nature of enzyme-substrate complexes

Cells

Contributions of van Leewenhoek, Hooke, Schleiden, Schwann and Virchow to understanding the basic nature of cells

The SI system

Basic metric units for length, volume, mass, time and temperature

Types of microscopes:

Light microscope

Compound light microscope

Electron microscopes (transmission and scanning)

Scanning tunneling microscope

Parts of the Cell Theory

Limitations to cell size

Differences between prokaryotic and eukaryotic cell

Selective permeability of the plasma membrane

Functions of the four types of membrane proteins

Structure of and major parts of the plasma membrane, including phospholipids, cholesterol, membrane proteins, and hydrophilic/hydrophobic areas

The function and structure of the following cell structures...be able to identify them on a diagram:

Cell wall

Centrioles (p. 128 in text)

Chloroplast

Chromatin

Endoplasmic reticulum

Golgi apparatus/complex

Mitochondrion

Nucleus

Nucleolus

Nuclear membrane/envelope

Plasma membrane

Ribosome

Vacuole

Cytosol

Cytoskeleton

lysosome

cilia

flagella

Differences between plant and animal cells

Advantage of folded membranes within cellular organelles

Cell Environments

Passive Transport:

Diffusion:

Brownian motion

Concentration gradients

dynamic equilibrium

Relationship between diffusion, dialysis, and osmosis

How a concentration gradient determines the direction of osmosis:

Isotonic solution

Hypertonic solution

Hypotonic solution

Differences between the following types of water: tap water, distilled water, and salt water

Facilitated diffusion (ion channels)

Active Transport:

Carrier proteins (membrane pumps)

Endocytosis (pinocytosis and phagocytosis)

Exocytosis

Signal Molecules

Photosynthesis and Cellular Respiration

The relationship between the sun and food chains

Contributions of the following scientists to our understanding of cellular energy: Jan van Helmont, Joseph Priestley, Jan Ingenhousz, Melvin Calvin, Hans Krebs

Structure of ATP

Formation and break down of ATP

Structure of a chloroplast: stroma, grana, thylakoid membranes, chlorophyll

Relationship of light and various pigments—color absorption/reflection

Photosynthesis:

Light dependent reactions, electron transport chain (ETC)

Location of electron transport chains

Function of the 1st ETC

Function of ATP synthetase

Photolysis

Function of the 2nd ETC

Light independent reactions, Calvin cycle

Why they are called the dark reactions

Location of the dark reactions

How the Calvin cycle involves CO_2 , RuBP, PGA, PGAL, ATP, and NADPH

General equation of photosynthesis

Factors that affect photosynthesis

Cellular respiration:

Glycolysis...where does it occur, what does it break down, what are the resulting products

Location of the Krebs cycle

How the Krebs cycle involves Acetyl-CoA, oxaloacetic acid, citric acid, CO_2 , NADH, $FADH_2$ and ATP

The location of electron transport chains in cellular respiration

The role of oxygen in electron transport chains

Anaerobic vs. aerobic respiration

Identify whether the following are aerobic or anaerobic:

Glycolysis, Krebs cycle, electron transport chain, fermentation

The relationship between fermentation and glycolysis

Differences between the two types of fermentation

General equation for aerobic cellular respiration

What does the term "oxidative phosphorylation" refer to during the breakdown of glucose?

Amount of net ATP acquired from each part of respiration:

Aerobic respiration

Glycolysis

Krebs Cycle

ETC

Fermentation

General comparison of photosynthesis and cellular respiration

Cell Cycle and Division

1. What three main phases occur during the cell cycle?
 2. List the phases of mitosis in order.
 3. What is the relationship between the chromosome number in a parent cell and the chromosome number of the daughter cells produced during mitosis?
 4. What is the structure formed during cytokinesis in plant cells?
 5. What is binary fission? In what type of cell does it occur?
 6. In what types of cells does mitosis occur?
 6. When does the replication of DNA occur during the cell cycle?
 7. Name the stage of mitosis in which the following occur:
 - A) chromosomes line up in the middle
 - B) nuclear membrane and nucleolus disappear
 - C) nuclear membrane and nucleolus reappear
 - D) chromosomes separate and move to opposite ends of the cell
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1. What is meiosis?
 2. What is crossing over?
 4. How do chromosomes line up differently in metaphase I versus metaphase in mitosis?

5. In which part of meiosis does the chromosome number reduce?
6. What causes genetic variation in organisms that reproduce sexually?
7. What causes genetic variation in organisms that reproduce asexually?
8. What is the difference in chromosome number between a body (somatic) cell and a gamete?
9. What are differences between spermatogenesis and oogenesis?
10. What is a clone?
11. How was Dolly formed through cloning?
12. What is nondisjunction?
13. Describe the haploid life cycle.
14. Describe the alternation of generations.

Genetics

1. Define phenotype and give an example.
2. Define genotype and give an example.
3. How is probability figured for a single event? For multiple events?

4. Be able to work out a monohybrid cross between two heterozygous parents. What is the genotypic and phenotypic ratio of the offspring?
5. What is a dominant trait? What is a recessive trait?
6. After Mendel's time we discovered that some genes are linked on _____.
 - a. How does the above statement affect the law of independent assortment?
 - b. How does the above statement affect genetic variation?
7. If a trait is codominant, what is seen in a heterozygous individual?
8. If a trait is governed by incomplete dominance, what is seen in a heterozygous individual?
9. How are the sex chromosomes inherited? (from which parent to which offspring).
10. What is a sex-linked trait?
11. How is a recessive x-linked trait inherited? Who is most likely to be affected and why?
12. How is a dominant x-linked trait inherited?
13. What is the cause of Down syndrome? How is this different from the inheritance of cystic fibrosis?
14. What is polygenic inheritance? Give some examples of traits that are polygenic.
15. What is the basic structure of DNA?

16. What is a nucleotide?
17. What makes up the DNA code? How many nucleotides are needed for each "word" of the code?
18. What does DNA code for?
19. What is a mutation?
20. In order for a mutation to be passed on to offspring, where must it occur?
21. Describe DNA replication

Protein Synthesis

1. What is transcription? In what part of the cell does it occur?
2. What is translation? In what part of the cell does it occur?
3. What is the function of mRNA? of tRNA? of rRNA?
4. What are the complementary base pairings between DNA and mRNA?
5. Translate the following DNA sequence into a complementary mRNA sequence and then to tRNA.

TAC/GGT/CGA/ACT/TGC

6. What is an exon? an intron?

7. What happens during mRNA splicing?

Early Earth

1. What was Oparin and Haldane's hypothesis about the formation of organic molecules (chemical evolution)?

2. What scientists conducted an experiment to test the hypothesis in question 1?

3. Why is the bubble model currently more valid than the primordial soup model?

4. What provided the first oxygen to the early earth's atmosphere?

5. What was made possible by the ozone layer?

6. What form of life existed 3 billion years ago? What about 1.5 billion years ago?

7. If a fossil has 1/8 the C14 remaining and the half life of C14 is 5730 years calculate the age of the fossil.

8. What does the theory of endosymbiosis refer to? What is some of the support for this theory?

9. What is a protocell?

Ecology

1. What is a population?
2. What is the difference between J growth and S growth?
3. What are density dependent and independent limiting factors? Give examples.
4. What is natural selection? How is it affected by geographical isolation?
5. What does "Industrial Melanism" refer to?
6. What are some types of scientific evidence that support that support evolution?
7. What is the difference between gradualism and punctuated equilibrium?
8. Why does rapid evolution occur after mass extinctions?
9. What is an adaptation?
10. What is divergence / adaptive radiation?

Population Ecology

1. Explain how allele frequencies are related to evolution.
2. What are the Hardy Weinberg equations, be able to apply them to problems.
3. How do the following processes affect allele frequencies in a population?
 - a. Gene flow
 - b. Nonrandom mating
 - c. Genetic Drift
 - d. Mutations
 - e. Natural selection

Classification

1. What is taxonomy?
2. What is a biological species?
3. List the hierarchies of classification in order from the most general to the most specific.
4. What are the parts composing a scientific name?
5. How can you tell the relatedness of two organisms from their scientific names?
6. What are the characteristics of mammals?
7. Which kingdoms are made of prokaryotes?

8. What are hybrid animals? What are they usually unable to do?

9. Describe convergent evolution and analogous traits.

10. Why is it important for scientists to determine differences between homologous and analogous structures?(Hint: how does it relate to evolution)

11. Who developed the present naming system of classification...what is it called?

12. What is difference between cladograms and phylogenetic trees?

Ecosystems

1. What is biodiversity?

2. What is succession?

3. What are some examples of pioneer species?

4. What is the difference between a food chain and a food web?

5. What are 1st order consumers, 2nd order consumers, and 3rd order consumers?

6. To what trophic level do producers belong? Herbivores?
7. How much energy is passed along to higher trophic levels?
8. What is an energy pyramid?
9. What is biomass?
10. Does biomass increase or decrease as you move up trophic levels?
11. What are the important processes in the carbon cycle?
12. What processes are important in the water cycle?
13. In what type of plant is nitrogen fixing bacteria found directly on their roots?
14. What kinds of organisms are decomposers...what do they do?
15. Place the following levels of organization in order from smallest to largest...
ecosystem, biosphere, organism, community, population
16. What is a habitat?

More Ecology

1. What is an ecological niche?

2. Identify and explain the three types of symbiosis.
3. What is a biome?
4. What factors affect the formation of the terrestrial biomes?
5. What are some examples of aquatic biomes?
6. What is biological magnification and how does it relate to toxic materials most concentrated in a food chain?
7. What is the greenhouse effect? What gases contribute to this?
8. How is acid rain formed?
9. How are CFCs related to the ozone layer?