

AP Biology must cover the topic of Ecology. Since emphasis is placed on understanding concepts, not plain memorizing of facts, you can read the chapters on Ecology as a winter assignment. *Ecology is the scientific study of the interactions between organisms and the environment.* Because of its great scope, ecology is an enormously complex and also an exciting area of Biology.

For each chapter, I have provided additional essays that contain relevant ideas or data on the chapter content. **Read the essays** that pertain to the chapter, then **read the chapter** and **answer the questions in your NOTES. YOUR NOTES WILL BE SHARED WITH ME USING GOOGLE DRIVE.**

Question for each chapter should be answered after you have read the article and the chapter. Follow the chapters in order in order to acquire a better understanding of the topics covered in each section.

After successful completion of all of the chapters and questions, you will be required to complete an free response question (FRQ) related to the topics you have just learned. The FRQ is located immediately in this document, immediately after the chapter questions.

In summary:

Read Chapters 51 – 56 and the corresponding essays (located in this packet).

- Complete the attached assignments for Chapters 51 – 56.
- Complete the FRQ (found after the chapter questions)

Chapter 51: Animal Behavior

Notes - Mating Systems in Sexual Animals

1. How is *behavior* defined?
2. What is *ethology*?
3. What is the difference between *proximate* and *ultimate causation*?
4. Using red-crowned cranes, provide an example of a proximate causation question and an example of an ultimate causation question?
5. What is a *fixed action pattern* (FAP)? Provide one example not presented in the text.
6. What is a *sign stimulus*? Give at least 3 examples of sign stimuli (2 of the examples must not be presented in the text).
7. *Nicholas Tinbergen's* work with the stickleback fish is a classic study. Explain what he found. Use the terms *fixed action pattern* and *sign stimulus* in your response.
8. Define the both kinesis and taxis and provide one example of each term not presented in the text.
9. Explain what is meant by *circadian clock* and *circadian rhythm*. Identify two behaviors, either plant or animal, that demonstrates a circadian rhythm. (You may need to refer to other chapters in the text for examples).
10. Explain two navigational strategies used by birds to migrate.
11. Animals communicate in various ways. Discuss at least three specific examples of animal communication using different organisms.
12. Note Figure 51.4 that shows fruit fly courtship behavior. Identify two other modes of communication used by the fruit fly?
13. *Karl von Frisch* studied European honeybees. What are the two types of dances

- that a returning worker bee does, and what information does each dance convey? Use a labeled sketch to describe each dance.
14. What are *pheromones*? Give three specific types of information that can be transmitted through pheromones.
 15. Based on *cross-fostering* and *human twin studies*, what are the two factors that contribute significantly to behavior?
 16. What is the difference between *innate* and *learned* behavior? Give an example of each.
 17. What is meant by *fitness*? How can *habituation* increase fitness?
 18. Describe the process of *imprinting*, and explain what is meant by *sensitive* or *critical period*.
 19. Describe the classic study of *parental imprinting* done by *Konrad Lorenz*.
 20. What occurs in *spatial learning*?
 21. What are two types of *associative learning*? Which type did *Ivan Pavlov* use to get a dog to salivate at the sound of a bell?
 22. What occurs in *operant conditioning*?
 23. What is *cognition*? Give three examples of cognition in animal species; include at least one bird behavior.
 24. Many bird songs are learned during a critical period. What will happen if a white-crowned sparrow does not hear the song of its species during this time?
 25. What is *foraging behavior*?
 26. What is proposed by the *optimal foraging theory*? Explain it in terms of cost and benefit, and cite two examples from your text.
 27. To demonstrate that you understand the principle of optimal foraging, describe a food source that you would not be likely to exploit.
 28. Explain each of the following mating systems and provide one example of a species that uses each system.
 - a. Promiscuity
 - b. Monogamy
 - c. Polygamy
 - d. Polygyny
 - e. Polyandry
 29. What is *sexual selection*? (See Chapter 23)
 30. There are two types of sexual selection. Explain each of them.
 - a. Intersexual selection
 - b. Intrasexual selection
 31. What is *agonistic behavior*? Give one example of this behavior that is not in your book.
 32. What is *altruism*?
 33. Explain the evolutionary advantage to a population of having members who exhibit *altruistic behavior*.
 34. *Altruism* may reduce the fitness of an individual—for example, by making that individual more obvious to a predator. Explain this behavior using the concept of *inclusive fitness*.
 35. Explain the logic behind the comment that a person would lay down his life for two brothers or eight cousins.
 36. Contrast *kin selection* and *reciprocal altruism*. Do not simply give a definition.

Chapter 52: An Introduction to Ecology and the Biosphere
 Notes – *Global Warming*

1. What is *ecology*?
2. What is a *biome*?
3. Figure 52.20 shows a *climograph* for some major biomes in North America. What two abiotic factors shown here are most important in determining the distribution of the biome?
4. Describe each major terrestrial biome as to rainfall, temperature, location, and representative flora and fauna.

Biome	Rainfall	Temperature	Location	Flora (at least 2)	Fauna (at least 2)
Tropical Rainforest					
Desert					
Savanna					
Chaparral					
Temperate grassland					
Northern coniferous forest/Taiga					
Temperate broadleaf forest					
Tundra					

5. What is the largest marine biome, and how much of Earth's surface does it cover?

6. As you read this section and study Figure 52.13, you will encounter a number of new terms. Distinguish between each of the following pairs of terms:

- a. photic/aphotic
- b. benthic/pelagic
- c. oligotrophic/eutrophic
- d. littoral zone/limnetic zone
- e. zooplankton/phytoplankton
- f. neritic/abyssal

7. Complete the following chart of the aquatic biomes.

Biome	Description	Autotrophs (at least 2)	Heterotrophs (at least 2)	Negative Human Impact
Lakes				
Wetlands				
Streams and rivers				
Estuaries				
Intertidals				
Ocean Pelagic				

Chapter 53: Population Ecology

Notes – *Population Ecology, Tales of Nightmare Numbers*

1. Draw type I, II, and III survivorship curves on a graph with labeled axes. Explain why the growth rate of species with a type I survivorship curve depends primarily on fertility rates. Explain why the growth rate of species with a type III survivorship curve is extremely sensitive to changes in adult survivorship.
2. Make a rough sketch of the age distribution in developing versus developed countries, and explain the significance of the differences.
3. Consider 2 rivers: One is spring fed and is constant in water volume and temperature year-round; the other drains a desert landscape and floods and dries out at unpredictable intervals. Which is more likely to support many species of iteroparous animals? Why?
4. Explain why a constant rate of increase (r_{max}) for a population produces a growth graph that is J-shaped rather than a straight line.
5. Offer a hypothesis to explain why humans have undergone near-exponential growth for over 500 years. Why can't exponential growth continue indefinitely? Give 2 examples of density-dependent factors that influence population growth in natural populations.
6. Where is exponential growth by a plant population more likely- on a newly formed volcanic island or in a mature, undisturbed rain forest? Why?
7. How does the prediction of the exponential model of population growth differ from that of the logistic model?
8. What is carrying capacity? Is it a property of a habitat or of a population?
9. What is time lag?
10. How have humans sidestepped the controls that regulate populations of other organisms?
11. How does the age structure of a population influence its future population growth?
12. Explain why a population that fits the logistic growth model increases more rapidly at intermediate size than at relatively small or large sizes.
13. Identify three density-dependent factors that limit population size, and explain how each exerts negative feedback.

Chapter 54: Community Ecology

Notes – *Community Interactions: No Pigeon is an Island*

1. Why are there limits on the food chain length?
2. Compare a dominant species with a keystone species – give an example of each.
3. How do keystone species influence species richness in communities?
4. What are the differences between cryptic coloration, aposematic coloration, and mimicry? Explain the differences.
5. Compare bottom-up and top-down controls on biological communities and their organization.
6. What is disturbance and give an example?
7. To investigate the structure and function of ecosystems, ecologists may construct a microcosm using organisms and materials from the ecosystem. Properly constructed, these model systems should be self-sustaining. If you remove the primary producers from the microcosm, would you predict that your model would continue to be self-sustaining? Explain.
8. If you remove the decomposers and detritivores, would the microcosm be self-sustaining? Explain.
9. Species interactions affect the distribution and abundance of populations. Summarize experimental evidence that population size for snowshoe hares depends on both predation rates by lynx and competition for food among hares.
10. Using your knowledge of ecosystem structure and function, compare the trophic structure of a desert to that of a temperate hardwood forest. Include the relative number (not exact) of organisms and energy availability for the different trophic levels.
11. What is the difference between primary succession and secondary succession?
12. How does the essay, *No Pigeon Is An Island*, explain the information about community interactions in this chapter?

Chapter 55 (Ecosystems and Restoration Ecology) and Chapter 56 (Conservation Biology and Global Change)

Notes – *Phosphate Pollution, Acid Rain, and the Ozone Hole: Hope for the Ecosystem Recovery*

Notes – *Exotic and Endangered Species*

1. Why is the transfer of energy in an ecosystem referred to as energy flow, not energy cycling?
2. How are detritivores essential to sustaining ecosystems?
3. Why is only a small portion of the solar energy that strikes Earth's atmosphere stored by primary producers?
4. What is the difference between gross primary productivity and net primary productivity?
5. What environmental factors influence rates of primary productivity in terrestrial and aquatic ecosystems?
6. Why is an ecosystem's net primary production lower than its gross primary production?
7. On a global scale, herbivores consume only about 17% of net primary production of terrestrial plants, yet most plant biomass is eventually consumed. Explain.
8. Why is energy lost from an ecosystem at every transfer from one trophic level to the trophic level above it?
9. Marguerite has a vegetable garden in Maine. Eduardo has one in Florida. What are some of the variables that influence primary production in each place?
10. Look around you and name all of the objects, natural or manufactured, that might be contributing to amplification of the greenhouse effect.
11. Why does deforestation of a watershed increase the concentration of nitrates in streams draining the watershed?
12. Draw a SIMPLE diagram that shows one possible path for an atom or molecule of that chemical from abiotic to biotic reservoirs and back for each of the 4 biogeochemical cycles.
13. How can the addition of excess nutrients to a lake threaten its fish population?
14. In the face of biological magnification of toxins, is it healthier to feed at a lower or higher trophic level? Explain.
15. Suppose that herbivores were removed from a temperate deciduous forest ecosystem. Predict what would happen to the rate of nitrogen cycling. Explain the logic behind your prediction.
16. What is Earth's main reservoir for phosphorus, and why is it recycled at such a slow rate from that reservoir?
17. In 1997, nonnative and invasive Asian swamp eels were collected in Florida for the first time at two sites near Tampa and Miami. These fish are extremely adaptable to a wide range of freshwater habitats, from wetlands to streams and ponds. They are predators that feed on worms, insects, crayfish, frogs, and other fishes, including bluegill and bass. Swamp eels have the ability to gulp air, which allows them to survive in only a few inches of water and to move over land to a

nearby body of water. Scientists are tracking their movements and increasing numbers in the Southeast. In one pond, several species of fish have been completely eliminated. Based on your understanding of the pond ecosystem, predict the effect of introducing swamp eels on the following components of the pond.

Bluegill:

Bass:

Pond Life:

18. Using your knowledge of ecosystem structure and function, propose a plan of action for eliminating the swamp eels (question 17) from the pond before they eliminate the other organisms. You cannot use toxins, since the local anglers fish in this pond.
19. In what ways would humans benefit by preserving biodiversity?
20. Describe the 4 main threats to biodiversity and how each one damages diversity.
21. Why does the reduced genetic diversity of small populations make them more vulnerable to extinction?
22. How do naturally occurring organisms provide humans with ecosystem services?
23. What are the consequences of the overexploitation of fish populations?
24. How do extinction rates today compare with the background extinction rate evident in the fossil record?
25. Would a single large nature preserve or several small preserves experience greater edge effects?
26. Why is a population's effective size (N_e) almost always smaller than its total size (N)?
27. What are the goals of restoration ecology?
28. How do bioremediation and biological augmentation differ?
29. What is meant by the term sustainable development?
30. What are the lessons that can be learned from the essays – use information from the chapter to explain your answer.

ECOLOGY FRQ

After reading the ecology chapters 51-56 and completing the question listed above, complete the following FRQ. This is a graded essay.

Your Answer must be in essay form. Outline form is NOT acceptable. Labeled diagrams may be used to supplement discussion, but in no case will a diagram alone suffice. It is important that you read the question carefully before you begin to write.

Your answer MUST be an original work. DO NOT copy from a friend or take information directly from the web. Although your answer may differ from others in the class, it does not mean it is wrong. As long as you answer logically and reasonably provide correct information you will be given credit.

These answers do not have to be lengthy. You can answer each part in one paragraph. I am grading on correct information. The food chain can be depicted using arrows between the organisms.

FRQ

1.

- a) Living organisms play an important role in the recycling of many elements within an ecosystem. Discuss how various types of organisms and their biochemical reactions contribute to the recycling of **either** carbon or nitrogen in an ecosystem. Include in your answer one way in which human activity has an impact on the nutrient cycle you have chosen.
- b) The survival of organisms depends on regulatory mechanisms at various levels. Explain how the density of a population is regulated.
- c) Compared with other terrestrial biomes, deserts have extremely low productivity. Discuss how temperature, soil composition, and annual precipitation limit productivity in deserts.
- d) Describe a four-organism food chain that might characterize a desert community, and identify the trophic level of each organism.