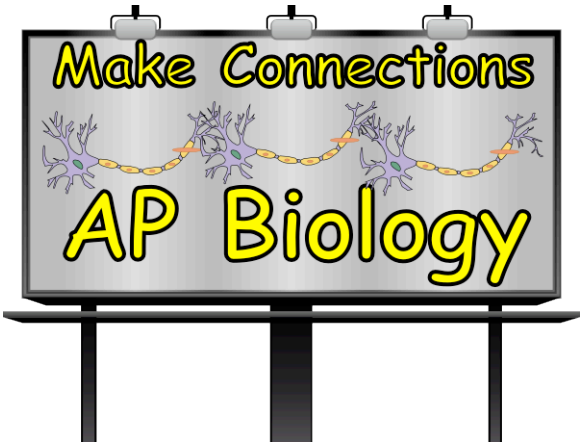
Mrs. Okladek
AP Biology 2016-2017
Summer Assignment



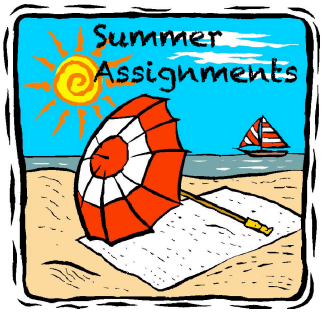
Welcome to Advanced Placement Biology! You are most likely taking AP Bio because you have done well in your previous Biology class and have a sincere interest in the subject. You will be expected to have a full understanding of all information taught in CP or Honors Biology and I will *not* be re-teaching that material. AP Biology is an extremely independent course that will require both time management and organizational skills. AP Biology should not be considered "college prep" as it is a COLLEGE COURSE, with *college level expectations* for behavior, attendance, participation and effort. Further, AP Biology is an interdisciplinary field of study, which will integrate the content of Biology, Chemistry, Statistics, Physics, Algebra, Sociology, History, etc. You will be using a college-level textbook throughout the course and we will be completing at least 12 in-depth inquiry-based labs. AP Biology provides students with the conceptual framework, factual knowledge, and analytical skills necessary to deal critically with the rapidly changing science of biology. This course is designed to prepare students for the College Board Advanced Placement Biology Exam. We will be working at a very rapid pace in order to address all necessary content.

The course description, as set forth in the AP course handbook states: "The AP Biology course is designed to be the equivalent of a college introductory biology course taken by biology majors during their first year". As a consequence, we will be covering, on average, a chapter or two a week (sometimes more) out of a college-level textbook for the entire year. The end result will be a much deeper knowledge of biology and (hopefully) a passing score on the AP Biology exam, which may lead to the receipt of college credit for all of your hard work. Please understand that YOU will determine your success in this course.

I have put together a multi-faceted summer assignment to help prepare you for what will be a very challenging, yet rewarding, experience. It is expected that you will complete this (and all) assignments in order to prepare for the AP exam in May. We will *not* be spending class time reviewing this summer assignment; rather, the purpose is for you to introduce yourself to me (Part I), gain some new insights and perspectives on how others internalize biology (Part II) and to re-visit the material taught in your previous science and math courses (Part III). Lastly, you will be asked to sign an "Ethics Pledge" to verify that you understand the expectations of these, and future, assignments (Part IV).

It is recommended that you purchase an AP Biology study guide (such as "*Cracking the AP Biology Exam*" from The Princeton Review or Barron's "*AP Biology*"). There are many different books out there and most contain similar information so find one that you like!

Below you will find the AP Biology Summer Assignment(s):



☺ **PART I: Send me an Introductory Email!** I would like to know a little about who you are, so your first assignment is to send me an email. Yes, that's it- your first AP Biology grade will be sending me an email (if only all of the grades were this easy ☺!) I will reply so you have electronic record that your assignment was received. Here is what I would like you to email me at okladekj@warrenhills.org by **August 15th 2016**. It should include the following:

Subject Line: Your name, AP Biology 16-17

Body of email:

- Your full name (& nickname that you go by if you have one) & information about you, such as:
- Who was your last Biology teacher? What class was it?
- Was there anything that you liked or disliked about your earlier biology class?
- What other science classes have you taken? With whom?
- What sciences are planning to take next year (or are you graduating)?
- What do you like to do (hobbies, sports, music, interests, etc.)?
- What are you looking forward to the most in AP Biology?
- What are you most anxious about in AP Biology?
- Why are you taking AP Biology? What do you hope to accomplish/gain?

Please be thorough and honest in your responses so that I can figure out the best way to help you next year ☺. Just a word of advice…I am your teacher, NOT your "BFF" or "FB friend", so please remember to use proper salutations, phrasing, etc.

☺ **PART II: Choose a book from attached list and create a typed reader response. It will be graded and is due on your first day of class!**

Your task: With the book you choose, create a typed reader response to what you have read. Basically, bridge a connection between the Big Ideas of AP Biology and your reaction to what the author has written.

Remember that this is a college-level class, so DO NOT use a low-level approach of just writing: "I liked this book because it is so cool and the ending made me really think about the world of biology," or "I hated it because it was stupid/boring, and had nothing at all to do with my life."

In writing a response you may assume the reader has already read the text. Thus, do NOT summarize the contents of

the text at length, as I've already read the book. Instead, take a systematic, analytical approach to the text.

How to write a reader response: First of all, be sure to mention the title of the work to which you are responding, the author, and the main thesis or ideas of the text. Then answer ALL of the questions below.

a. What does the text have to do with the Four Big Ideas of AP biology? Use evidence from the book and relate the content to one or more of the 4 BIG IDEAS in Advanced Placement Biology (** read attachment titled "*AP Biology Big Ideas, Enduring Understandings & Science Practices*" to gain a stronger understanding of what each Big Idea entails).

b. What did you learn and how much were you challenged by this text, if at all? Give examples to support this.

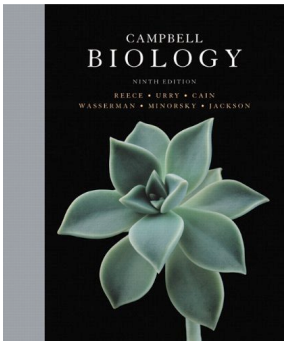
c. How well did you enjoy the text (or not) as fact, entertainment or as a work of art? Use quotes or examples to illustrate the quality of the text as art or entertainment. ** Of course, be aware that some texts are meant to be strictly informational, but done so in a creative way.

d. To sum up, what is your overall reaction to the text? Would you read something else like this, or by this author, in the future or not? Why or why not? To whom would you recommend this text?

Reminder… this project will be graded and is due on your first day of class! Also, be sure to keep a copy for yourself ☺

☺ **PART III: Science/Math Review.** Again, there will be no re-teaching of content that you should already know as a pre-requisite to be in this course. Complete the attached "Review". **It will be graded and is due on your first day of class!**

☺ **PART IV: Ethics Pledge**. Please complete, with all required signatures. **It, too, is due on your first day of class (and it is worth credit for doing so)!**



Recommendations:

- If you did not pick up a hard-copy text at the end-of-year meeting, you may have online access by following these simple instructions:
  - 1. Go to: www.PearsonSchool.com/Access
  - 2. Select the link that matches your Student Code.
  - 3. Select the title of your textbook from the *Covered Titles* drop down menu. (Your text is Campbell, Biology 9th edition)
  - 4. Follow screen instructions to register your code & create login name & password. Your **Student Access Code** is: **SSNAST - CLINK - YOGIC - NEMAN - TAROT – NONES**
- If the above does not work, try these steps:

- Log on to: http://www.pearsonmylabandmastering.com/northamerica/masteringbiology/
- Select the **student link** under "register now" .
- Select your location (in US or Canada)
- Select "Yes, I have an access code"
- Create an account with your email address and password and enter the following access code: SSNAST - CLINK - YOGIC - NEMAN - TAROT – NONES

*****FYI... Access to this text is NOT needed to complete your summer assignment!*****

Also, I would re-familiarize yourself with the following "biology basics", as they will not be re-taught as part of this course:

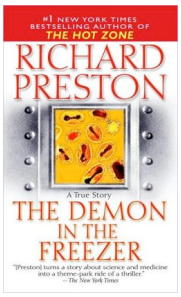
- Basic general chemistry (protons, electrons, neutrons, atomic mass, atomic number, bonding patterns, periodic table interpretation, etc.).
- Scientific Method (steps and functions, processes).
- Cytology (cell organelle structure, function and location).
- Basic math skills and problem-solving using algebra and stoichiometry skills.

Please contact me with questions pertaining to the summer assignment at okladekj@warrenhills.org. I will try to address your concerns as promptly as possible! **I am looking forward to working with each of you next year as we explore the in-depth world of Biology.**

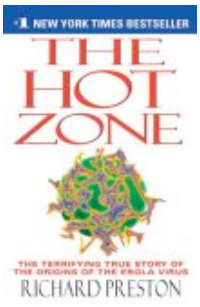
Have a wonderful 

!!!

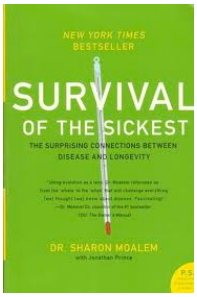
Reader Response Choices (book descriptions and pictures compliments of Barnes and Noble)



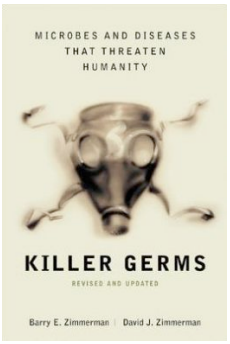
1. The Demon in the Freezer: A True Story by Richard Preston (http://www.barnesandnoble.com/w/demon-in-the-freezer-richard-preston/1101316239?ean=9780345466631) ISBN-13: 9780345466631



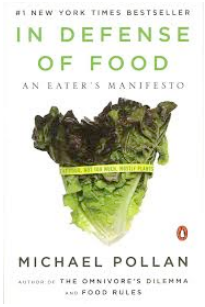
2. The Hot Zone by Richard Preston (http://www.barnesandnoble.com/w/the-hot-zone-richard-preston/1120492908?ean=9780385479561) ISBN-13: 9780385479561



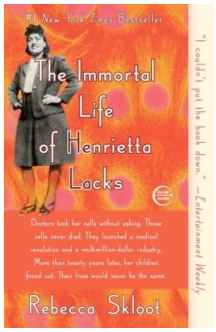
3. Survival of the Sickest: The Surprising Connections between Disease and Longevity by Sharon Moalem (http://www.barnesandnoble.com/w/survival-of-the-sickest-sharon-moalem/1100552536?ean=9780060889661) ISBN-13: 9780060889661



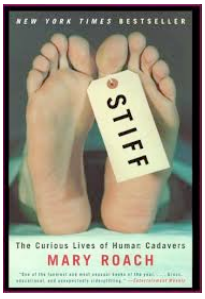
4. Killer Germs: Microbes and Diseases that Threaten Humanity by Barry Zimmerman (http://www.barnesandnoble.com/w/killer-germs-barry-zimmerman/1102880622?ean=9780071409261) ISBN-13: 9780071409261



5. In Defense of Food: An Eater's Manifesto by Michael Pollan (http://www.barnesandnoble.com/w/in-defense-of-food-michael-pollan/1102239989?ean=9780143114963) ISBN-13: 9780143114963



6. The Immortal Life of Henrietta Lacks by Rebecca Skloot (http://www.barnesandnoble.com/w/immortal-life-of-henrietta-lacks-rebecca-skloot/1016568374?ean=9781400052189) ISBN-13: 9781400052189



7. Stiff: The Curious Lives of Human Cadavers by Mary Roach (http://www.barnesandnoble.com/w/stiff-mary-roach/1101998814?ean=9780393324822)

ISBN-13: 9780393324822

Name _____

Part III . Science and Math Review: Complete the following questions using basic math skills. Be sure to SHOW ALL WORK to receive full credit, as this will be a graded assignment due on the 1st day of class.

Experimental Design Practice:

1. Biologist Jill Okladek, and her colleagues, Alexandra Helle, Elizabeth Nicolosi, and Jesse Damiano investigated the effects of the herbicide Round Up on sexual development in amphibians. In their experiments, they exposed each group of tadpoles to a specific amount of Round Up, and they repeated each experiment multiple times for each treatment. Their observations suggested that amphibians exposed to Round Up early in life developed multiple gonads, mixed gonads or became de-masculinized as a result.

In experiment 1, tadpoles were exposed to Round Up at nominal concentrations of .001, .01, .1, 1.0, 10.0, and 25.0 parts per billion (ppb). Concentrations were confirmed by two independent laboratories (WHRSH Bio Lab Corp and the Okladek Genomic Laboratory,). All stock solutions were made in ethyl alcohol (ethanol) (10 ml), mixed in 20-gallon containers, and dispensed into treatment tanks. Control groups were treated with ethanol such that all tanks contained 0.004% ethanol. Water was changed and treatments were renewed once every 3 days. Each treatment was replicated 3 times with 30 amphibians per replicate (total of 90 animals per treatment) in both experiments. All treatments were systematically rotated around the shelf every 72 hours to ensure that no one treatment or no one tank experienced position effects. Experiments were carried out at 22°C with amphibians under a 12-h light/12-h dark cycle.

Every quality experiment has several well-defined experimental design elements. Identify these elements found in the Round UP experiment.

Independent Variable: _____

Range of the Independent Variable: _____

Dependent Variable(s): _____

Control Group: _____

Experimental Group: _____

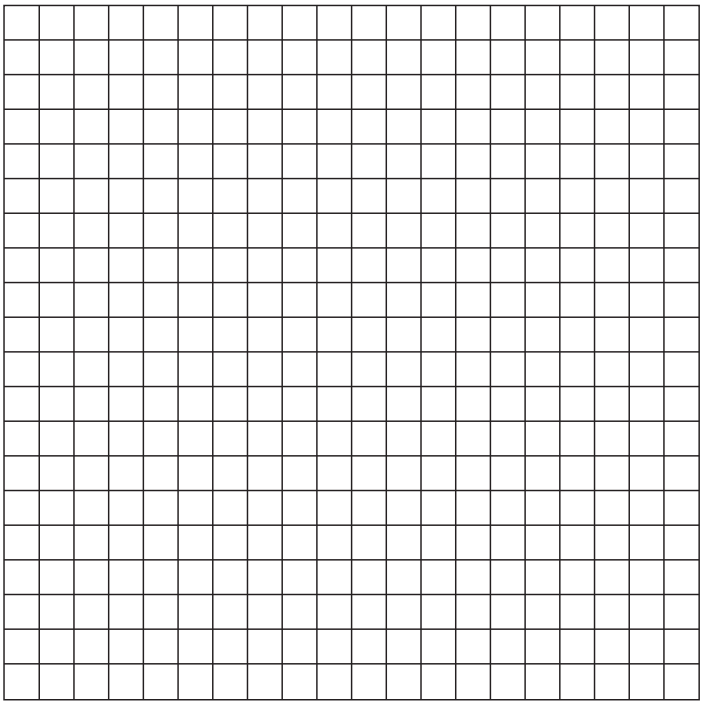
Control Variable(s): _____

_____

Repeated Trials: _____

2. Using the information below, create a graph that reflects how temperature affects the rate of transpiration in plants. Be sure to include all necessary components (title, proper labels, etc.)

Temperature (°C)	20	23	27	28
Transpiration Rate ($mmol/m^2.sec$)	1.5	3	5	4.5

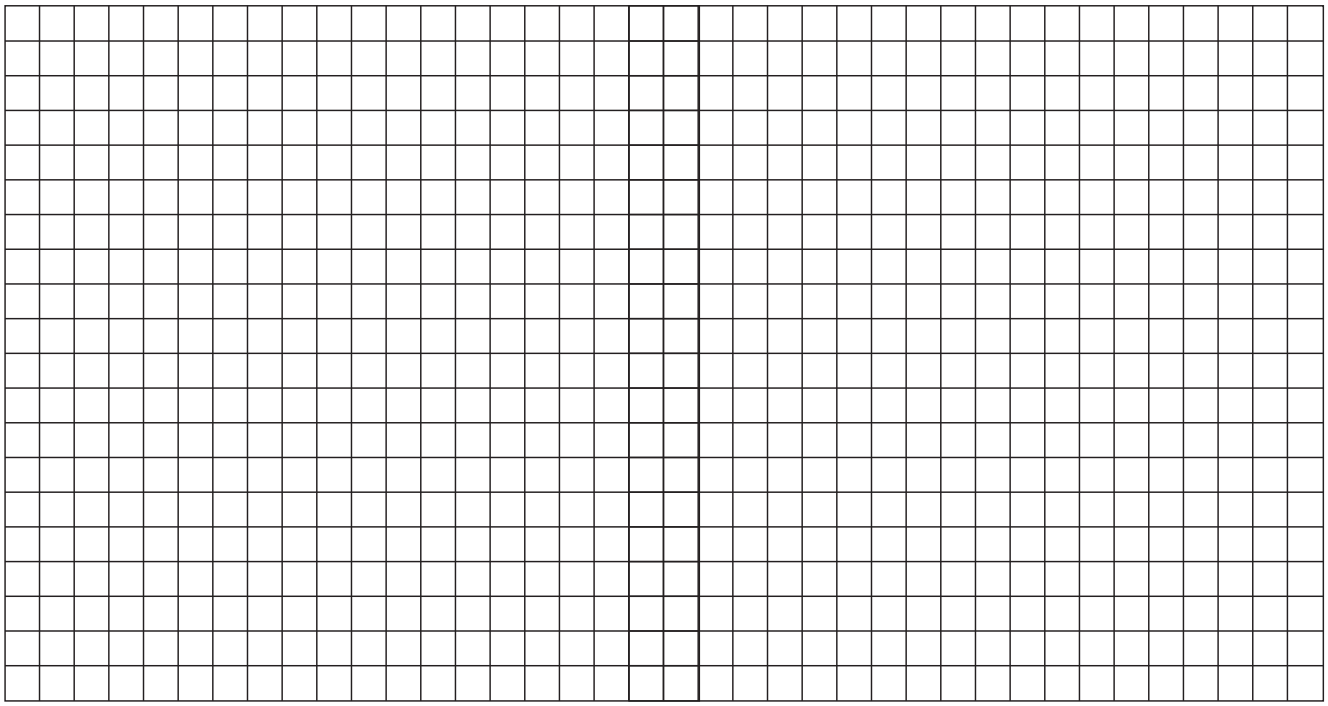


3. Create a graph to reflect the following data: One hundred and fifty juvenile sea stars were placed into various temperatures of water to see the effects of temperature on growth rate.

Water Temperature (°C)	Number of developing sea stars
15	72
20	92
25	120
30	140
35	99
40	72
45	36
50	12
55	0

- What is the dependent variable? _____
- What is the independent variable? _____
- What is the optimum temperature for sea star development? _____
- What is the mean number of sea stars per sample? _____

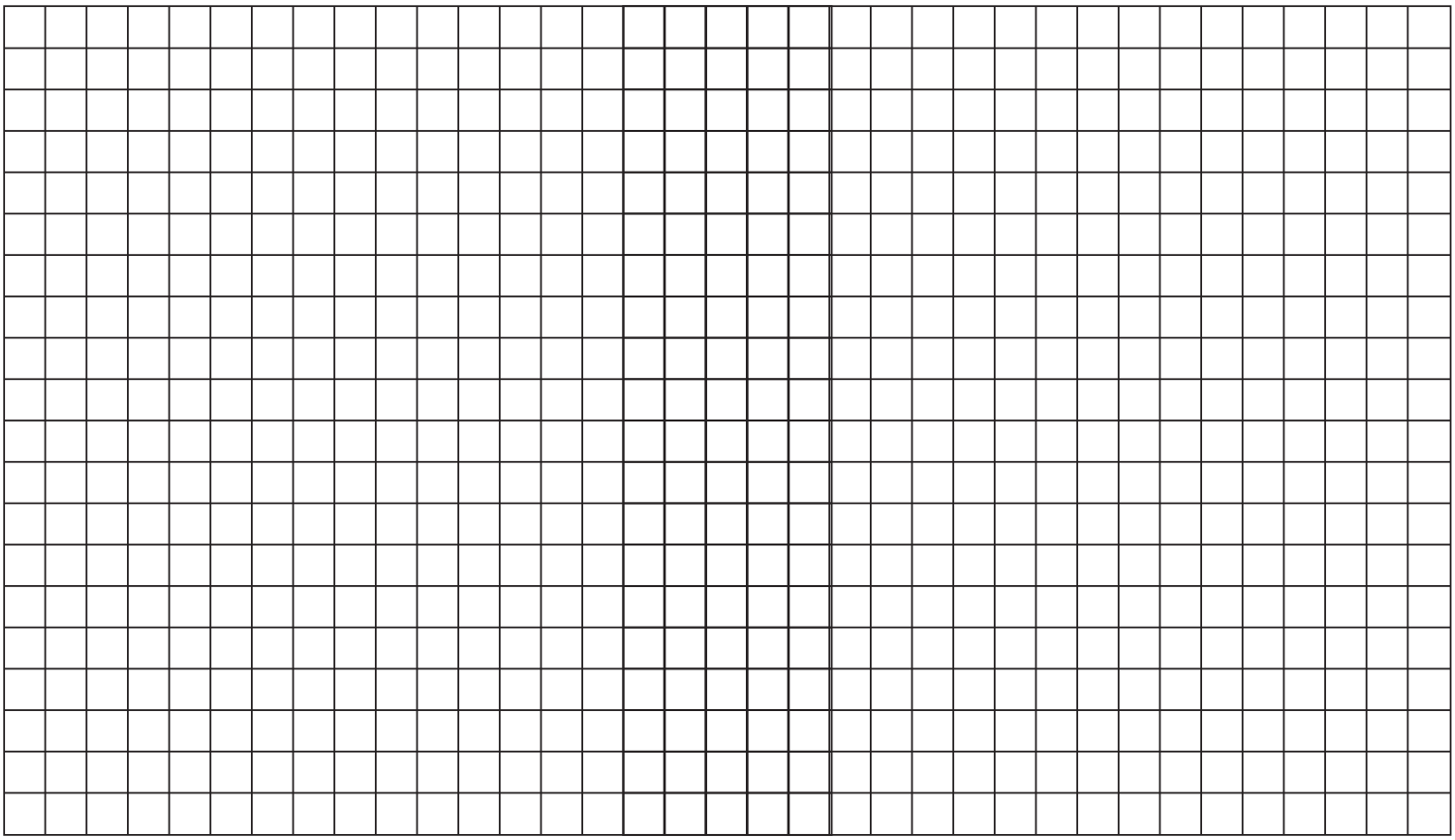
Again, be sure to include all components necessary to create a proper graph to receive full credit.



3. Using the sample data below, graph the rate of temperature change over time in unthawing embryonic stem cells . Again, be sure to include all components necessary to create a proper figure to receive full credit.

Time (minutes)	Temperature (°C)
2	-4
4	-3
6	-1
8	0
10	0
12	0
14	0
16	2

18	3
20	5
22	8
24	12
26	15
28	18
30	27



Math/Chem/Bio Practice

AP Biology requires regular integration of basic algebra skills and statistical concepts. Attached to this assignment is the AP Biology Equation sheet that will be accessible to students during all assessments, including the AP Biology Exam in May. Students should familiarize themselves with this equations and formula sheet. Students are not expected to understand all of the calculations shown on the AP Biology Equation sheet at this point, however concepts such as conversions, surface area and volume ratio, pH concentration and probability should all be familiar concepts at this point in your academic career.

Be sure to show all work to receive credit.

1. An experiment requires 800 ml of solution. How many liters is this equal to?

The same experiment must be kept under experimental conditions for 11.85 hours. How long is this experiment in minutes?

2. Assume you observe a cell measuring 100 μm. How many of these cells would you have to stack on top of each other to make the stack as tall an athlete who is 4 m tall?

3. How many 10 μm prokaryotic cells would be needed to meet the same objective?

4. How many 1 mm cells would it take to equally fit inside 1 kilometer sized cell?

5. Suppose a tree is 6.5 m tall. How many 1 nanometer cells would it take to reach the height of this tree?

6. Calculate the surface area to volume (SA:V) ratio for a cube whose dimensions are typical of a eukaryotic cell- 0.5mm on a side. Be sure to include proper units!

a. Area of 1 side

b. Surface area of cube

c. Volume of cube

d. SA: V ratio

7. Complete the following table. Be sure to reduce the SA:V ratio to its simplest form!

Model	Dimensions of Cube (cm)	Surface area (cm^2)	Volume (cm^3)	SA: V
1	1 cm each side			
2	2 cm each side			
3	3 cm each side			
4	4 cm each side			

a. Which model above has the largest surface area? _____

b. Which model above has the largest volume? _____

c. Which model above has the greatest surface area to volume ratio? _____

d. Based on these observations, what can you can you conclude about the surface area to volume ratio as cell size increases? _____

8. Calculate the pH using the information given below. Write out the formula and round to the nearest tenth.

a. $[H^+] = 2.6 \times 10^{-3} M$

b. $[H^+] = 1.5 \times 10^{-14} M$

9. Calculate the pH using the information given below. Write out the formula and round to the nearest tenth.

a. $[OH^-] = 7.3 \times 10^{-4} M$

b. $[OH^-] = 3.3 \times 10^{-9} M$

10. Assume you have two solutions labeled solution X and solution Y. Solution X has a pH of 3.50 and solution Y has a pH of 5.00 - How many times more acidic is solution X than solution Y? Support your answer with calculations.

11. What is the pH of a 0.0154M solution of hydrochloric acid (HCl).

12. What is the pOH of a 0.0245M solution of hydrochloric acid?

13. Using calculations to support your answer, explain why a solution with a concentration of $1.00x10^{-7}$ is said to be neutral.

14. A man and a woman have 5 children, all of whom are females. What is the probability that the sixth child will be also be a female? Show your work with a Punnett Square.

15. Color blindness is an X-linked recessive disorder. Assume a heterozygous woman marries a man without this disorder. What is the probability that a son will have color blindness? A daughter? Support each answer with a Punnett square.

16. A woman with blue eyes has a son with brown eyes. This son marries a woman with brown eyes whose father had blue eyes. Assuming brown eyes is the phenotype expressed by the presence of a dominant allele and blue eyes is strictly recessive, determine the probability that the couple's child will have blue eyes. Support your answer with a Punnett square.

17. You have two bags. Each bag contains three red blocks and two green blocks. What is the probability of selecting a red block from one of the bags?

What is the probability of selecting a red block from the first bag and a green block from the second bag?

What is the probability of selecting a green block from each bag?

18. Consider a six-sided dice.
What is the probability of rolling a "5" on the first and second rolls?

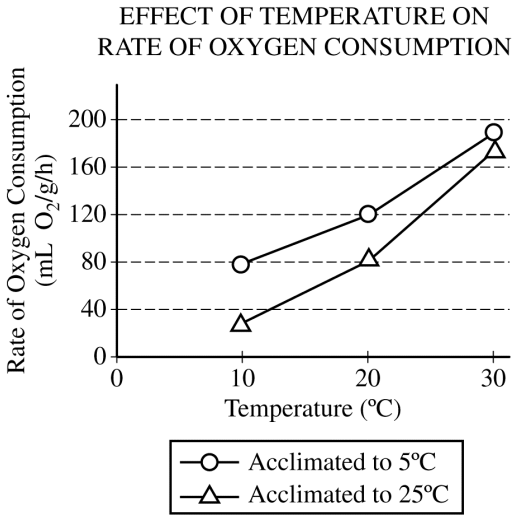
What is the probability that you will roll a "3" on the first dice and a "4" or "5" on the second dice?

19. Consider the cross of a heterozygous male cat with a homozygous recessive female cat.

What is the probability that the offspring will be heterozygous? Support your answer with a Punnett Square.

What is the probability the offspring will be homozygous recessive? Support your answer with a Punnett Square.

20. What is the rate of increase in O_2 consumption for organisms acclimated to 5°C as the temperature increases from 10°C to 30°C.? Provide your answer in mL O2/g/h/°C to the nearest tenth. ***hint... you might want to use some basic algebra to find this answer!



21. Two gene loci, *A* and *D* are independently assorted (not linked). Alleles *A* and *D* are dominant and alleles *a* and *d* are recessive alleles. Indicate the probabilities of producing the following crosses. Present your answer as a fraction and be sure to show all work to receive full credit.

- An *AD* gamete from an *AaDd* individual?

- An *AD* gamete from an *AADd* individual?

- An *AADD* zygote from a cross *AaDd X AaDd*?

- An *AaDd* zygote from a cross *AaDd X AADD*?

- An *Aadd* zygote from a cross *AaDd X AAdd*?

- An *AD* phenotype from a cross *AaDd X AaDd*?

- An *AD* phenotype from a cross *aadd X AADD*?

- An *aD* phenotype from a cross *AaDd XAaDD*?

22-25. Two independently assorting loci, *a* and *b*, control coat color in rabbits. Rabbits that are homozygous for recessive *b* cannot synthesize pigment and thus, have white hair (albino). Rabbits that are homozygous for a have completely black hair. Biologists hypothesize that the a locus is involved with melanin production because when *aa* is the genotype, melanin is distributed throughout the hair, but when *A* is present, the melanin only gets distributed through parts of the hair, resulting in a grayish color known as "agouti". No color can occur when a rabbit has albinism (*bb*) even if the alleles *A* or *a* are present. Suppose a black rabbit *(BBaa)* is mated with a white rabbit *bbAA*. What is the phenotypic ratio for the F2 generation? Present your answer for the F2 generation as fractions and show their placement on a dihybrid cross with either color or symbols.

Parental generation (P): Black (*BBaa*) X Albino (*bbAA*)

F1 generation: Agouti X Agouti

F2 generation: _____ X _____

_____ Agouti

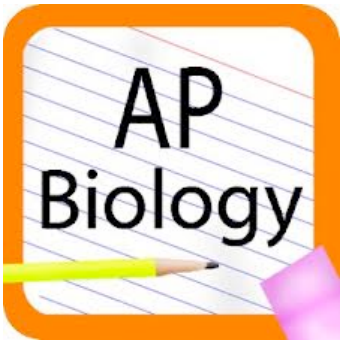
_____ Black

_____ Albino

How did you do on these "Basics"?
Ready to start AP Bio ?

AP BIO 2016-2017

Part IV. Summer Assignment Ethics Pledge



By signing below, I certify that:

- I understand the meaning of plagiarism. If I am unclear on what it means to plagiarize, I will watch "A Quick Guide to Plagiarism" by cfccnc on YouTube at https://www.youtube.com/watch?v=VnTPv9PtOoo

- I have completed ALL of the 2016-2017 AP Biology Summer Assignment on my own and it is written in my own words. None of the assignment has been copied, in whole or in part, from any other source, including other students currently in the course or from students who have previously taken this course.

- I understand that if caught plagiarizing on this assignment, or any future assignment, my overall grade will be "0".

- I understand that I have the entire summer to complete this assignment and that Part I was due by August 15th, 2016 and Parts II- IV are due on the 1st day of class.

- I understand that "late work" policy is that 10% will be automatically deducted off the total score for work that is turned in 1 day late and that 20% will be deducted if work is turned in 2 days late... beyond two days late, my score will be a "0".

- I understand that if I had any questions over the summer I could have emailed Mrs. Okladek at okladekj@warrenhills.org for help.

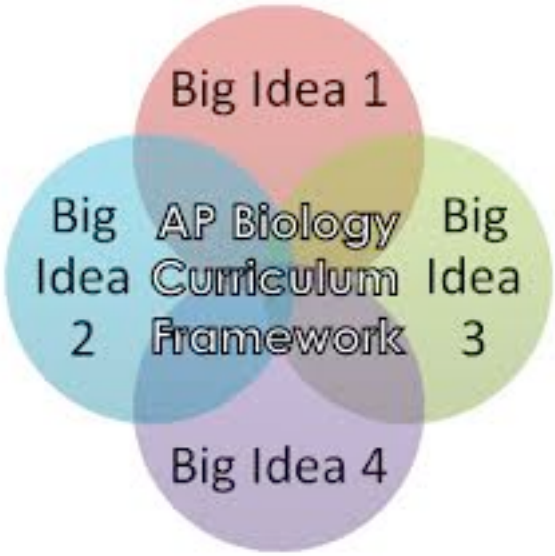
- I understand this course is equivalent to a college course and the notes, tests, pacing, labs, etc. will be treated as such.

Student Name (Printed): _____

Student Signature: _____

Parent/Guardian Signature(s): _____

AP Biology Big Ideas, Enduring Understandings & Science Practices



BIG IDEA 1: The process of evolution drives the diversity and unity of life.

- **Enduring Understanding 1.A. Change in the genetic makeup of a population over time is evolution.**

  1.A.1 Natural selection is a major mechanism of evolution.

  1.A.2 Natural selection acts on phenotypic variations in populations.

  1.A.3 Evolutionary change is also driven by genetic drift and artificial selection.

  1.A.4 Biological evolution is supported by evidence from many scientific disciplines.

- **Enduring Understanding 1.B. Organisms are linked by lines of descent from common ancestry.**

  1.B.1 Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.

  1.B.2 A phylogenetic tree and/or a cladogram is a graphical representation (model) of evolutionary history that can be tested.

  1.B.3 Non-eukaryotes can transfer genetic information laterally through the mechanisms of transformation, transduction and conjugation; most eukaryotes do not transfer information laterally.

- **Enduring Understanding 1.C. Life continues to evolve within a changing environment.**

- **Enduring Understanding 1.D. The origin of living systems is explained by natural processes.**

  1.D.1 There are causal models about the origin of life on Earth.

  1.D.2 Evidence from many different scientific disciplines supports models of the origin of life.

BIG IDEA 2: Biological systems utilize energy and molecular building blocks to grow, to reproduce, and to maintain homeostasis.

- **Enduring Understanding 2.A. Growth, reproduction, and maintaining organization of living systems require energy and matter.**

2.A.3. Organisms must exchange matter with the environment to grow, reproduce, and maintain organization.

2.A.4. Programmed cell death (apoptosis) plays a role in development and differentiation, allows molecules to be reused, and helps maintain homeostasis within a biological system.

- **Enduring Understanding 2.B. Growth, reproduction, and homeostasis require that cells create and maintain internal environments that are different from their external environments.**

  2.B.1. Cell membranes are selectively permeable due to their structure.

  2.B.2. Growth and homeostasis is maintained by the constant movement of molecules across membranes.

  2.B.3. Eukaryotic cells maintain internal membranes that partition the cell into specialized regions.

- **Enduring Understanding 2.C. Organisms use feedback mechanisms to regulate growth and maintain homeostasis.**

  2.C.1. Positive feedback mechanisms amplify responses and processes in biological organisms.

  2.C.2. Organisms use negative feedback mechanisms to maintain their internal environments and respond to external environmental changes.

  2.C.3. Organisms constantly respond to changes in their external environments.

- **Enduring Understanding 2.D. Growth and homeostasis of a biological system are influenced by changes in the system's environment.**

  2.D.1. All biological systems from cells to populations, communities, and ecosystems are affected by complex biotic and abiotic interactions.

  2.D.2. Homeostatic mechanisms reflect both continuity due to common ancestry and divergence due to adaptation in different environments.

  2.D.3. Biological systems are affected by disruptions to their homeostasis.

  2.D.4. Plants and animals have a variety of chemical defenses against infections that affect homeostasis.

- **Enduring Understanding 2.E. Many biological processes involved in growth, reproduction, and homeostasis include temporal aspects.**

  2.E.1. Timing and coordination of several events are necessary for the normal development of an organism, and these events require regulation by multiple mechanisms.

  2.E.2. Timing and coordination of physiological events are regulated by multiple mechanisms

  2.E.3. Timing and coordination of behavior is regulated by several mechanisms.

BIG IDEA 3: Living systems store, retrieve, transmit, and respond to information essential to life processes.

- **Enduring Understanding 3.A. Heritable information provides for continuity of life.**

3.A.1 DNA, and in some cases RNA, is the primary source of heritable information.
3.A.2 In most eukaryotes, heritable information is passed to the next generation through mitosis or meiosis plus fertilization.
3.A.3 Mendelian genetics provides a basic understanding of the underlying causes of the pattern traits from parent to offspring.
3.A.4 The inheritance pattern of many traits cannot be explained by simple Mendelian genetics.

- **Enduring Understanding 3.B. Expression of genetic information involves cellular and molecular mechanisms.**
  3.B.1 Cells can be activated, produce new products, and retain their activated state through gene regulation
  3.B.2 A variety of intercellular and intracellular signal transmissions mediate gene expression.

- **Enduring Understanding 3.C. Transfer of genetic information may produce variation**.
  3.C.1 Changes in genotype can result in changes in phenotype.
  3.C.2 Biological systems possess multiple mechanisms that increase genetic variation.
  3.C.3 Viruses reproduce and can introduce genetic variation into their hosts.

- **Enduring Understanding 3.D Cells communicate by generating, transmitting, and receiving chemical signals.**
  3.D.1 Cell communication involves processes resulting from evolution that are shared common features.
  3.D.2. Cells communicate with each other through direct contact with other cells or from a distance *via* chemical signaling.
  3.D.3. Signal transduction pathways link signal reception with cellular response.
  3.D.4. Errors in normal signal transduction may alter cellular response.

- **Enduring Understanding 3.E. Transmission of non-heritable information results in changes within and between biological systems.**
  3.E.1. Organisms exchange information with each other in response to internal changes and external cues, which may change behavior.
  3.E.2. Multi-cellular animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce responses.
  3.E.3. Individuals can act on information and communicate it to others.

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BIG IDEA 4: Biological systems interact, and these interactions possess complex properties.

- **Enduring Understanding 4.A. Interactions within biological systems lead to complex properties**.

4.A.1. The subcomponents of a biological polymer and their sequence determine the properties of that polymer.
4.A.2. Interactions of subcellular structures, including a repertory of eukaryotic organelles possessing specialized functions, provide essential cellular functions and activities.
4.A.3. Interactions between external stimuli and gene expression result in specialization of cells, tissues, and organs.
4.A.4. Organisms exhibit complex properties due to interactions between their constituent parts.
4.A.5. Communities are composed of populations of organisms that interact in complex ways.
4.A.6. Interactions among living systems and with their environment result in the movement of matter and energy.

- **Enduring Understanding 4.B. Competition and cooperation are important aspects of biological systems.**
  4.B.1. Interactions between molecules affect their structure and function.
  4.B.2. Interactions between cells affect the fitness of the organism.
  4.B.3. Cooperative interactions within organisms increase efficiency in the use of energy and matter.
  4.B.4 Interactions between and within populations influence patterns of species distribution and abundance
  4.B.5 Global distribution of ecosystems changes substantially over time.

- **Enduring Understanding 4.C. Variation within biological systems affects interactions with the environment.**
  4.C.1. Variation in molecular units provides cells with a wider range of functions.
  4.C.2. Environmental factors influence the expression of the genotype in an organism.
  4.C.3. The level of variation in a population affects population dynamics.
  4.C.4. Diversity of species within an ecosystem may influence the stability of the ecosystem

The redesign of AP science courses and exams focuses on seven overarching practices that capture important aspects of the work of scientists. Science practices describe the knowledge and skills that students should learn and demonstrate to reach a goal or complete a learning activity.

Science Practice 1

- The student can use representations and models to communicate scientific phenomena and solve scientific problems.

Science Practice 2

- The student can use mathematics appropriately.

Science Practice 3

- The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.

Science Practice 4

- The student can plan and implement data collection strategies in relation to a particular scientific question. (Note: Data can be collected from many different sources, e.g., investigations, scientific observations, the findings of others, historic reconstruction and/or archived data.)

Science Practice 5

- The student can perform data analysis and evaluation of evidence.

Science Practice 6

- The student can work with scientific explanations and theories.

Science Practice 7

- The student is able to connect and relate knowledge across various scales, concepts and representations in and across domains.

AP BIOLOGY EQUATIONS AND FORMULAS

STATISTICAL ANALYSIS AND PROBABILITY

Standard Error	Mean
$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$	$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$
Standard Deviation	**Chi-Square**
$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$	$\chi^2 = \sum \frac{(o-e)^2}{e}$

s = sample standard deviation (i.e., the sample based estimate of the standard deviation of the population)

$\bar{x}$ = mean

n = size of the sample

o = observed individuals with observed genotype

e = expected individuals with observed genotype

Degrees of freedom equals the number of distinct possible outcomes minus one.

CHI-SQUARE TABLE

	Degrees of Freedom							
p	1	2	3	4	5	6	7	8
0.05	3.84	5.99	7.82	9.49	11.07	12.59	14.07	15.51
0.01	6.64	9.32	11.34	13.28	15.09	16.81	18.48	20.09

LAWS OF PROBABILITY

If A and B are mutually exclusive, then P (A or B) = P(A) + P(B)

If A and B are independent, then P (A and B) = P(A) x P(B)

HARDY-WEINBERG EQUATIONS

$p^2 + 2pq + q^2 = 1$

$p + q = 1$

p = frequency of the dominant allele in a population

q = frequency of the recessive allele in a population

METRIC PREFIXES

Factor	Prefix	Symbol
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Mode = value that occurs most frequently in a data set

Median = middle value that separates the greater and lesser halves of a data set

Mean = sum of all data points divided by number of data points

Range = value obtained by subtracting the smallest observation (sample minimum) from the greatest (sample maximum)

AP BIOLOGY EQUATIONS AND FORMULAS

RATE AND GROWTH

Rate

dY/dt

Population Growth

dN/dt=B-D

Exponential Growth

$$\frac{dN}{dt} = r_{max}N$$

Logistic Growth

$$\frac{dN}{dt} = r_{max}N\left(\frac{K-N}{K}\right)$$

dY= amount of change

t = time

B = birth rate

D = death rate

N = population size

K = carrying capacity

r_{max} = maximum per capita growth rate of population

Temperature Coefficient Q_{10}

$$Q_{10} = \left(\frac{k_2}{k_1}\right)^{\frac{10}{t_2 - t_1}}$$

Primary Productivity Calculation

mg O_2/L x 0.698 = mL O_2 /L

mL O_2/L x 0.536 = mg carbon fixed/L

t_2 = higher temperature

t_1 = lower temperature

k_2 = metabolic rate at t_2

k_1 = metabolic rate at t_1

Q_{10} = the *factor* by which the reaction rate increases when the temperature is raised by ten degrees

SURFACE AREA AND VOLUME

Volume of a Sphere

$V = 4/3\ \pi\ r^3$

Volume of a Cube (or Square Column)

V = l w h

Volume of a Column

$V = \pi\ r^2\ h$

Surface Area of a Sphere

$A = 4\ \pi\ r^2$

Surface Area of a Cube

A = 6 a

Surface Area of a Rectangular Solid

A = Σ (surface area of each side)

r = radius

l = length

h = height

w = width

A = surface area

V = volume

Σ = Sum of all

a = surface area of one side of the cube

Water Potential (Ψ)

Ψ = Ψp + Ψs

Ψp = pressure potential

Ψs = solute potential

The water potential will be equal to the solute potential of a solution in an open container, since the pressure potential of the solution in an open container is zero.

The Solute Potential of the Solution

Ψs = – iCRT

i = ionization constant (For sucrose this is 1.0 because sucrose does not ionize in water.)

C = molar concentration

R = pressure constant (R = 0.0831 liter bars/mole K)

T = temperature in Kelvin (273 + °C)

Dilution – used to create a dilute solution from a concentrated stock solution

$C_iV_i = C_fV_f$

i = initial (starting)

C = concentration of solute

f = final (desired)

V = volume of solution

Gibbs Free Energy

$\Delta G = \Delta H - T\Delta S$

ΔG = change in Gibbs free energy

ΔS = change in entropy

ΔH = change in enthalpy

T= absolute temperature (in Kelvin)

pH = – log [H+]

Name_____

Extra Science Review: It is expected that you will know the foundations of Biology prior to entering this course. As a non-graded review, please complete the following assignment:

I. Know the "Language of Biology"!

The main reason students find it difficult to understand Biology is because of all the "hard" to write, spell and read words. Actually, scientific vocabulary is a mix of small words that are linked together to have different meanings. If you learn the meanings of the little words, you'll find scientific vocabulary much easier to understand. Find the meaning to the following Greek/Latin root words- each meaning should only be one or two words long!
http://www.dictionary.com would be a great resource!

Word	Meaning
a / an	
meso	
leuco	
aero	
anti	
amphi	
aqua / hydro	
arthro	
auto	
bi / di	
bio	
cephal	
chloro	
chromo	
cide	
cyto	
derm	

Word	Meaning
Heme/hemo	
hyper	
hypo	
intra	
-itis	
lateral	
-logy	
-lysis	
-meter	
mono	
morph	
micro	
macro	
multi / poly	
-pod	
-phobia	
-philia	

haplo	
ecto (exo)	
endo	
epi-	
gastro	
genesis	
herba	
hetero-	
homo-	
ovo (ova)	
kary	
neuro	
soma	
saccharo	
primi / archea	
phyll	

proto-	
photo	
psuedo	
synthesis	
sub	
troph	
therm	
tri	
zoo, zoa	
-tropism	
-taxis	
-stasis	
zyg / zygous	
phago	
path / pathy	
sym / syn	

Once you have completed the above table, use it to develop a definition, **in your own words**, for each of the following terms. ***** Do NOT look up definitions!**

1. Chromosome: _____

2. Cytolysis: _____

3. Phagocytosis: _____

4. Heterotroph: _____

5. Spermatogenesis: _____

6. Biotic: _____

7. Abiotic : _____

8. Pathogen: _____

9. Psuedopod: _____

10. Hemophilia: _____

11. Endocystosis: _____

12. Herbicide: _____

13. Anaerobic: _____

14. Bilateral: _____

15. Autotroph: _____

16. Monosaccharide: _____

17. Archaebacteria: _____

18. Polymorphic: _____

19. Hypothermia: _____

20. Biogenesis: _____