



Environmental Systems A Study Guide Credit by Exam for Credit Recovery or Acceleration

The exam you are interested in taking is designed to test your proficiency in the relevant subject matter. You should be thoroughly familiar with the subject matter before you attempt to take the exam. This EA/CBE Study Guide can help you prepare for the exam by giving you an idea of what you need to review. You can check your familiarity level by reviewing the Texas Essential Knowledge and Skills (TEKS) for this course. (See below.) To refine your skills, you can refer to any of the state-adopted textbooks.

Texas Essential Knowledge and Skills (TEKS)

Every question that appears on this exam is derived from the knowledge and skills statements and student expectations within the Texas-mandated standards, the Texas Essential Knowledge and Skills (TEKS). You can view the TEKS for this exam online via the following link: <http://ritter.tea.state.tx.us/rules/tac/chapter112/ch112c.html#112.37>. Refer to section (c), Knowledge and skills, 1A–9L. Throughout this guide, you’ll see TEKS references. These refer to the numbers listed under (c) Knowledge and skills; for example, 1A or 3B.

Materials Needed

You will need to bring a #2 pencil and a scientific calculator to complete the exam. You will receive a computer-graded answer sheet when you arrive at the testing center.

Exam Structure

You will be allowed **3 hours** to complete this exam. The Environmental Systems A exam consists of 50 multiple-choice questions worth 2 points each for a total of 100 points. The exam covers a wide variety of topics. To help you study, we have isolated 9 key topics and provided study tips and sample questions for each. You can expect about 4-6 multiple-choice questions on each of the following topics:

- Topic 1:** Safety and Measurements
- Topic 2:** The Nature of Science
- Topic 3:** The History of Environmental Science
- Topic 4:** The Geosphere
- Topic 5:** The Hydrosphere
- Topic 6:** The Atmosphere
- Topic 7:** The Biosphere
- Topic 8:** Ecosystem Dynamics
- Topic 9:** Populations

Scholastic Honesty

When you arrive at the testing center you will be asked to carefully read the exam rules and sign a statement agreeing to take the exam in accordance with the rules. This is called the Examinee's Certification. The following is a copy of these rules:

Examinee's Certification

This certification must be signed *before* the exam is administered and then returned with the completed examination attached, or credit for the exam will not be given.

Scholastic dishonesty is a serious academic violation that will not be tolerated. Scholastic dishonesty encompasses, but is not limited to:

- copying from another student's work;
- using an unauthorized testing proctor or taking the exam at an unauthorized testing location;
- using materials not authorized by a testing proctor;
- possessing materials that are not authorized by a testing proctor, such as lessons, books, or notes;
- knowingly using or soliciting, in whole or Topic, the contents of an unadministered test;
- collaborating with or seeking aid from another student without authorization during the test;
- substituting for another person, or permitting another person to substitute for oneself, in taking a course test or completing any course-related assignment;
- using, buying, stealing, or transporting some or all of the contents of an unadministered test, test rubric, homework answer, or computer program.

Evidence of scholastic dishonesty will result in a grade of *F* on the examination and an *F* in the course (if applicable).

At the testing center, you will be asked to sign a statement that says you have read the above and agree to complete the examination with scholastic honesty.

General Study Tips

The bulleted lists and sample questions in this study guide can assist you in preparing for the exam. It is a fairly complete guide for studying, but does not cover every item on the test. Ultimately, you should use the TEKS to guide your exam preparation.

Additional Study Tips

The following information provides direction for your studies. For each part, you will find study tips and sample questions to give you a general idea of the types of questions you can expect to see on the exam.

Topic 1: Safety and Measurement

Lab and field safety are important when carrying out experiments and research for an Environmental Systems course. Furthermore, if an emergency does occur even after proper safety techniques are followed, it is best to be prepared by knowing the correct first aid response. In addition, proper lab equipment and data collection ensure accurate outcomes when doing research or experiments.

Study Tips for Topic 1:

This topic relates to TEKS 1A, 2F, 2G, and 2H. Familiarize yourself with those TEKS, and then be prepared to:

- demonstrate safe lab practices, including first aid responses to accidents that can occur in the field
- collect data with precision and accuracy
- record data using correct units and calculate quantities to describe mean, median, and mode
- apply knowledge of appropriate use of lab and field equipment, techniques, and procedures

Sample Questions for Topic 1:

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST responses to the following questions.

1. You and your lab partner are in the field collecting soil and water samples. Your partner begins to show the symptoms of overheating. What is one thing you should NOT do when providing care?
 - A. Do not move the person because you may make the symptoms worse.
 - B. Do not provide shade because it can cause the body to cool down too quickly.
 - C. Do not give the person any soda to drink because it can cause further dehydration.
 - D. Do not give the person any water to drink because it can exacerbate the symptoms.

2. You are going to the field to collect water samples from a nearby pond. You also want to observe aquatic organisms in the pond. To do so, you pack your first aid kit, hand magnifier, and field guides. What additional equipment should you take with you to collect and test the samples?
- A. shovel, bucket, ruler, water test kit, pipettes, 100 ft. appraisers tape, tarp
 - B. graduated cylinder, bucket, ruler, binoculars, turbidity testing kit, gloves
 - C. trowel, bucket, screen, thermometer, internet access, meter stick, soil test kit
 - D. turbidity testing kit, water quality test kit, bucket, pipettes, graduated cylinder
3. You are checking the accuracy and precision of your pH meter before you take it into the field. You test neutral water, which you know has a pH of 7. You test the pH level of the water 3 times. The results are below. What conclusion can you come to about your pH meter?

Test	pH level
1	5.18
2	5.15
3	5.20

- A. The pH meter is accurate but not precise.
- B. The pH meter is precise but not accurate.
- C. The pH meter is both accurate and precise.
- D. The pH meter is neither accurate nor precise.

Topic 2: The Nature of Science

Science is a self-correcting process in search of explanations about the natural world. Scientific hypotheses are tentative, testable predictions that can become incorporated in scientific theories if multiple independent researchers observe and collect evidence to support them, over a wide variety of conditions. Science is responsible for a multitude of technological, medical, and agricultural innovations that provide the foundation for modern society. However, science also has its limits.

Study Tips for Topic 2:

This topic relates to TEKS 2A– 2D. Familiarize yourself with those TEKS, and then be prepared to:

- define science and know that it has limitations
- explain that a hypothesis is a tentative and testable statement
- explain that a theory is well established and a highly reliable explanation
- distinguish between a scientific hypothesis and a scientific theory

Sample Questions for Topic 2:

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST responses to the following questions.

4. Which of the following distinguishes a hypothesis from theory?

- I. A hypothesis is a tentative and testable statement
- II. A hypothesis must be capable of being supported or not supported by observational evidence
- III. A theory is a tentative and testable statement
- IV. A theory is based on natural and physical phenomena
- V. A theory is capable of being tested by multiple independent researchers

- A. I, III, V
 - B. I, II, IV, V
 - C. I, III, IV, V
 - D. II, III, IV, V
5. Which of the following is a testable hypothesis?
- A. If the fish becomes ill or dies, then there was not enough oxygen in the water.
 - B. If a dog appears to be unhappy, then you should take it for a walk and feed it.
 - C. If you smile at people throughout the day, then the world will be a better place to live in.
 - D. If the oxygen content of water decreases by 8%, then the marine life in the water will die.

Topic 3: The History of Environmental Science

Concern for the environment has been documented in historical manuscripts, publications, and archives throughout history. Scientists, politicians, and activists alike have played an integral role in educating the public about environmental concerns, challenges, and protecting sensitive natural resources. Some of these figures include John Muir, Theodore Roosevelt, Rachel Carson, and the Radium Girls.

Study Tips for Topic 3:

This topic relates to TEKS 3F. Familiarize yourself with those TEKS, and then be prepared to:

- research the history of environmental science
- research and describe the contributions of scientists and activists to environmental science, including Rachel Carson, John Muir, Theodore Roosevelt, and the Radium Girls

Sample Questions for Topic 3:

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST responses to the following questions.

6. How did the scientist Rachel Carson contribute to the health of the environment?
 - A. Rachel Carson worked with President Roosevelt to protect the national forests and establish a dam at Yosemite.
 - B. Rachel Carson worked with John Muir to help protect natural land such as the Grand Canyon and Petrified Forest.
 - C. Rachel Carson published the book *Silent Spring* that influenced the removal of DDT as a pesticide sprayed on plants.
 - D. Rachel Carson published a book called *Now You Know* which influenced the removal of lead based fuel as an option to fuel automobiles.
7. Mercury poisoning in Japan from 1930-1970 is now linked to the neurological disease known as _____.
 - A. Malaria disease
 - B. Occular disease
 - C. Minamata disease
 - D. Hiroshima disease

Topic 4: The Geosphere

The geosphere is the earth system that includes the interior, landforms, rocks, minerals, and processes that shape the earth's surface. Although Earth is a dynamic planet, nearly all of its mineral resources accumulated when the planet was formed approximately 4.6 billion years ago. The earth's structure and geological processes continue to distribute these resources and shape our planet. In addition, human activities are shaping the distribution of these resources and impacting our environment. The geosphere interacts with other systems – the hydrosphere, the biosphere, and the atmosphere – to support life on Earth.

Study Tips for Topic 4:

This topic relates to TEKS 6A and 8A. Familiarize yourself with those TEKS, and then be prepared to:

- identify the geological processes that continually shape the earth
- describe how rocks and minerals form
- explain how the geosphere and the cryosphere interact with other earth systems, such as the atmosphere and hydrosphere

Sample Questions for Topic 4:

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST responses to the following questions.

8. Fossil fuels formed over hundreds of millions of years from the remains of dead plants and animals. Over time, this organic matter was pushed deeper and deeper into the earth's crust where it was converted into oil, coal, and natural gas by the earth's high pressure and heat. Fossil fuels most likely formed in which layer of the earth?
 - A. mantle
 - B. inner core
 - C. lithosphere
 - D. asthenosphere
9. Volcanic eruptions are a major source of carbon in our atmosphere. Volcanoes form at which of the following types of tectonic boundaries?
 - A. transform and divergent continental boundaries
 - B. transform and convergent continental boundaries
 - C. convergent oceanic and divergent oceanic boundaries
 - D. convergent continental and divergent continental boundaries

Topic 5: The Hydrosphere

Many would argue that of all the natural resources available to humans on earth, water is the most essential. The components of our planet that are made of water are collectively known as the *hydrosphere*. The hydrosphere plays many crucial roles in maintaining the overall health of each of Earth's systems, including the atmosphere and lithosphere.

Study Tips for Topic 5:

This topic relates to TEKS 5B and 6A. Familiarize yourself with those TEKS, and then be prepared to:

- explain the distribution of water on Earth
- identify the different components of the hydrosphere, such as surface water and groundwater
- explain how the hydrosphere interacts with Earth's other systems, such as the atmosphere
- analyze the water cycle and how it interacts with the lithosphere and atmosphere
- identify source, use, quality, management, and conservation of water

Sample Questions for Topic 5:

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST responses to the following questions.

10. Earth's systems interact with each other in a variety of ways. Which of the following best describes an interaction between the lithosphere and the hydrosphere?
 - A. the movement of water over the land, weathering the rocks and forming a deep canyon
 - B. the movement of water from the ground into the clouds via the process of evaporation
 - C. the formation of a large mountain range from the powerful interaction between the earth's tectonic plates
 - D. a volcanic eruption in the Ring of Fire that causes a violent earthquake, leading to a massive tsunami
11. The frozen parts of Earth are collectively known as the earth's cryosphere. Which of the following is NOT an important function of the earth's cryosphere?
 - A. The large amounts of sea ice are important habitat areas for many species of wildlife.
 - B. The snow and ice help regulate global temperatures by reflecting many of the sun's rays.
 - C. The snow and ice that make up the permafrost are the ultimate source of energy for the hydrologic cycle.
 - D. The permafrost region holds large amounts of carbon, which if released, could be damaging to the Earth's atmosphere.

12. Which of the following is an example of a point source of pollution?
- A. storm water from street surfaces runs into a river
 - B. animal manure washed from a farm enters a stream
 - C. an industrial waste pipe discharges water into a lake
 - D. deforestation leads to soil erosion, which empties into a pond

Topic 6: The Atmosphere

Earth is surrounded by a unique mixture of gases that sets it apart from the other planets in our universe. The atmosphere has many important functions that enable life on Earth to continually thrive. The efficient transfer of heat from the sun by our atmosphere drives many of our weather processes. Although it is natural for the atmosphere to change constantly, over the past two hundred years it has changed more rapidly than ever due to human influence. Both natural and man-made alterations to the atmosphere impact weather and climate on Earth.

Study Tips for Topic 6:

This topic relates to TEKS 6A, 6C, 8D and 8E. Familiarize yourself with those TEKS, and then be prepared to:

- explain the composition and structure of Earth's atmosphere
- explain the interactions between the atmosphere and Earth's other systems, such as the geosphere, hydrosphere, and biosphere
- describe and compare three mechanisms of heat transfer in Earth's atmosphere
- analyze how temperature inversions can impact Earth's weather conditions, including El Niño and La Niña oscillations
- analyze the impact of temperature inversions on global warming, ice cap and glacial melting, and changes in ocean currents and surface temperatures

Sample Questions for Topic 6:

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST responses to the following questions.

13. Energy must be able to move through and within an ecosystem in order for the ecosystem to function properly. Which of the following sentences best describes a scenario in which energy is moving through an ecosystem via the process of radiation?
- A. The sun's rays that warm the surface of a pond.
 - B. The cool breeze that comes in from the ocean to the shoreline.
 - C. Heat moves through a layer of soil via direct contact of the soil particles.
 - D. The transport of heat from the surface into the atmosphere, and its subsequent condensation in a cloud.

14. Which of the following weather conditions can be attributed to the presence of a temperature inversion near the surface of the Earth?
- A. heavy rain
 - B. high winds
 - C. smoggy skies
 - D. freezing temperatures
15. Regional changes in any environment can also have global effects. Which of the following examples below is NOT an example of this?
- A. The melting of Arctic sea ice causes global temperatures to rise.
 - B. The increased melting of glaciers and ice sheets in Antarctica causes global sea levels to rise.
 - C. The clearing of a small forest to build a shopping center leads to an increase in surface runoff and water pollution.
 - D. The clear cutting of trees in the rainforest impacts global weather patterns and global oxygen and carbon dioxide levels.

Topic 7: The Biosphere

Ecology is the study of the relationship between organisms, and their interactions with their physical environment. Abiotic factors are a critical component of every ecosystem, and have natural fluctuations or cycles. These abiotic factors include water, carbon, nitrogen, and rocks. In addition to abiotic cycles, energy flows throughout an ecosystem, supporting life at every level of the food chain. While conditions in an ecosystem naturally fluctuate based on the availability of natural resources, human activities have a large impact on the balance between biotic and abiotic factors.

Study Tips for Topic 7:

This topic relates to TEKS 4A– 4D and 6C– 6E. Familiarize yourself with those TEKS, and then be prepared to:

- use diagrams of abiotic cycles to make observations about the fluctuations in abiotic cycles including the rock, hydrologic, carbon, and nitrogen cycles
- make observations and utilize data to evaluate the effects of abiotic factors on local ecosystems and biomes
- identify native plants and animals using a dichotomous key
- assess the role of native plants and animals within a local ecosystem, and compare them to plants and animals from other biomes
- explain how energy flows through an ecosystem via different methods of heat transfer such as conduction, convection, and radiation
- investigate and explain the effects of energy transformations and interactions within an ecosystem
- assess the roles of native species in local ecosystems and compare these organisms with organisms from other biomes

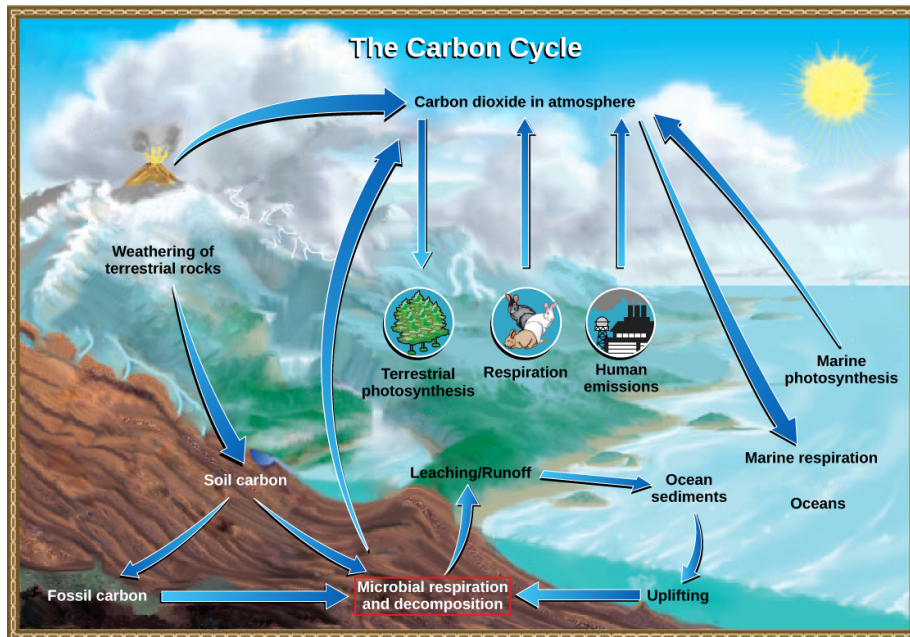
Sample Questions for Topic 7:

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST responses to the following questions.

16. If earth's atmosphere is made up of 78% nitrogen, why is nitrogen a limiting factor for producers?
- A. Nitrogen is unusable in its liquid form.
 - B. Nitrogen is unusable in its gaseous form.
 - C. There are more plants than gaseous nitrogen.
 - D. Consumers respire all of the available nitrogen.

17. The diagram below illustrates the carbon cycle. Which of the following components of the diagram represent carbon sinks?



(Image source: <http://cnx.org/contents/65d16444-425c-4f43-bc48-a3d0de0c2fbd@6/Biogeochemical-Cycles>)

- A. oceans and fossil carbon
- B. volcanoes and soil carbon
- C. factories and photosynthesis
- D. marine photosynthesis and respiration

18. *Calligeron giganteum* is a species of brown moss that is characterized by tiny roots and leaves, slow growth (one centimeter per year), a long life span, and the ability to grow close to the ground and underwater. *Calligeron giganteum* has a symbiotic relationship with certain plants, covering and warming the ground to allow other plant species to grow. *Calligeron giganteum* is most likely native to which of the following biomes?

- A. Desert, where it is well adapted to a cold, dry, and windy climate.
- B. Tundra, where it is well adapted to a cold, dry, and windy climate.
- C. Desert, where is well adapted to a warm, moist, and sunny climate.
- D. Tundra, where is well adapted to a warm, moist, and sunny climate.

19. In a food chain, what percent of a prey organism is transferred to its predator?

- A. 90%; the remaining energy is lost as heat during metabolic processes.
- B. 90%; the remaining energy is transferred back to the organism's prey.
- C. 10%; the remaining energy is lost as heat during metabolic processes.
- D. 10%; the remaining energy is transferred back to the organism's prey.

Topic 8: Ecosystem Dynamics

The earth is home to a stunning amount of biodiversity, both within specific biomes and between them. Natural events, caused by tectonic movement and changes in weather patterns, can have disastrous and long lasting consequences on ecosystem balance and biodiversity. So too, can human activities, such as the introduction of invasive species, and air, soil, and water pollution. While conditions in an ecosystem naturally fluctuate based on natural events and the availability of natural resources, human activities have a large impact on the balance between biotic and abiotic factors.

Study Tips for Topic 8:

This topic relates to TEKS 2E, 4F, 4G, 4H, and 8A. Familiarize yourself with those TEKS, and then be prepared to:

- predict how the introduction or removal of an invasive species may alter the food chain and affect existing populations in an ecosystem
- analyze and describe the effects on areas impacted by natural events such as tectonic movement, volcanic events, fires, tornadoes, hurricanes, flooding, tsunamis, and population growth
- diagram and explain the steps of succession that occur after natural events
- explain how regional changes in the environment may have a global effect.
- predict how species extinction may alter the food chain and affect existing populations in an ecosystem
- research and explain the causes of species diversity and predict changes that may occur in an ecosystem if species and genetic diversity is increased or reduced
- follow investigative procedures, including making observations, asking questions, and formulating testable hypotheses

Sample Questions for Topic 8:

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST responses to the following questions.

20. The diagram below depicts the steps involved in the secondary succession of an oak and hickory forest after a forest fire. According to the diagram, which of the following statements is NOT true of succession?

Secondary Succession of an Oak and Hickory Forest



Pioneer species

Annual plants grow and are succeeded by grasses and perennials.

Intermediate species

Shrubs, then pines, and young oak and hickory begin to grow.

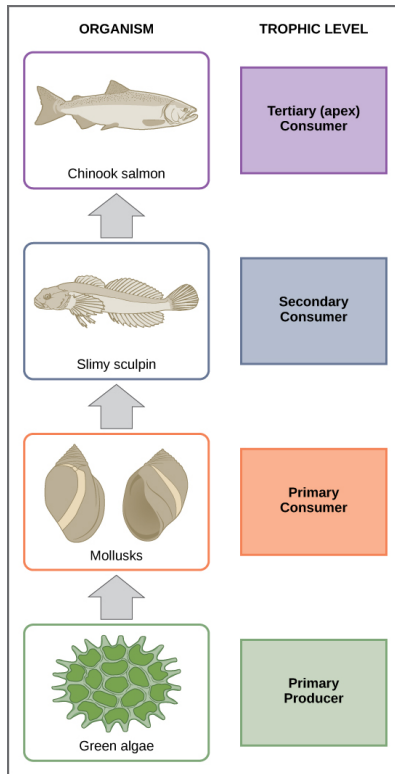
Climax community

The mature oak and hickory forest remains stable until the next disturbance.

(Image source: <http://cnx.org/contents/d4c6f4b0-f83e-4200-aec9-e178595656b4@3/Ecological-Succession>)

- A. After a forest fire, pioneer species such as annual plants will grow first.
- B. The ecological succession of this forest will end with the climax community.
- C. Mature oaks and hickory trees will begin to grow immediately after the growth of the pioneer species.
- D. After a forest fire, intermediate species such as shrubs and young oak trees will grow immediately after the pioneer species.

21. Examine the food chain at the right. What would be the most likely impact if all of the Chinook salmon in this ecosystem were depleted by overfishing?



(Image source: <http://cnx.org/contents/5f31b7ed-13e0-4a64-93b2-d1bb73a3e022@5/Ecology-of-Ecosystems>)

- A. The slimy sculpin would also become depleted due to bycatch in bottom trawling nets.
 - B. The mollusks would experience population growth in the absence of their main predator.
 - C. The green algae would bloom because the salmon would no longer be blocking the sunlight.
 - D. The slimy sculpin would experience population growth in the absence of their main predator.
22. All of the following human activities can cause a reduction in species diversity, except _____.
- A. deforestation
 - B. a volcanic eruption
 - C. overharvesting a fishery
 - D. introducing an invasive species

Topic 9: Populations

Humans, along with all other organisms on Earth, have a constant drive to reproduce. Creating a stable or growing population is crucial to the success of a species, and all of the organisms on Earth are competing to grow their own species. Eventually, an ecosystem must achieve a balance. Population growth of unique species depends on its carrying capacity, which in turn is determined by the availability of natural resources.

Study Tips for Topic 9:

This topic relates to TEKS 2I, 7A, 7B, and 7D. Familiarize yourself with those TEKS, and then be prepared to:

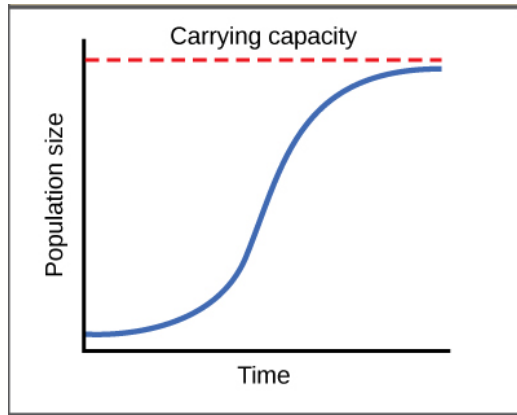
- relate carrying capacity to population dynamics
- explain the strategies used by animals in reproduction
- calculate birth rates and exponential growth of population
- organize, analyze, evaluate, make inferences, and predict trends from data

Sample Questions for Topic 9:

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the **BEST** responses to the following questions.

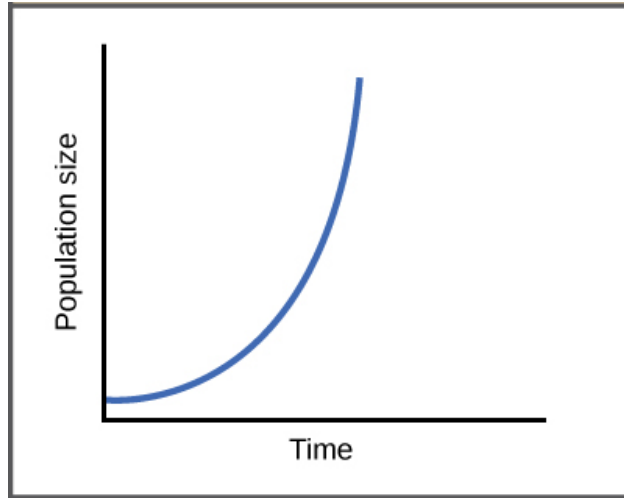
23. Based on the information contained in the graph below, what can you infer about the relationship between population growth and carrying capacity?



(Image source: <http://cnx.org/contents/f8657159-1f6c-4068-9945-780ff2bf441a@3/Population-Growth-and-Regulati>)

- A. In the absence of a limiting factor, population growth will level off when it reaches its carrying capacity.
- B. In the absence of a limiting factor, a population will experience exponential growth as it reaches its carrying capacity.
- C. Carrying capacity, as determined by limiting factors in an environment, is the maximum population size that can be supported in an ecosystem.
- D. Carrying capacity, as determined by limiting factors in an environment, is the minimum population size that can be supported in an ecosystem.

24. The population growth illustrated in the graph below can best be characterized as _____.



(Image source: <http://cnx.org/contents/f8657159-1f6c-4068-9945-780ff2bf441a@3/Population-Growth-and-Regulati>)

- A. logistic
 - B. inverse
 - C. exponential
 - D. density-dependent
25. On January 1st, 2013, San Marcos, Texas was home to 54,007 residents. That year, 406 people died, there were 823 births, 1288 people immigrated to San Marcos, and 350 people emigrated out of the city. What was the overall population growth rate of San Marcos in 2013?
- A. -5%
 - B. 3%
 - C. 5%
 - D. 13%

Answer Key

Item Number	Correct Answer	TEKS expectation
1	C	1A
2	D	2G
3	B	2F, 2K
4	B	2B, 2C, 2D
5	D	2B
6	C	3F
7	C	3F
8	C	6A, 6B
9	C	6A
10	A	6A
11	C	6A
12	C	5B, 6A
13	A	6C
14	C	8D
15	C	8D, 8E
16	B	4C
17	A	4C, 6A
18	B	4B
19	C	6C, 6D
20	C	8A
21	D	4G
22	B	4H
23	C	2I, 7A
24	C	2I, 7A
25	B	7B