Name _____

Ecology

Unit 8 (the last one)

Levels of Organization
Ecosystem Changes and Succession
Organismal Interaction
Biogeochemical Cycles

Due Date _____

VOCABULARY

Abiotic: A term that describes a nonliving factor in an ecosystem.
Agriculture: The artificial cultivation of food, fiber, and other goods by the systematic growing and harvesting of various organisms.
Aquatic: A term that describes an organism associated with a water environment.
Biochemical Conversion: The changing of organic matter into other chemical forms such as fuels.
Biogeochemical Cycle: The movement of abiotic factors between the living and nonliving components within ecosystems; also known as nutrient cycles (i.e., water cycle, carbon cycle, oxygen cycle, and nitrogen cycle).
Biome: A large area or geographical region with distinct plant and animal groups adapted to that environment.
Biosphere: The zone of life on Earth; sum total of all ecosystems on Earth.
Biotic: A term that describes a living or once-living organism in an ecosystem.
Community (Ecological): Different populations of organisms interacting in a shared environment.
Competition: When individuals or groups of organisms compete for similar resources such as territory, mates, water, and food in the same environment.
Consumer (Ecological): An organism that obtains energy by feeding on other organisms or their remains.
Decomposer: An organism that obtains nutrients by consuming dead and decaying organic matter which allows nutrients to be accessible to other organisms.
Ecology: The study of the relationships between organisms and their interactions with the environment.
Ecosystem: A system composed of organisms and nonliving components of an environment.
Endemic Species: A species that is found in its originating location and is generally restricted to that geographic area.
Endosymbiosis: A theorized process in which early eukaryotic cells were formed from simpler prokaryotes.
Energy Pyramid: A model that illustrates the biomass productivity at multiple trophic levels in a given ecosystem.
Energy Transformation: A process in which energy changes from one form to another form while some of the energy is lost to the environment.
Environment: The total surroundings of an organism or a group of organisms.
Food Chain: A simplified path illustrating the passing of potential chemical energy (food) from one organism to another organism.
Food Web: A complex arrangement of interrelated food chains illustrating the flow of energy between interdependent organisms.
Habitat: An area that provides an organism with its basic needs for survival.
Isolating Mechanisms: Features of behaviors, morphology, or genetics which serve to prevent mating or breeding between two different species (e.g., temporal isolation, in which individuals are active at different times of the day, seasons, or mating periods; ecological isolation, in which individuals only mate in their specific habitat; behavioral isolation, when there are no sexual cues between representatives of the species; mechanical isolation, when there is no sperm transfer during an attempted mating; and gametic incompatibility, when there is sperm transfer without fertilization occurring). If mating can take place, there are four factors that prevent hybrid viability: zygotic mortality (fertilization but no zygote), hybrid inviability (embryo is not viable), hybrid sterility (resulting adult is sterile), and hybrid breakdown (first generation is viable but future generations are not).
Limiting Factor: Chemical or physical factor that limits the existence, growth, abundance, or distribution of an individual organism or a population.
Nonnative Species: A species normally living outside a distribution range that has been introduced through either deliberate or accidental human activity; also can be known as introduced, invasive, alien, nonindigenous, or exotic.
Population: A group of individuals of the same species living in a specific geographical area and reproducing.
Population Dynamics: The study of short- and long-term changes in the number of individuals for a given population, as affected by birth, death, immigration, and emigration.
Producer (Ecological): An organism that uses a primary energy source to conduct photosynthesis or chemosynthesis.
Succession: A series of predictable and orderly changes within an ecosystem over time.
Symbiotic Relationship: A relationship between two organisms (i.e., mutualism, in which both organisms benefit; parasitism, in which one organism benefits and the other organism is harmed; and commensalism, in which one organism benefits and the other organism does not benefit or is not harmed).
System: A set of interacting or interdependent components, real or abstract, that form an integrated whole. An open system is able to interact with its environment. A closed system is isolated from its environment.
Terrestrial: A term that describes an organism associated with a land environment.
Trophic Level: The position of an organism in relation to the flow of energy and inorganic nutrients through an ecosystem (e.g., producer, consumer, and decomposer).

MAIN CONCEPTS

1. **Describe the levels of ecological organization (organisms, population, community, ecosystem, biome, and biosphere)**
   - **Biosphere**
     - The broadest, most inclusive level
     - The biosphere is the thin volume of Earth and its atmosphere that supports life
     - All living organisms are found in the biosphere
     - Living things are not distributed evenly throughout the biosphere
   - **Ecosystem**
     - An ecosystem includes all of the organisms and the nonliving environment found in a particular place
   - **Community**
     - A community is all the interacting organisms living in an area
     - Ecologists often focus on how species interact and how these interactions influence the nature of the community
   - **Population**
     - A population includes all the members of a species that live in one place at one time
   - **Organism**
     - The simplest level of organization in ecology

2. **Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems**
   - The living components of the environment are called **biotic** factors – they include all of the living things that affect the organism
   - The nonliving factors, called **abiotic** factors, are the physical and chemical characteristics of the environment
     - Temperature
     - Humidity
     - pH
     - Salinity
     - Oxygen Concentration
     - Amount of Sunlight
     - Availability of Nitrogen
     - Precipitation

3. **Describe how energy flows through an ecosystem (food chains, food webs, energy pyramids)**
   - Most **producers** are photosynthetic and make carbohydrates by using energy from the sun
   - **Consumers** obtain energy by eating other organisms and include herbivores, omnivores, carnivores, detritivores, and decomposers.
     - A **food chain** is a single pathway of energy transfer
     - A **food web** is a network showing al paths of energy transfer
   - Energy transfer
     - Ecosystems contain only a few trophic levels because there is a low rate of energy transfer between each level
     - Energy is passed from producer to consumer to decomposer

4. **Describe biotic interactions in an ecosystem (competition, predation, symbiosis)**
   - **Predation** – an individual of one species (**predator**) eats all or part of an individual of another species (**prey**)
     - **Carnivores** – Predators that eat animals
     - **Herbivores** – Predators that eat plants
   - Predator adaptations
     - Natural selection favors the evolution of predator adaptations for finding, capturing, and consuming prey
     - Prey detection mechanisms, camouflage, adapted mouth parts, speed, are all examples of adaptations
     - Natural selection also favors adaptations in prey that allow the prey to escape, avoid, or otherwise ward off predators
   - **Symbiosis** – a close, long term relationship between two organisms
     - **Mutualism** – A relationship in which both individuals involved in relationship have ecological benefits
       - Examples – Bees and Flowers, Squirrels & Oak Trees
     - **Commensalism** – A relationship in which one individual benefits and one has a null interaction, no harm no benefit
       - Examples - Clown fish and sea anemone, scavenger species

- **Parasitism** – A relationship where one individual benefits and one is harmed
  - Benefiter – Parasite organisms with the negative experience – host
  - Does not result in the immediate death of the host
  - Examples – Ticks, tape worms

5. **Describe how matter recycles through an ecosystem (water cycle, carbon cycle, oxygen cycle, nitrogen cycle)**
   - **Water cycle**
     - Key processes in the water cycle include evaporation, transpiration and precipitation
   - **Carbon Cycle**
     - Key processes include photosynthesis (carbon fixation) and cellular respiration
   - **Nitrogen cycle**
     - Nitrogen fixing bacteria convert atmospheric nitrogen gas into a usable form of nitrogen for plants
   - **Phosphorous Cycle**
     - Phosphorous moves from in the soil, taken in by plants, then eventually cycled back into the ocean
   - **Oxygen Cycle**
     - Oxygen released from photosynthesis
     - Aerobic respiration takes in oxygen and releases carbon dioxide
     - Plants take in carbon dioxide in during photosynthesis (carbon fixation) and the process cycles over

6. **Describe how ecosystems change in response to natural and human disturbances (climate change, invasive species, pollution, fires)**
   - One of the most important characteristics of a community is how it responds to disturbance. Disturbances are events that change communities, remove or destroy organisms from communities, or alter resource availability.
     - Abiotic disturbances – droughts, fires, floods, volcanic eruptions, earthquakes, storms
     - Biotic disturbances – elephants tearing up trees while eating, bulldozing, clear cutting, paving, plowing, and mowing land
     - Some organisms may depend on disturbances to survive
     - May create the opportunities for new species to occupy a new habitat
   - The gradual, sequential regrowth of a community of species in an area is called **ecological succession**
   - Two types of succession
     - **Primary succession** is the development of a community in an area that has not supported life previously, such as bare rock, sand dune, or a recently formed volcanic island
     - **Secondary succession** is the sequential replacement of species that follows disruption of an existing community; occurs where soil is already present
   - The community proceeds through a predictable series of stages until it reaches a stable end point, called the **climax community**
     - Each stage paves the way for the next leading to the climax community which remains constant for long periods of time

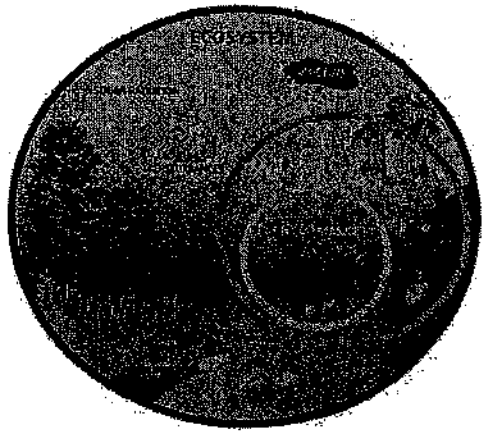
7. **Describe the effects of limiting factors on population dynamics and potential species extinction**
   - When the **carrying capacity** is reached, the number of individuals the environment can support is reached and population growth becomes stable
   - Any factor that restrains the growth of a population is a **limiting factor** (sunlight, water, food, space, mates)
   - As the population grows, competition for natural resources increases. Thus reproduction shrinks over time. This may lead to species extinction.

REVIEW QUESTIONS

1. Which of the following is NOT a basic need for a living organism in any habitat? Circle one.
   Food (nutrients) Water Shelter (space) Rocks

2. Using the diagram of an ecosystem below, list 5 biotic and 5 abiotic components found in both aquatic and terrestrial ecosystems.

Biotic	Abiotic



3. Fill in the following chart which lists levels of ecological organization from the most basic (lowest) to the most complex (highest) with either an example of that level or a definition of the term.

Use the diagrams of food chains below to answer the following questions.

Level of Organization	Example(s)	Definition/explanation
Organism	A deer, an oak tree, a fish	
Population	A herd of deer, a stand oak trees or a school of fish	Group of organisms of the same species
Community		
Ecosystem	A nature center, like Robbins Park, a fallen log, a pond or lake	
Biome		A region on Earth characterized by a specific climate and dominated by plants and animals suited to living in that climate/geographic area.
Biosphere		Region on Earth containing all living things.

4. The arrows in a food chain always point in the direction of _____.

5. The ultimate source of energy for the Earth and therefore all food chains is the _____.

6. Producers, like a tree, make their own energy. Name the process in which they make energy and write the equation. (Refer back to the "energy" section to help you.)

7. Consumers, like a human, get energy from eating (or consuming) something else. Name the process in which they obtain energy and write the equation. (Refer back to the "energy" section to help you.)

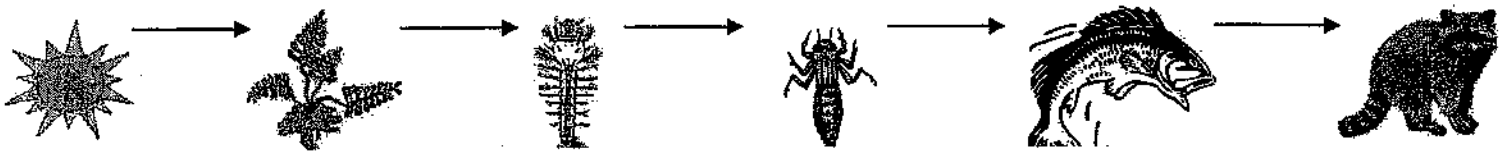
8. Primary consumers only eat producers. What do we call organisms that only eat producers? _____

9. What do we call organisms that only eat animals? _____ eat anything? _____

10. What's missing from the Ocean Aquatic Life Zone food chain below? _____

11. LABEL each food chain below with the **producer, primary consumer, secondary consumer, tertiary consumer, and quaternary consumer.**

Freshwater Aquatic Ecosystem

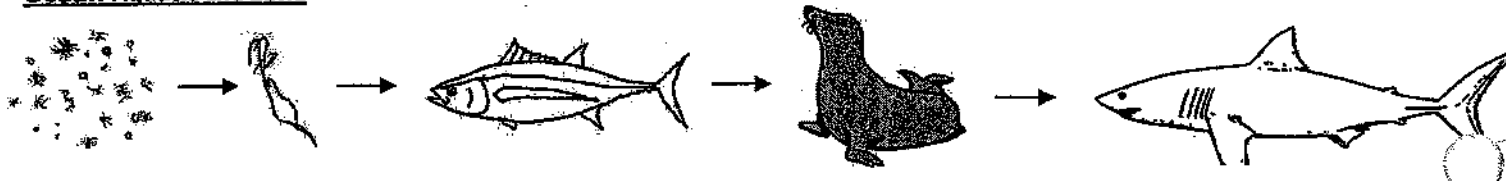


Algae Mosquito Larva Dragonfly nymph fish raccoon

Field Ecosystem (Grassland)

Grass grasshopper shrew snake hawk

Ocean Aquatic Life Zone



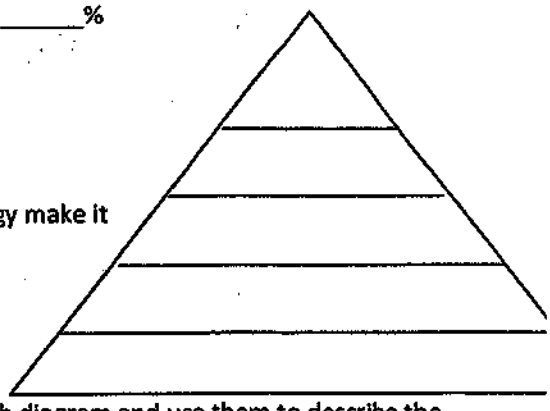
Phytoplankton zooplankton fish seal shark

12. A trophic level is the level at which an organism feeds. Choose one of the food chains above and place the organisms in the correct trophic levels on the energy pyramid to the right.

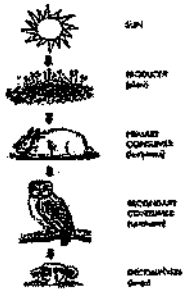
13. A pyramid is used to indicate energy flow in an ecosystem. (What happens to the energy as the trophic levels proceed upward?) How much energy is transferred from one trophic level to the next? _____%

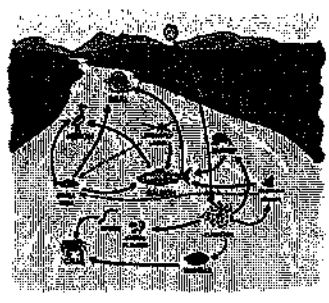
14. Why do many food chains only contain 3-4 links?

15. There are 10,000 kcal of energy in the producer level. How many kcal of energy make it up to the tertiary consumer level?



16. The diagrams below represent a food chain and food web. Correctly label each diagram and use them to describe the difference between a food chain and a food web.





17. For each case below label the relationship with one of the following labels:

Mutualism(M), Commensalism (C), Parasitism (P), Predator- prey (PP), Competition (Co)

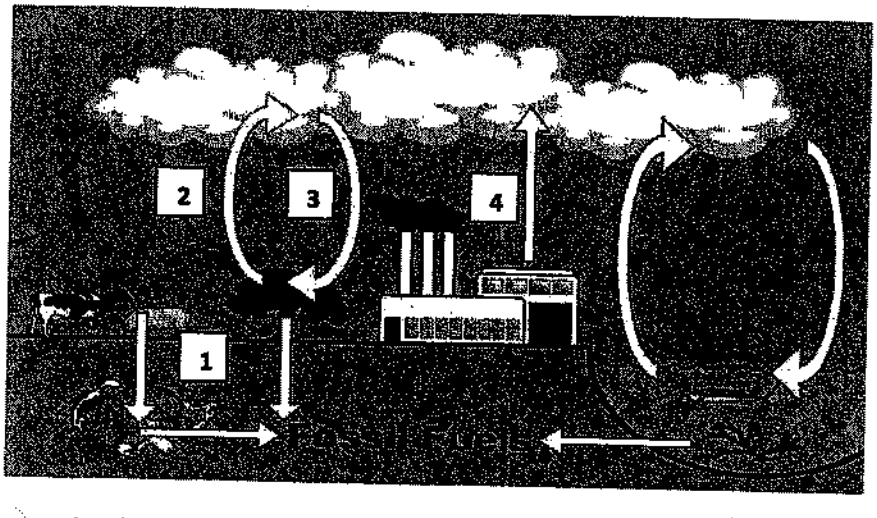
Remember:
In a mutualistic relationship both species benefit. ++
In a commensalistic relationship one species benefits, the other is unaffected +O
In a parasitic relationship one species benefits to the detriment (harm) of the other + -
In a predator prey relationship, one species catches and eats another + -
In a competitive relationship, both species want the same resource. - -

_____ A colony of deep sea polyps "becomes" the shell for a hermit crab providing a life-long shell for the crab and gaining transportation for itself in the process.
_____ A lichen is an algae and a fungus living in symbiosis, both gaining a method by which to obtain food.
_____ A deer tick lives off of the blood from a white footed mouse often weakening the mouse during its life time.
_____ A "herd" of hyena follows a lion to snatch the lion's prey once it is killed.
_____ An orchid is a plant that grows on a tree in the rain forest that gains nourishment from the humidity in the air (an epiphyte). The tree provides structure for the orchid, but is not harmed or benefited in the relationship.
_____ Humans use the habitat of the Ivory Billed woodpecker for development. (not predation)
_____ An ant "milks" honeydew from an aphid for nourishment while protecting a colony of aphids from predators.
_____ A hawk and a mouse.
_____ Trees in a forest grow taller and taller.

Carbon Cycle

18. Look back at the "Organic Chemistry" section to help you fill in the following blanks. Carbon is the basic building block for _____, _____, _____, _____. These are all _____ compounds because they contain Carbon.

Use the words below to fill in the blanks below:	
Combustion	Decomposition
Photosynthesis	Cellular Respiration



Arrow 1 shows _____

Arrow 2 shows _____

Arrow 3 shows _____

Arrow 4 shows _____

19. The carbon cycle is based on what gas? _____

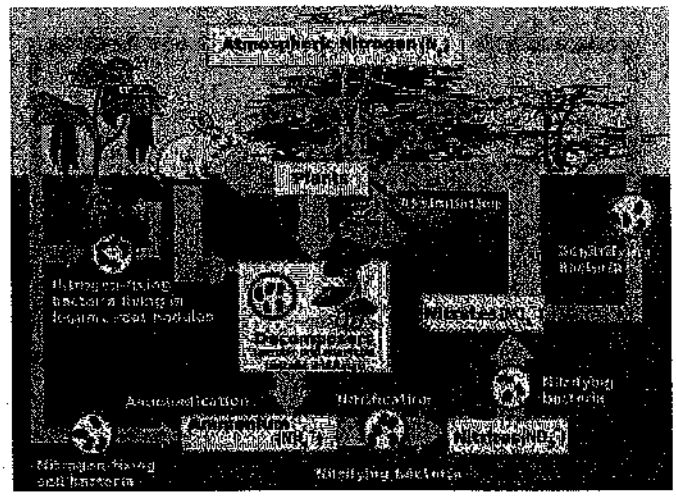
20. CO_2 is considered "nature's thermostat". Explain what happens when there is more CO_2 in a certain mass of air and what happens when there is less CO_2.

21. Oil, coal, and natural gas are fossil fuels that provide us with energy. Why are fossil fuels considered part of the carbo cycle?

22. Explain the human impacts on the carbon cycle.

Nitrogen Cycle

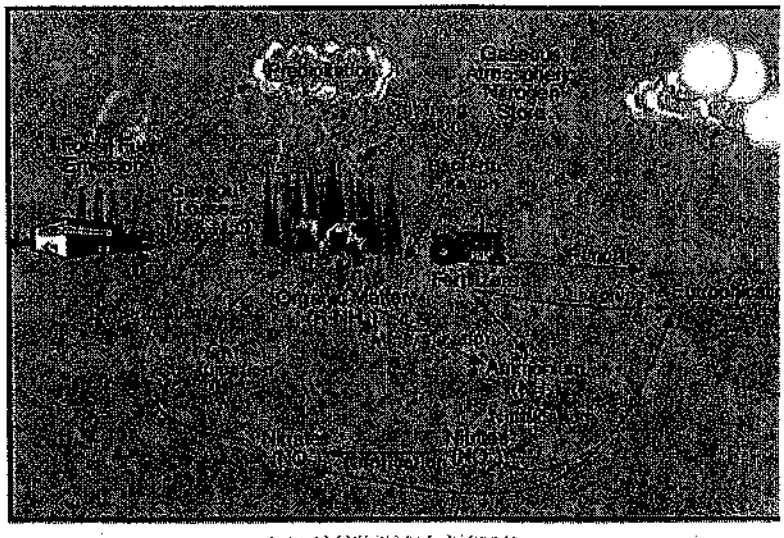
Plants and animals need nitrogen in order to form macromolecules. Animals get the nitrogen they need by eating plants or other animals. Even though the atmosphere is 80% nitrogen, plants get their nitrogen from the soil. Use the diagrams to help answer the following questions.



23. Why can't plants use the nitrogen directly from the atmosphere?

24. What organisms change atmospheric nitrogen into nitrate the form needed by plants?

25. How does nitrogen get returned back to the atmosphere?



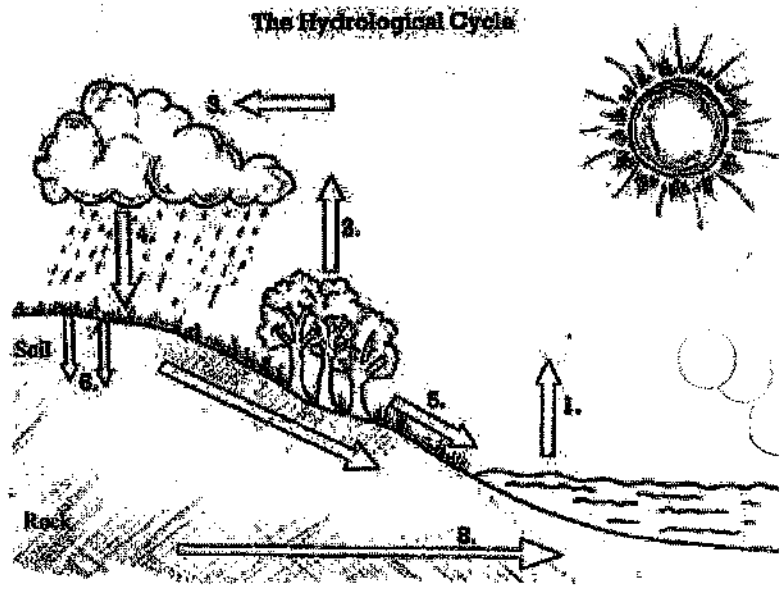
26. How is acid rain formed from nitrogen compounds?

27. Describe the agricultural practices that affect the nitrogen cycle.

28. Describe how nitrogen is removed from grasslands and forests.

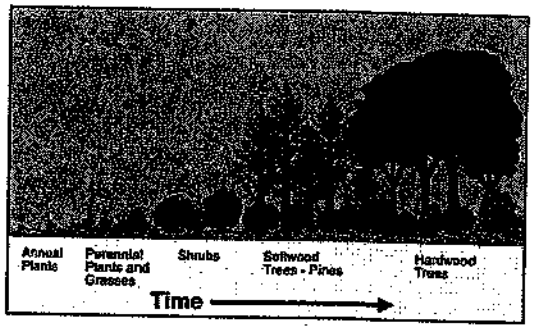
Water Cycle

29. Label the diagram with the steps of the water cycle ***transpiration, evaporation, condensation, infiltration, precipitation, runoff.*** Can you explain what is happening at each step?



30. Explain 2 ways that humans are impacting the hydrologic (water) cycle.

31. Use the diagram to the right to help you define ecological succession.



A ***limiting factor*** is something that, when limited, determines the carrying capacity of an ecosystem for a particular species. The ***carrying capacity*** is the largest population that an environment can support at any given time. If an important resource is limited, such as food, the carrying capacity will decrease causing individuals in the population to die or migrate.

32. Explain how the following limiting factors can change populations and contribute to species extinction. Refer to the "evolution" section if you need help.
    a. Nutrients, water, shelter, clean air

    b. competition for resources, predation and disease

    c. Describe the differences between density dependent factors and density-independent factors on population size

33. What is the greenhouse effect? How does is protect the earth?

34. What is global warming? What causes it?

35. What are some ways that carbon dioxide emissions can be reduced?

36. What is acid rain? What causes it?

37. What are non-native species and why are they a threat to endemic species?

38. What is eutrophication and how has agricultural runoff contributed to this problem?

39. What are some factors that influence birth/death rates in the human population?

40. Differentiate between positive growth, negative growth, moderate growth, and zero population growth.

46. Give examples of sustainable practices that will help save the environment.

PRACTICE QUESTIONS

131. Producers are single and multicellular organisms, such as algae and flowering plant that make their own food. How do these organisms produce their own food?
    a. They fix nitrogen from the atmosphere
    b. They consume other producers
    c. They exchange RNA with other organisms
    d. They convert sunlight into chemical energy

132. In general, which trophic level has the ***most*** energy available to it?
    a. producer
    b. primary consumer
    c. secondary consumer
    d. tertiary consumer

133. Which statement describes why pesticides are said to "move up the food chain?"
   a. Pesticides have a greater effect on larger animals than on insects.
   b. Top predators often accumulate the pesticides contained in the bodies of their prey.
   c. Birds and predatory mammals are not affected by pesticides.
   d. Pesticides kill insects and other target pests before they can absorb the poison.

134. Deer share the open plains with other grazing animals and predators. Which of the following would lead to a decrease in the deer population?
   a. a reduction in the predator population
   b. an increase in the number of other grazing animals
   c. a reduction in the grazing animal population
   d. an increase in restrictions on the hunting of deer

135. The burning of fossil fuels is causing an increase in which of the following?
   a. atmospheric oxygen
   b. atmospheric nitrogen
   c. atmospheric carbon dioxide
   d. atmospheric phosphate

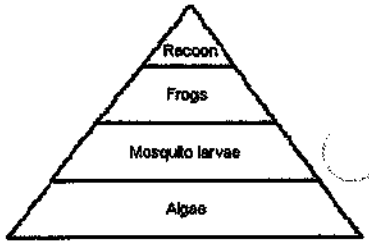
136. What is an ecosystem composed of?
   a. all the members of one species
   b. the biotic and abiotic factors in an environment
   c. all the members of a species living in the same area
   d. the biotic factors in an environment

137. Which event illustrates the interaction of an abiotic factor with a biotic factor in the environment?
   a. The lamprey eel survives by parasitizing trout.
   b. The temperature of water affects its oxygen level.
   c. The low light intensity of the forest affects the growth of pine trees.
   d. A gypsy moth caterpillar eats the leaves of an apple tree.

138. Nitrogen-fixing bacteria live on the roots of leguminous plants in swellings called nodules. The bacteria synthesize nitrogen compounds that are used by the plants, and the plants provide moisture and nutrients for the bacteria. The interaction between the nitrogen-fixing bacteria and the leguminous plants is known as
   a. parasitism
   b. mutualism
   c. predation
   d. commensalism

139. Select the term most closely associated with the statement: The roots of the mistletoe plant absorb nutrients from living oak trees, causing some damage to the tissues of the trees.
   a. mutualism
   b. commensalism
   c. parasitism
   d. saprophytism

140. Which term best describes the mosquito larvae? Refer to the diagram on the right.
   a. producer
   b. parasite
   c. carnivore
   d. consumer



141. Approximately 45 million acres of tropical rain forest are destroyed each year. Which of these probably does not result from the burning and clearing of tropical rain forests?
   a. an increase in global warming
   b. a decrease in the sources for new medicines
   c. an increase in oxygen in the atmosphere
   d. a decrease in the number of different species

142. In the carbon cycle, atmospheric carbon dioxide is converted into organic material by which process?
   a. cellular respiration
   b. decomposition
   c. photosynthesis
   d. transpiration

143. Why do ecosystems rarely contain more than a few trophic levels?
   a. Energy transfer efficiency is high
   b. Energy transfer efficiency is low
   c. Energy amounts remain constant
   d. Energy cannot flow through levels

144. Visiting sailors brought goats to the Galapagos Islands. The goats competed with native animals for food and shelter. Which of these was probably not affected by the goats?
   a. food supply
   b. spread of disease
   c. natural disasters
   d. stability of the ecosystem

145. Recent climate data suggest a global warming trend. The most likely cause could be an increase in which gas?
   a. oxygen
   b. carbon dioxide
   c. nitrogen
   d. hydrogen sulfide

Use the list below to answer the question.

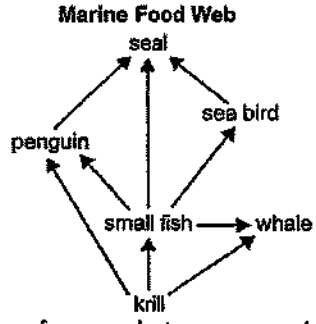
Observations
- two grey wolves
- five moose
- several species of conifer trees
- large granite rock
- shallow pond

146. A student wrote several observations in a field notebook. Which term **best** classifies all of the student's observations?
   a. population
   b. food chain
   c. ecosystem
   d. community

147. A researcher observing an ecosystem describes the amount of sunlight, precipitation, and type of soil present. Which factors is the researcher **most likely** describing?
   a. biotic factors in a forest
   b. biotic factors in a tundra
   c. abiotic factors in a prairie
   d. abiotic factors in an ocean

148. A species of snapping turtles has a tongue that resembles a worm. The tongue is used to attract small fish. Which best describes the interaction between the fish and the snapping turtle?
   a. predation
   b. symbiosis
   c. parasitism
   d. competition

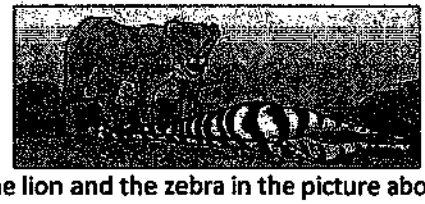
Use the diagram below to answer the question.



149. Which sequence correctly describes the flow of energy between organisms in the marine food web?
   a. from seals to penguins to krill
   b. from whales to krill to small fish
   c. from sea birds to seals to penguins
   d. from small fish to penguins to seals

150. Agricultural runoff can carry fertilizers into lakes and streams. This runoff can cause algae populations to greatly increase. Which effect does this change in the algae population sizes **most likely** have on affected lakes and streams?
   a. an increase in water level
   b. an increase in water clarity
   c. reduction in dissolved oxygen needed by fish and shellfish
   d. reduction in temperature variations near the water's surface

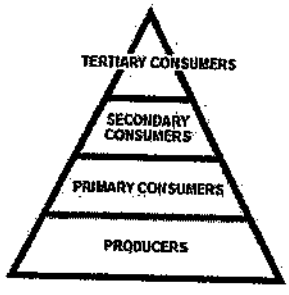
151. A farmer observed that an increase in a field's soil nitrogen content was followed by an increase in producer productivity. What does this observation **most likely** indicate about the relationship between nitrogen and the producers in the field?
   a. Nitrogen was a biotic factor.
   b. Nitrogen was a limiting factor.
   c. Nitrogen became a surplus resource.
   d. Nitrogen became a selection pressure.



152. What interaction is shown between the lion and the zebra in the picture above?
   a. predator/prey
   b. parasite/host
   c. consumer/decomposer
   d. consumer/producer

153. The Mute Swan is a species of bird with an orange-reddish bill and white feathers. It is naturally found in Europe and Asia but can sometimes be found in the United States as a result of the importation of these non-native birds. Mute Swans are one of the heaviest flying birds and consume up to 8 pounds of vegetation each day. How will the migration of Mute Swans into an area most likely affect the birds native to that area?
   a. The native birds and the Mute Swans will coexist peacefully together.
   b. The native birds will immediately migrate to another area.
   c. The native birds will decrease in number because there is not enough food for all the birds.
   d. The native birds will adapt to consume less food or different types of food.

154. Biomes are large geographical areas with distinct plants and animals that are adapted to that particular environment. The largest biome in the world is the taiga which stretches over the northern portions of Eurasia and North America. The taiga is a major biome characterized by lots of snow and very cold temperatures. In fact, the winter temperature range is -54 to -1°C (-65 to 30°F), and the summer temperature range is -7 to 21°C (20 to 70°F). Given this description of the taiga, which of the following organisms is best suited to live in this biome?
   a. camels
   b. parrots
   c. frogs
   d. moose



155. The above diagram suggests that
   a. energy flows from secondary consumers to primary consumers in an ecosystem.
   b. tertiary consumers are the ultimate source of energy in an ecosystem.
   c. there are more tertiary consumers than producers in an energy pyramid.
   d. producers are the foundation of all energy pyramids.

156. A herd of zebra eating grass includes groups of organisms from different species. These groups best exemplify
   a. a biome interaction.
   b. a community interaction.
   c. an ecosystem interaction.
   d. a population interaction.

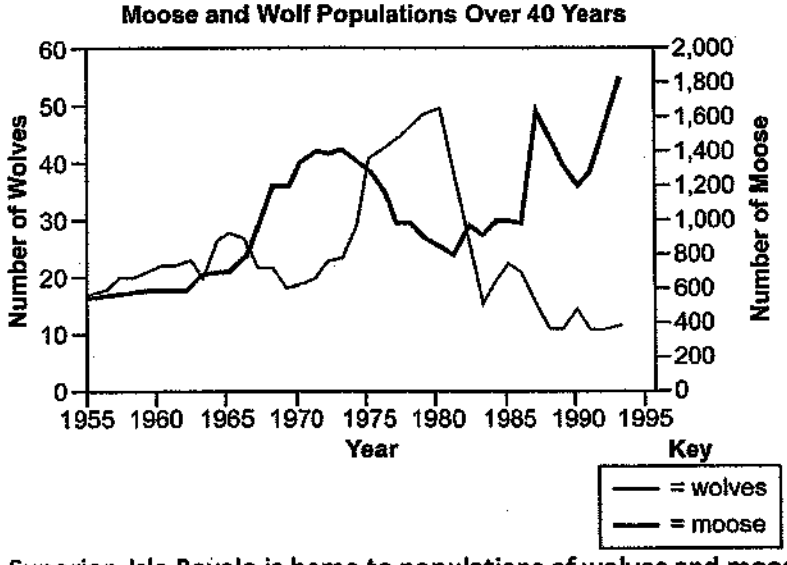
157. The Earth's carbon cycle consists of the flow, cycling, and recycling of all of the carbon on the Earth. Every living organism's composition includes the element carbon. How does carbon become part of living organisms?
   a. Producers take in carbon directly from the soil through their roots, and consumers eat the producers.
   b. Producers take in carbon dioxide from the air, and consumers eat the producers.
   c. Carbon is a part of sunlight and enters through the skins of all organisms.
   d. Consumers take in carbon dioxide from the air, and producers eat the consumers.

158. Which animal has modified ecosystems more than any other animal and has had the greatest negative impact on world ecosystems?
   a. Gypsy moth
   b. Zebra muscle
   c. Human
   d. Shark

159. One way to help provide suitable environments for future generations is to urge individuals to
   a. Apply ecological principles when making decisions that will have an environmental impact
   b. Control all aspects of natural environments
   c. Agree that population controls have no impact on environmental matters
   d. Work toward increasing global warming

160. Which statement best describes how species diversity helps ecosystems remain stable?
   a. It reduces the frequency of genetic mutations.
   b. It reduces the dependence of animals on plants.
   c. It increases the health of all the individual organisms.
   d. It increases the variety of responses to environmental changes.

Use the graph below to answer the question.



Isle Royale is located in Lake Superior. Isle Royale is home to populations of wolves and moose. The interactions between the wolves and moose, as well as the individual population sizes, have been studied since 1958. The graph shows the population sizes over time for both wolves and moose.

Part A: Describe one limiting factor for the moose population.

Part B: Explain one likely reason why the wolf population rapidly increased between 1975 and 1980.

Part C: Predict what will happen to the moose population's size after 1994 by describing the shape of the curve. In your answer, be sure to explain the reasoning behind your prediction.