

AP Biology Summer Assignment 2024

Dear AP Biology Students,

Welcome to AP Biology! I am excited to have you join the class and look forward to an engaging and enlightening year. To prepare for the upcoming course, you will be responsible for completing the following four assignments over the summer:

1. **Reading *The Immortal Life of Henrietta Lacks* by Rebecca Skloot and answering questions**
2. **Reading *Your Inner Fish* by Neil Shubin and answering questions**
3. **Completing Math Problems that are relevant to AP Biology**
4. **Binge Watching Nature Programs**

You will need to turn in various assignments at different times throughout the summer. Please make sure to check the due dates for each assignment and submit them on time to the appropriate teacher. All assignments should be submitted via OneDrive.

Book Availability:

- You can check out a copy of *The Immortal Life of Henrietta Lacks* by Rebecca Skloot from the school or you may purchase it on Amazon or Barnes & Noble.
- *Your Inner Fish* by Neil Shubin can be purchased on Amazon.

Important Notes:

- Detailed information about all assignments, including due dates and specific questions, can be found on my teacher website. <https://www.madison-schools.com/Domain/5625>
- Should you have any questions over the summer, feel free to contact me via email at swilson@madison-schools.com.

I am looking forward to meeting you all in August and embarking on this AP Biology journey together.

Best regards,

Ms. Sahara Wilson

AP Biology Teacher

Ridgeland High School

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AP Summer Assignment: The Immortal Life of Henrietta Lacks

DIRECTIONS

1. Read *The Immortal Life of Henrietta Lacks* By *Rebecca Skloot* and then answer the discussion questions from the Random House Reading Guide listed below.
2. Include your name, course, due date and title on top of assignment as your heading.
 - Prologue, Chapters 1-11 and #s 1-8 of Chapters 12-20 due by June 15th upload in the one drive.
 - #s 9-18 from Chapters 12-20, Chapters 21-36 and Overall Questions due by July 6th upload in the one drive.
3. Assignment must be typed (12 pt font) and answers should be clearly labeled & numbered for each chapter. Answer completely and in full sentences. Use good grammar and spelling (AP style) but be clear and concise; discussion should be in your own words even if page numbers are referenced.

Prologue: The Woman in the Photograph

1. What happens when there is a mistake during the process of mitosis?
2. According to Defler, how important was the discovery of HeLa cells?

Chapters 1-11

1. What did Howard Jones find “interesting” about Henrietta’s medical history? What does this finding suggest about Henrietta’s cancer?
2. How are different types of cancer categorized?
3. Summarize Dr. TeLinde’s position in the debate over the treatment of cervical cancer.
4. Explain how the development of the Pap smear improved the survival rate of women diagnosed with cervical cancer.
5. How did TeLinde hope to prove that his hypothesis about cervical cancer was correct?
6. Explain what an immortal cell line is.
7. Summarize the main obstacles Gey and his assistants faced in their effort to grow cells.
8. Where did the name “HeLa” come from?
9. What happened to the HeLa cells that Mary cultured?
10. What did Gey hope to accomplish with HeLa cells?
11. What did HeLa allow scientists to do for the first time?
12. How did the media react to Carrel’s announcement that he had grown immortal chicken heart cells?
13. What details suggest that Carrel’s claims about the immortal cell line were not scientifically sound?
14. After her initial round of treatment, what did Henrietta’s doctors assume about the effectiveness of the radium therapy?
15. Describe the progression of Henrietta’s cancer in the eight months between her diagnosis and her death.

Chapters 12-20:

1. Explain how a neutralization test is used to determine a vaccine’s efficacy.
2. What unusual characteristics of HeLa cells made them ideal for use in the polio vaccine trials?
3. Paraphrase the explanation of how a virus reproduces found on page 97. Why did the fact that HeLa cells are malignant make them particularly useful in the study of viruses?
4. Why was the development of methods of freezing cells an important scientific breakthrough?
5. Why did scientists want to be able to clone cells for research?
6. Explain the contribution that HeLa made to the emerging field of genetics.
7. Describe the experiment that Southam developed to test his hypothesis about HeLa.
8. What was the result of Southam’s first research study? Based on these results, did his hypothesis appear to be correct?

9. Based on the results of the second study, what two things did Southam believe that injections of HeLa cells might be able to do?
10. How did Southam justify his decision to inject HeLa cells into patients without their knowledge or consent?
11. Summarize the various ways that HeLa was used in the space program.
12. What disturbing discovery did scientists make about the way HeLa responded in orbit?
13. Explain what happens during somatic cell fusion.
14. What scientific discoveries were made possible as a result of fused hybrid cells?
15. How was Gartler able to link the contamination problem to HeLa?
16. What unique abilities did HeLa have that allowed it to contaminate cultures without researchers being aware that contamination had occurred?
17. Why would HeLa contamination be a problem for researchers?
18. What is “spontaneous transformation”? What did Gartler suggest about spontaneous transformation?

Chapters 21-36

1. What was the purpose of President Nixon’s National Cancer Act?
2. Why did advances in genetic research necessitate establishing the legal requirement that doctors or researchers obtain informed consent documentation prior to taking DNA samples from patients for research?
3. Describe the lawsuit that set a legal precedent for patenting biological “products” such as cell lines.
4. Summarize the pros and cons of giving patients legal ownership of their cells.
5. What was the Supreme Court of California’s decision regarding the Moore lawsuit? Summarize the reasoning behind the decision.
6. Explain how the human papillomavirus (HPV) causes cervical cancer.
7. Are scientists able to definitively explain why HeLa grew so powerfully?
8. Describe the contribution that HeLa has made to research on the HIV virus and the AIDS epidemic.
9. Explain Van Valen’s theory that HeLa cells are “no longer human.” Was his theory accepted by the scientific community?
10. Explain the Hayflick limit.
11. Why are HeLa cells able to live beyond the Hayflick limit?
12. Summarize Gary’s spiritual explanation for why Henrietta’s cells lived on after her death.

Overall Questions:

1. There is often a tension between religious faith and science. Explore the importance of both religious faith and scientific understanding in the lives of the Lacks family. How does religious faith help frame the Lackses’ response to, and interpretation of, the scientific information they receive about HeLa? How does Skloot’s attitude toward the relationship between religious faith and science evolve as a result of her relationship with the Lacks family?
2. Using the book as a guide, describe the process of scientific inquiry. Examine the often contradictory forces of altruism and profit as they influenced research related to HeLa. What are the risks and benefits of allowing profit to guide research? What are the obstacles involved with conducting research purely for altruistic reasons?
3. Create a time line that begins with the removal of Henrietta’s tissue sample and traces the scientific and medical breakthroughs that have been made possible as a result of HeLa cells. Explain how HeLa cells were used in each situation.

AP Biology Summer Assignment: Your Inner Fish

DIRECTIONS

1. Read *Your Inner Fish* by Neil Shubin and then answer the discussion questions listed below.
2. Include your name, course, due date and title on top of assignment as your heading.
 - Due on July 31st via upload to one drive.
3. Assignment must be typed (12 pt font) and answers should be clearly labeled & numbered for each chapter. Answer completely and in full sentences. Use good grammar and spelling (AP style) but be clear and concise; discussion should be in your own words even if page numbers are referenced.

DISCUSSION QUESTIONS

Chapter 1 - Finding Your Inner Fish

1. Describe the fossil Tiktaalik. Why does this fossil confirm a major prediction of paleontology?
2. Explain why Neil Shubin thinks Tiktaalik says something about our own bodies? (in other words – why the Inner Fish title for the book?)

Chapter 2 - Getting a Grip

1. Describe the “pattern” to the skeleton of the human arm that was discovered by Sir Richard Owen in the mid-1800s. Relate this pattern to his idea of exceptional similarities.
2. How did Charles Darwin’s theory explain these similarities that were observed by Owen?
3. What did further examination of Tiktaalik’s fins reveal about the creature and its’ lifestyle?

Chapter 3 - Handy Genes

1. Many experiments were conducted during the 1950s and 1960s with chick embryos and they showed that two patches of tissue essentially controlled the development of the pattern of bones inside limbs. Describe at least one of these experiments and explain the significance of the findings.
2. Describe the hedgehog gene using several animal examples. Be sure to explain its’ function and its’ region of activity in the body.

Chapter 4 - Teeth Everywhere

1. Teeth make great fossils - why are they “as hard as rocks?” What are conodonts?
2. Shubin writes that “we would never have scales, feathers, and breasts if we didn’t have teeth in the first place.” (p. 79) Explain what he means by this statement.

Chapter 5 - Getting Ahead

1. Why are the trigeminal and facial cranial nerves both complicated and strange in the human body?
2. What are Hox genes and why are they so important?
3. Amphioxus is a small invertebrate yet is an important specimen for study – why? Be sure to include characteristics that you share with this critter!

Chapter 6 - The Best Laid (Body) Plans

1. Early embryonic experiments in the 1800s led to the discovery of three germ layers. List their names and the organs that form from each.
2. What is meant by “ontogeny recapitulates phylogeny?”
3. What type of gene is Noggin and what is its function in bodies?
4. Sea anemones have radial symmetry while humans have bilateral symmetry but they still have “similar” body plans – explain...

Chapter 7 - Adventures in Bodybuilding

1. What is the most common protein found in the human body? Name it and describe it.

2. Explain how cells “stick” to one another; give at least one example.
3. How do cells (generally) communicate with one another?
4. What are choanoflagellates and why have they been studied by biologists?
5. What are some of the reasons that “bodies” might have developed in the first place? Include any environmental conditions that might have favored their evolution.

Chapter 8 - Making Scents

1. Briefly explain how we perceive a smell.
2. Jawless fish have a very few number of odor genes while mammals have a much larger number. Why does this make sense and how is it possible?

Chapter 9 - Vision

1. Humans and Old World monkeys have similar vision – explain the similarity and reasons for it.
2. What do eyeless and Pax 6 genes do and where can they be found?

Chapter 10 - Ears

1. An early anatomist proposed the hypothesis that parts of the ears of mammals are the same thing as parts of the jaws of reptiles. Explain any fossil evidence that supports this idea.
2. What is the function of the Pax 2 gene?

Chapter 11 - The Meaning of It All

1. What is Shubin’s biological “law of everything” and why is it so important?
2. What is the author trying to show with his “Bozo” example?
3. This chapter includes many examples of disease that show how humans are products of a lengthy and convoluted evolutionary history. Choose one (1) of the problems listed below and briefly explain how ancient ancestors’ traits still “haunt” us:
 - Obesity
 - Heart disease
 - Hemorrhoids
 - Sleep apnea
 - Hiccups
 - Hernias
 - Mitochondrial diseases

[http://media.collegeboard.com/digitalServices/pdf/ap/bio-manual/CB Bio TM APPENDIX A WEB.pdf](http://media.collegeboard.com/digitalServices/pdf/ap/bio-manual/CB_Bio_TM_APPENDIX_A_WEB.pdf)

for math formulas

AP Biology-Math Problems- **PRINT THIS DOCUMENT TO COMPLETE MATH PROBLEMS**

Complete the math problems below according to the follow schedule:

- Questions 1-4 and Multiple Choice Questions 1-5 due by June 30th via One Drive.
- Questions 5-9 and Multiple Choice Questions 6-10 due by July 31st via One Drive
- Questions 10-13 and Multiple Choice Questions 11-16 due on Friday August 2nd .

1. Include your name, course, due date and title on top of assignment as your heading.
2. Assignment must be typed (12 pt font) and answers should be clearly labeled & numbered.

Basics: There are many basic math skills that you must be able to do to work the more complex math problems in AP Biology.

1. **Working with decimals, ratios, fractions and percentages**
2. **Convert scientific notation to standard numbers**
3. **Report your answer with the number of significant figures that the question requires**

Decimals, Ratios, Fractions and Percentages - Example:

In a monohybrid cross, when two heterozygotes are crossed, the phenotypic ratio in the offspring is predicted to be in a 3:1 ratio; approximately 75% will show the dominant phenotype, and 25% will show the recessive phenotype.

Two heterozygotes produce 345 offspring

1. How many individuals are expected to have the dominant phenotype? _____

How many individuals are expected to have the recessive phenotype? _____

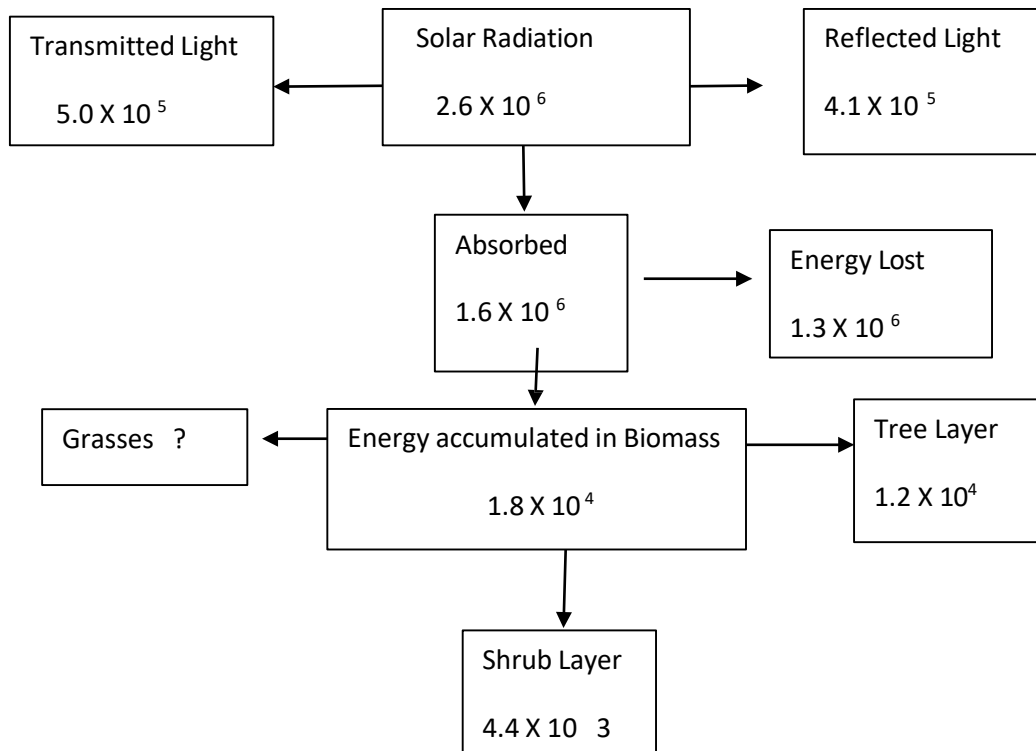
2. **The following data was observed; fill in the missing values.**

Stage of the Cell Cycle	Number of Cells in each stage	% of Cells in each stage
Interphase	62	
Prophase	31	
Metaphase	12	
Anaphase	8	
Telophase	4	

On the AP Biology exam, you will only be allowed to use a four function calculator. You will not be able to enter numbers using scientific notation. You must convert to standard numbers, then simply add or subtract (and maybe convert to percentages) to get the correct answer

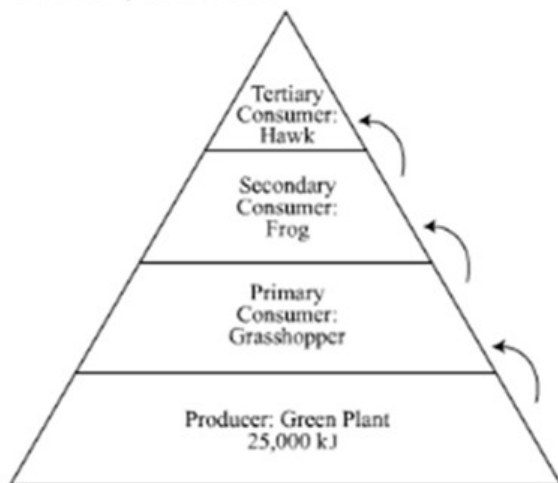
Energy Flow in a Hardwood Forest

What percentage of the biomass in the forest community represented is tied up in the grass layer which has a Question Mark?



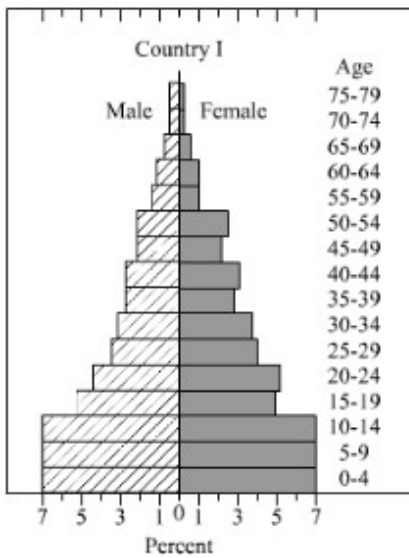
3. **What percentage** of the biomass in the forest community is tied up in the grass layer? Give your answer to the nearest whole number.

Here is a food pyramid that begins with producers and ends with tertiary consumers. If the producer level contains 25,000 kJ of energy and this pyramid follows the 10% rule, then how much energy gets transmitted to the tertiary consumers?

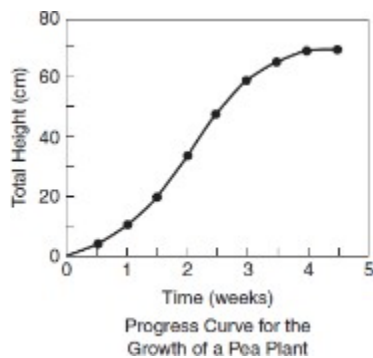


4. How much energy gets transmitted to the tertiary consumers? _____

Study this age structure diagram that shows the human population for India. What percent of the population is under 20?



5. _____



The graph shows the growth in cm of a pea plant over a period of 5 weeks. What was the mean growth rate per day between week 1 and week 3?

6. Give your answer to the nearest tenth.

Hardy-Weinberg Problems-

The Hardy-Weinberg formula is $p^2 + 2pq + q^2 = 1.0$

7. The allele for the hair pattern called “widow’s peak” is dominant over the allele for no “widow’s peak”. In a population of 100 individuals, 91 show the dominant phenotype.

What is the frequency of the dominant allele?

What is the frequency of the recessive allele?

How many individuals would you expect to be heterozygous for the trait?

Chi Square

8. A Cellular Biologist wants to double check that statement that cells spend 90 percent of their time in Interphase as compared to the various stages of Mitosis. She grows some *Allium* in her laboratory. She then takes one of the plants, cuts off the root tips, stains the DNA in the cells so as to be able to see the stages of the cell cycle. Her hypothesis states “If cells spend 90 percent of their time in Interphase, then she should be able to calculate the relative time existing between Interphase and Mitosis based upon the cells counted in her specimen.” She counted 1000 cells from her preserved specimen under the microscope. Her data are shown below. **Calculate the X^2 to the nearest hundredth.**

Stage of the Cell Cycle	Number of Cells Observed	Number of Cells Expected
Interphase	872	900
Mitosis	128	100

	Interphase	Mitosis	Total
Observed (O)	872	128	
Expected (E)	900	100	
Deviation (O – E)			
D ² (O-E) ²			
D ² / E (O-E) ² /E			

Chi Square = _____

In the Diffusion Lab, agar cubes are used to illustrate the relationship of surface area/volume/diffusion rate. Fill in the values missing in the table

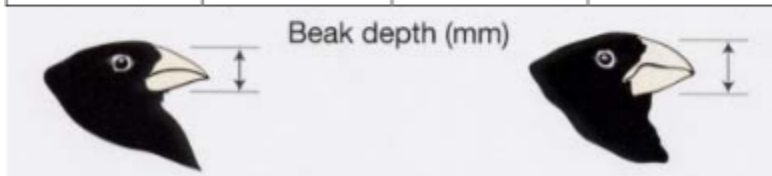
Block	cm x cm	Surface Area cm	Volume ml	Surface Area:Volume Ratio
A	2 x 2	24	8	3:1
B	3 x 3	54	27	2:1
C	4 x 4	96	64	1.5:1

You use this data to answer questions like this-

- Predict-** If you put each of the blocks into a solution, into which block would that solution diffuse throughout the entire block fastest? Slowest? How do you explain the difference?
- Describe the relationship between the surface area: volume ratio

A study was conducted on the island of Daphne Major in the Galapagos Islands by Peter and Rosemary Grant. This study lasted over 20 years. The study investigated how the type of seeds available to the finches impacted the depth of their beaks. In years when rain and water were plentiful, the available seeds were smaller and easy to crack. In years experiencing drought, fewer seeds were produced, and the finches had to eat the larger, leftover seeds produced from previous years. During years of drought, birds with a greater beak depth had a selective advantage.

Bird ID Tag Number	Wet Year Beak Depth (mm)	Bird ID Tag Number	Dry Year Beak Depth (mm)
1A	10.81	1B	11.02
2A	8.74	2B	9.65
3A	10.04	3B	11.75
4A	9.75	4B	10.22
5A	9.76	5B	9.86



Use the data above to determine the increase in the mean of the depth of the beak between the wet and dry years. Give your answer to the nearest hundredth of a millimeter.

11. _____

The mark and recapture method of estimating population size is used in the study of animal populations where individuals are highly mobile. It is of no value where animals do not move or move very little. The number of animals caught in each sample must be large enough to be valid.

- In the first capture, each animal that is captured is marked in a distinctive way.

2. The marked animals are released into the natural habitat and left for a period of time.
3. A second capture is done. Only a portion of the second capture sample will have marked animals.

$$\frac{\text{Number of animals in first sample (all marked)} \times \text{Total number of animals in 2}^{\text{nd}} \text{ sample}}{\text{Number of marked animals in the second sample (recaptured)}}$$

Total population =

12. 30 turtles are captured in 1 km², they are marked and released back into the wild. Two weeks later 30 more turtles are caught. 6 had the marking of the original population. Based on this information, what is the best estimation of the turtle population in the area?

There are 4 genes on a single chromosome: A, B, C and D. They exhibit the following crossing over frequencies:

- A-B = 35%
- B-C = 10%
- C-D = 15%
- C-A = 25%
- D-B = 25%

13. Determine the order of the genes on the chromosome_____

Multiple Choice

1. In a Hardy-Weinberg population with two alleles, A and a, that are in equilibrium, the frequency of the allele a is 0.7. What is the percentage of the population that is homozygous for this allele?

- a. 3
- b. 9
- c. 30
- d. 49

Questions 2-3 In a hypothetical population of 1,000 people, tests of blood-type genes show that 160 have the genotype AA, 480 have the genotype AB, and 360 have the genotype BB.

2. What is the frequency of the A allele?
 - a. 0.001
 - b. 0.002
 - c. 0.100
 - d. 0.400
3. What percentage of the population has type O blood?
 - a. 0
 - b. 10
 - c. 24
 - d. 48

Refer to the information below to answer the next questions

You are studying three populations of birds. Population 1 has ten birds, of which one is brown (a recessive trait) and nine are red. Population 2 has 100 birds. In that population, ten of the birds are brown. Population 3 has 30 birds, and three of them are brown. Use the following options to answer the questions:

- A. Population 1
- B. Population 2
- C. Population 3
- D. They are all the same.
- E. It is impossible to tell from the information given.

4. In which population is the frequency of the allele for brown feathers highest?

- a. A
- b. B
- c. C
- d. D

5. In which population would it be *least* likely that an accident would significantly alter the frequency of the brown allele?

- a. A
- b. B
- c. C
- d. D

6. One liter of a solution of pH 2 has how many more hydrogen ions (H^+) than 1 L of a solution of pH 6?

- a. 4 times more
- b. 400 times more
- c. 4,000 times more
- d. 10,000 times more

7. Starting with a fertilized egg (zygote), a series of five cell divisions would produce an early embryo with how many cells?

- a. 4
- b. 8
- c. 16
- d. 32

8. How many unique gametes could be produced through independent assortment by an individual with the genotype *AaBbCCDdEE*?

- a. 4
- b. 8
- c. 16
- d. 32

9. When crossing a homozygous recessive with a heterozygote, what is the chance of getting an offspring with the homozygous recessive phenotype?

- a. 0%
- b. 25%
- c. 50%
- d. 75%

10. Two true-breeding stocks of pea plants are crossed. One parent has red, axial flowers and the other has white, terminal flowers; all F_1 individuals have red, axial flowers. If 1,000 F_2 offspring resulted from the cross, approximately how many of them would you expect to have red, terminal flowers? (Assume independent assortment).
- 65
 - 190
 - 250
 - 565
11. Given the parents $AABBcc \times AabbCc$, assume simple dominance and independent assortment. What proportion of the progeny will be expected to phenotypically resemble the first parent?
- $1/4$
 - $1/8$
 - $3/4$
 - $3/8$
12. Huntington's disease is caused by a dominant allele. If one of your parents has the disease, what is the probability that you, too, will have the disease?
- 1
 - $3/4$
 - $1/2$
 - $1/4$
13. Cinnabar eyes is a sex-linked recessive characteristic in fruit flies. If a female having cinnabar eyes is crossed with a wild-type male, what percentage of the F_1 males will have cinnabar eyes?
- 0%
 - 25%
 - 50%
 - 100%
14. Cytosine makes up 38% of the nucleotides in a sample of DNA from an organism. Approximately, what percentage of the nucleotides in this sample will be thymine?
- 12
 - 24
 - 31
 - 38
15. To measure the population density of monarch butterflies occupying a particular park, 100 butterflies are captured, marked with a small dot on a wing, and then released. The next day, another 100 butterflies are captured, including the recapture of 20 marked butterflies. One would estimate the population to be
- 200.
 - 500.
 - 1,000.
 - 10,000.

16. A population of ground squirrels has an annual per capita birth rate of 0.06 and an annual per capita death rate of 0.02. Estimate the number of individuals added to (or lost from) a population of 1,000 individuals in one year.
- a. 120 individuals added
 - b. 40 individuals added
 - c. 20 individuals added
 - d. 400 individuals added

AP Biology Summer Assignment: Binge Watch Nature Programs

Directions:

For this part of your summer assignment, you will be familiarizing yourself with vocabulary that we will be using at different times throughout the year. On the next page is the list of terms.

1. Look over the vocabulary on the next page. Look up words you are not familiar with.
2. Then, watch episodes of BBC's "Life". There are 10 episodes. Watch as many as you can. They are on Amazon Prime for a small cost, and I believe, Discovery+ for free. Or you may watch "Our planet", "Life in Color", or "Life on our Planet" on Netflix, just be aware it may be more difficult to find your examples there.
3. As you watch, look for examples of the vocabulary on the next page. As you find them, jot them down.
4. You will need 20 examples. Each example is worth 2 points. One for the definition of the word, one for the example and the episode it was found in.

Example: If the vocabulary word was a modified leaf, a modified leaf of a plant is a leaf-like structure whose job is not photosynthesis like a normal leave. Tendrils are an example of a modified leaf. In episode 9, plants, Passion vine tendrils are seen wrapping around structures to help the plant reach light.

Do not use the same example more than once. Enjoy the episodes!

BIOLOGY VOCABULARY ASSIGNMENT TERMS

1. abiotic vs biotic factors
2. adaptation of an animal or plant
3. analogous structure
4. autotroph
5. batesian mimicry
6. biodiversity
7. carrying capacity
8. coevolution
9. commensalism
10. convergent evolution
11. detritivore
12. dispersion -Clumped, random, or uniform
13. divergent evolution
14. ectotherm vs endotherm
15. heterotroph
16. homologous structures
17. intersexual vs intrasexual selection
18. interspecific vs intraspecific competition
19. invasive species
20. keystone species
21. life histories -K-selected, r-selected
22. limiting factors -Density-dependent, density-independent
23. logistic growth
24. mullerian mimicry
25. mutualism
26. mycelium
27. mycorrhizae
28. natural selection
29. niche
30. parasitism
31. predation
32. saprophyte
33. spore
34. symbiosis