June, 2019

Dear Future AP Student and Parents or Guardians:

By selecting Advanced Placement Biology in the upcoming school year, you have shown your commitment to academic achievement. AP Biology is a full year course, designed for highly motivated students who have successfully completed both biology and chemistry. In addition, you should have completed physics or be enrolled in it, concurrently. Because AP Biology is comparable to a college undergraduate course in biology, much is expected from you in terms of time, energy and independent work.

You should be prepared to spend differing numbers of hours per week, as needed, outside of class to prepare for class. This may involve reading the text and outside sources and completing written assignments. How you decide to use the time or organize the time is up to you. You are expected to complete individual lab reports, keep a notebook and to demonstrate scientific literacy using articles from scientific periodicals. These written assignments, along with tests and quizzes, will be used to determine each marking period grade. Your grade is 50% tests and 40% labs and 10% other assignments.

As established by the College Board, the AP Biology curriculum is rigorous and demanding. This curriculum includes a set of mandatory lab experiments. To achieve this, the AP science courses have more class time than other courses. We meet every day and have one lab period in every four day rotation. The lab period is 1 ½ sessions long.

The textbook used is *Principles of Life, second edition*, a book used extensively nationwide. Because the entire text is not covered and it is so comprehensive, it is strongly recommended that you purchase a study guide, such as *Cliffs Notes AP Biology*. This will give you summaries for each of the topics, along with additional practice questions. This is a study guide recommended by AP Biology teachers across the country. The newest version follows the design of the course and will help you prioritize what you need to know. Versions prior to 2012 are out of date and do not reflect the current AP Biology curriculum.

The summer assignment is based on the nature of science, evolution and a little review of genetics, which you need for evolution and is assigned before the end of the current school year. This will be the launch point for our study of evolution which is where we will begin in September. Students are responsible for this work, which is due on the first day of school in September. Failure to turn in the assignment on time will have a negative impact on your grade and learning.

In May of each year, the AP exams are administered. Since college credit may be earned by successful completion of the exam, you may choose to participate. College credit is determined by the grade earned on the exam and the policy of the college concerning AP exams. The course follows the same timeline as other courses, with a final exam at the end of the school year .

If you have any questions or concerns, please contact me.

Thank you,

Mrs. Lucci

Mrs. Lucci (609) 737-4003, ext 1322 karenlucci@hvrsd.org

Welcome to AP Biology 2019--2020

To get you started in AP Biology, this year, I would like you to take some time to enjoy a book and, also, to look at evolution using a few different resources. Evolution is the first unit of the year and an ongoing theme throughout the course.

We are going to start of the year with a Socratic seminar about a book, *Remarkable Creatures*, by Dr. Sean B. Carroll (make sure you check the author). This books chronicles expeditions and important discoveries in natural history and how they have impacted our understandings of evolution. For the Socratic Seminar, you are to read the book and submit 3 thoughtful and discussion-worthy questions. I will send out a google form for you to submit the questions; the deadline for these questions is 11:59 pm, Wednesday, September 4, 2019. These questions will guide the Socratic seminar.

I would also like to watch two videocasts that were made by Paul Anderson, a former AP Biology teacher in Bozemans, MT. You may already know his work and videos as he as videos the cover the major topics in AP Biology as well as general biology and some chemistry and physics. His website is a great resource for you to use throughout the year.

Bozeman Biology *Natural Selection* http://www.bozemanscience.com/001-natural-selection

Evidence for Evolution http://www.bozemanscience.com/004-evidence-for-evolution

These videos are background information. Write a one paragraph summary of each video and submit that with the rest of your written work.

In your textbook, you should read chapter 18, ***The History of Life on Earth*** and review ***Genetics***, chapter 8 section 1, pages 150-158. For chapter 18, complete the attached study guide. Also, complete the multiple choice questions by filling in the scantron..

Everything you hand in is assessed for accuracy. If it is late, there were will be an automatic point deduction.

I am available most of the summer at my school email (karenlucci@hvrsd.org). Please email me if you have any questions.

We are going to have an excellent year! I am looking forward to working with all of you.

In the meantime, enjoy your summer!

Name_____Date_____AP Biology

Summer Assignment Multiple Choice

Answer these questions after completing the textbook assignment,

1. The primary reason that dragonflies grew so much larger 300 million years ago than they do today is that
a. they lacked predators then.
b. they were able to exploit an aquatic niche that no longer exists.
c. there was more oxygen in the air then.
d. there was more nitrogen in the air then.
e. Earth was much colder then.

2. Humans and chimpanzees diverged from each other about 6 million years ago. Therefore, of the total time that life has been on Earth, humans and chimpanzees have been separate species for about _____ percent of the time.
a. 0.15
b. 0.75
c. 1.5
d. 3
e. 7.5

3.Fossils that are one hundred million years old date from the _____ period.
a. Devonian
b. Cambrian
c. Jurassic
d. Silurian
e. Cretaceous

4. In undisturbed sedimentary rock, strata from the _____ are immediately below rocks from the Ordovician.
a. Cambrian
b. Devonian
c. Jurassic
d. Silurian
e. Cretaceous

5. Which process led to the formation of coastal mountain ranges?
a. The mantle pushing against a tectonic plate
b. Tectonic plates moving sideways past one another
c. Magma pushing plates apart
d. One tectonic plate sliding under another
e. A single tectonic plate folding upon itself

6. Why are assemblages of fossils seen in successive geological periods so different?
a. Rapid continental drift has altered the positions of continents such that the strata represent different locations on Earth.
b. Rapid bursts of evolution have occurred due to changes in oxygen concentrations.
c. Mass extinctions and the subsequent rebound of biological diversity have brought about sudden changes in the assemblages.
d. Organisms continue to evolve during periods when fossilization does not occur.
e. Fossil assemblages across successive strata blend into one another, and there are no sharp breaks.

7. The possible collision of a large meteorite with Earth 65 million years ago may explain
a. the existence of Gondwana.
b. continental drift, according to Alfred Wegener.
c. the mass extinction that killed off the dinosaurs.
d. contemporary atmospheric conditions on Earth.
e. the breaking apart of Gondwana.

8. Which statement about oxygen and ancient Earth is true?
a. The atmosphere of early Earth contained almost as much free oxygen as present-day Earth, but most of this oxygen was lost in the Cambrian.
b. Early bacteria generated free oxygen as a by-product of the chemical splitting of water.
c. The oxygen-generating cyanobacteria have gone extinct.
d. Oxygen concentration increased from near zero to near present-day levels in a nearly straight line upwards.
e. Early bacteria generated free oxygen as a by-product of the chemical splitting of carbohydrates.

9.Larger single-celled organisms require a higher oxygen concentration than smaller ones do because the large cells
a. have a faster metabolic rate per unit mass.
b. have a slower metabolic rate per unit mass.
c. have a lower surface area-to-volume ratio.
d. have a greater surface area-to-volume ratio.
e. divide more quickly than small cells do.

10. The appearance of multicellular organisms coincided with increased levels of _____ in Earth's atmosphere.
a. sulfur
b. hydrogen
c. nitrogen
d. carbon
e. oxygen

11. Suppose twenty million years from now there are very large flying insects inhabiting Earth. What is the most likely atmospheric change that has occurred?
a. An increase in the oxygen concentration
b. A decrease in the carbon dioxide concentration
c. An increase in the carbon dioxide concentration
d. A decrease in the oxygen concentration
e. A decrease in the argon concentration

12.A fossil assemblage has 24 plant species, 35 insect species, and 17 crustacean species. How many species are in the flora?
a. 17
b. 24
c. 41
d. 52
e. 76

13. All of the animals living at a particular time or place are called its
a. biota.
b. flora.
c. Gondwana.
d. igneous species.
e. fauna.

14.Which condition would increase the likelihood of an animal's being fossilized?
a. Living in an oxygen-rich environment
b. Having an exoskeleton
c. Living in an area where geological processes often transform rocks
d. Living in an area where decomposition occurs rapidly
e. Having an internal digestive system

15. The period of time between life's first appearance on Earth and the definite appearance of multicellular life was about _____ years.
a. 200 million
b. 500 million
c. 1 billion
d. 2.5 billion
e. 4.5 billion

16.Humans reached North America approximately _____ years ago.
a. 500
b. 1,500
c. 15,000
d. 100,000
e. 1 million

17.Which statement about the Mesozoic era is true?
a. Atmospheric levels of oxygen fell dramatically.
b. The same groups of animals that were dominant during the Permian were also dominant throughout this period.
c. Pangaea came together.
d. Giant amphibians and flying insects were abundant.
e. Mammals and flowering plants appeared.

18. You are investigating a Triassic fossil bed. What would you *not* expect to find?
a. Pterosaurs
b. Frogs
c. Turtles
d. Seed ferns
e. Conifers

19. Which statement best explains the fundamental difference between the theory of blending inheritance and the theory of particulate inheritance?
a. Genes remain stable across generations according to the theory of blending inheritance, but not according to particulate inheritance.
b. Genes remain stable across generations according to the theory of particulate inheritance, but not according to blending inheritance.
c. Gametes fuse during fertilization according to the theory of blending inheritance, but not according to particulate inheritance.
d. Gametes fuse during fertilization according to the theory of particulate inheritance, but not according to blending inheritance.
e. The theory of blending inheritance applies to diploid organisms, whereas the theory of particulate inheritance applies to haploid organisms.

20.If two strains of true-breeding plants that have different alleles for a certain character are crossed, their progeny are called
a. the F_1 generation.
b. the P generation.
c. the F_2 generation.
d. F_1 crosses.
e. F_2 progeny.

21.The parents of individuals in the F_2 generation are members of the _____ generation.
a. P
b. F_1
c. F_2
d. F_3
e. M

22. Mendel's crossing of round-seeded pea plants with wrinkled-seeded pea plants resulted in progeny that all had round seeds. This indicates that the wrinkled-seed trait is
a. codominant.
b. dominant.
c. recessive.
d. rare.
e. abnormal.

23. If a trait that is *not* expressed in the F_1 generation reappears in the F_2 generation, the inheritance of the trait in question is an example of
a. codominance.
b. dominance and recessiveness.
c. incomplete dominance.
d. epistasis.
e. a test cross.

24. Different forms of a gene are called
a. traits.
b. phenotypes.
c. genotypes.
d. alleles.
e. characters.

25. In a simple Mendelian monohybrid cross, true-breeding tall plants are crossed with short plants, and the F_1 plants, which are all tall, are allowed to self-pollinate. What fraction of the F_2 generation will be both tall and heterozygous?
a. ⅛ b. ¼ c. ⅓ d. ⅔ e. 1/2

26. The physical appearance of an organism is called
a. the phenotype.
b. the genotype.
c. an allele.
d. a trait.
e. a gene.

27. In mice, short hair is dominant to long hair. If a short-haired individual is crossed with a long-haired individual and both long- and short-haired offspring result, one can conclude that
a. the short-haired parent is homozygous.
b. the short-haired parent is heterozygous.
c. the long-haired parent is heterozygous.
d. both parents are homozygous.
e. This cannot be answered without more information.

28. Classical albinism results from a recessive allele. What is the expected ratio for the progeny when a normally pigmented male with an albino father has children with an albino woman?
a. 3/4 normal, 1/4 albino
b. 3/4 albino, 1/4 normal
c. 1/2 normal,1/2 albino
d. All normal
e. All albino

29. Which statement about a dihybrid cross is true?
a. It results in a genotypic ratio of 2:1.
b. It involves genes located on the sex chromosomes.
c. It results in offspring of lower quality than that of the parents.
d. It results in two different phenotypes in the F_2 generation.
e. It is a cross between identical double heterozygotes.

30. Segregation of alleles occurs
a. during gamete formation.
b. at fertilization.
c. during mitosis.
d. during the random combination of gametes to produce the F_2 generation.
e. only in monohybrid crosses.

18 The History of Life on Earth

Chapter Outline

It's time to think about time. Understanding the impressive evolutionary changes of plants and animals requires you to think far beyond the lifespan of a human being, as life on Earth started long ago, was punctuated by five major extinctions, and will continue on for a very long time to come.

To organize our thinking about evolutionary time, Earth's geological history has been mapped out into four major intervals, called *eras*, starting 4,500,000,000 years ago (4.5 bya). Each era is subdivided into periods. While it is true that intense cataclysms (e.g., volcanoes, meteors, continental crashes, etc.) shaped life on Earth, it is also true that life shaped Earth—especially Earth's atmosphere—yielding more evolutionary opportunities. Puzzling through the evidence, the fossils, the geological changes, and the calculations allows us to see some of life's experimentation, including the dead ends and, perhaps, some of our planet's future opportunities.

In Chapter 18, specific parts of the AP Biology curriculum covering **Big Idea 1:** The process of evolution drives the diversity and unity of life, include:

- **1.A.4:** Biological evolution is supported by scientific evidence from many disciplines, including mathematics.
- **1.C.1:** Speciation and extinction have occurred throughout Earth's history.

Chapter Review

Concept 18.1 *explains how events in Earth's history can be dated. Imagine having an immense trash can into which you place all of your disposable items throughout your lifetime. Someone could sort through the layers, or strata, in the trash, and find out what you did last week, two years ago, and when you were five years old. In doing so, they could put together a picture of how you and your world have changed over the years. It is the same with fossils in ocean sediments: the oldest forms of life are in the bottom layer, and the newer forms are closer to the top. Analyzing the layers that have accumulated over the years tells us much about the history of life on Earth.*

The cooling rate of a recently deceased individual has been thoroughly studied in forensic science, so the temperature of a corpse is an important clue to an investigator at a murder scene. Just as heat energy dissipates when it is no longer being produced, elemental isotopes decay in a measureable way over time, albeit over a much longer period, and provide important clues that "date" rocks and other materials of interest to those focused on analyzing Earth's past.

1. Radioisotopic elements in igneous rock decay at predictable rates, as shown in the table below.

Radioisotope	Decay product	Half-life (years)	Useful dating range (years)
Carbon-14 (^{14}C)	Nitrogen-14 (^{14}N)	5,700	100 – 60,000
Uranium-234 (^{234}U)	Thorium-230 (^{230}Th)	80,000	10,000 – 500,000
Uranium-235 (^{235}U)	Lead-207 (^{207}Pb)	704 million	200,000 – 4.5 billion
Potassium-40 (^{40}K)	Argon-40 (^{40}Ar)	1.3 billion	10 million – 4.5 billion

For the samples listed in *Parts a* and *b*, use the table below to select the radioisotope that should be measured to best estimate the age of the samples. Explain your answers.

a. Alleged Permian sample: _____

b. Alleged Quaternary sample: _____

TABLE 18.1 Earth's Geological History

Eon	Era	Period	Onset
Phanerozoic (~0.5 billion years long)	Cenozoic	Quaternary (Q)	2.6 mya
		Tertiary (T)	65.5 mya
	Mesozoic	Cretaceous (K)	145.5 mya
		Jurassic (J)	201.6 mya
		Triassic (Tr)	251.0 mya
	Paleozoic	Permian (P)	299 mya
		Carboniferous (C)	359 mya
		Devonian (D)	416 mya
		Silurian (S)	444 mya
		Ordovician (O)	488 mya
		Cambrian (C)	542 mya
Proterozoic	Collectively called the Precambrian (~4 billion years long)		2.5 bya
Archean			3.8 bya
Hadean			4.5–4.6 bya

Note: mya, million years ago; bya, billion years ago.

2. Suppose that the sample you dated in Question 1a was found in igneous rock two meters above a dinosaur fossil. Explain how this information would affect your assessment of the geological age of the alleged Permian sample.

3. Suppose that the sample you dated in Question 1b was found in rock two meters above a dinosaur fossil. Explain how this information would affect your assessment of the geological age of the alleged Quaternary sample.

Concept 18.2 *examines how changes in Earth's physical environment have affected the evolution of life. The movement of the continental land masses has been an important influence on the distribution of plants and animals. Just as sheets of ice can move on water, plates of Earth's surface, or crust, move around on a bed of very hot molten rock. You probably know that these continental drifts can cause earthquakes. They are also instrumental in determining where volcanoes occur and in what direction ocean currents flow, thus influencing temperatures across the Earth. In addition to its own restlessness, Earth has been struck by extraterrestrial objects of varying sizes, possibly including an immense meteorite that caused mass extinctions. Furthermore, the organisms on the planet, especially the plants, have had a major effect on the amount of oxygen in the atmosphere.*

4. Discuss how climate changes can be associated with large reductions in sea level that coincide with mass extinctions of marine life.

5. Describe the hypothesis of current global climate change, and discuss how having an unusually cold winter fails to refute the hypothesis.

6. Iridium is fairly uncommon in the clay soils on Earth's surface. It is more abundant, however, in a thin layer of the Cretaceous–Tertiary boundary sample created 65 million years ago, when a mass extinction took place. Discuss this finding.

7. Describe how life on Earth has impacted the concentration of oxygen in the atmosphere at each of the following times:

a. 2 billion years ago:

b. 1 billion years ago:

c. 500 million years ago:

d. 250 million years ago:

Concept 18.3 *describes how major events in the evolution of life can be read in the fossil record. Fascination with dinosaurs is widespread, likely because the artistic models of these animals, based on fossil evidence, reveals animals that are so large and so strange that it is difficult to imagine them inhabiting our Earth. But fossils are evidence for many other kinds of plants and animals that can factor into solving the puzzles of evolutionary history. Unfortunately, the fossil record is only a tiny representation of the planet's past flora and fauna, since very few dying organisms end up in conditions appropriate for fossilization processes to occur.*

8. Around 500 million years ago, the Cambrian explosion in the number of plants and animals on Earth was in bloom. At the end of the Devonian period 150 million years later, a massive extinction occurred. This was followed by the "invasion of the land," as vertebrates began to move onto land and into drier habitats. Discuss the changes that produced the opportunity for a land invasion by animals.

9. Consider the hypothesis that the invasion of the land occurred at the end of the Devonian period. Describe the types of fossil evidence of animal morphology that would support this hypothesis.

10. Describe the primary geologic factors at work for each of these milestones of evolution:

a. 250 million years ago:

b. 225 million years ago:

c. 175 million years ago:

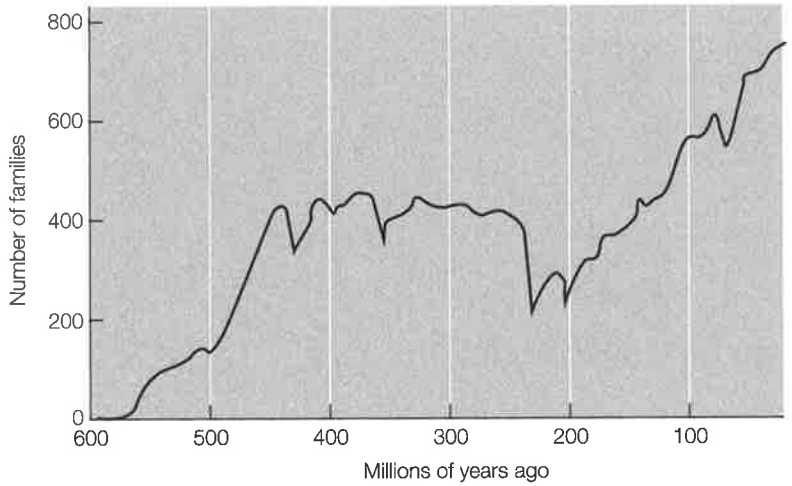
d. 100 million years ago:

Science Practices & Inquiry

In the AP Biology Curriculum Framework, there are seven Science Practices. In this chapter, we focus on Science Practice 5: The student can perform data analysis and evaluation of evidence. More specifically, we focus on Science Practice 5.1: The student can analyze data to identify patterns or relationships.

Question 11 asks you to analyze data related to questions of speciation and extinction throughout Earth's history (**Learning Objective 1.20**).

11. The graph below shows the number of families of organisms over time.



a. Select four intervals that include major extinctions, and label the extinctions with arrows.

b. Explain how a major extinction can impact the surviving species, that is, the survivors that do not go extinct.