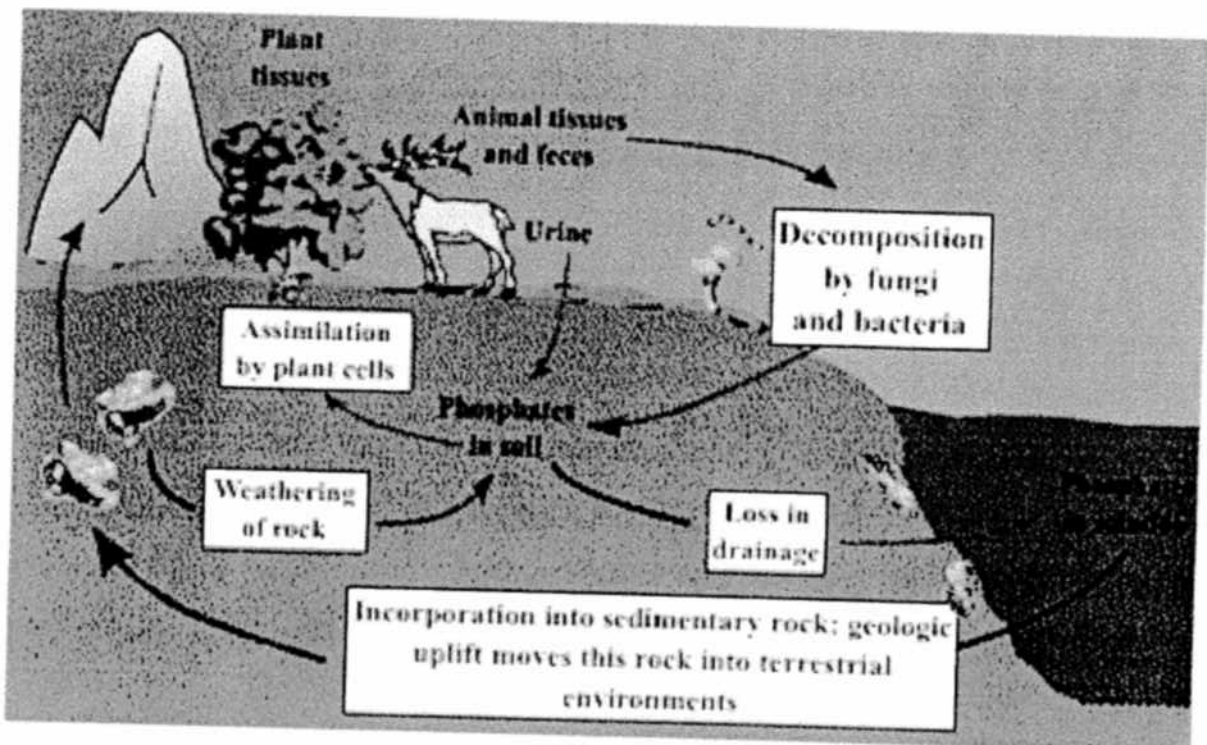


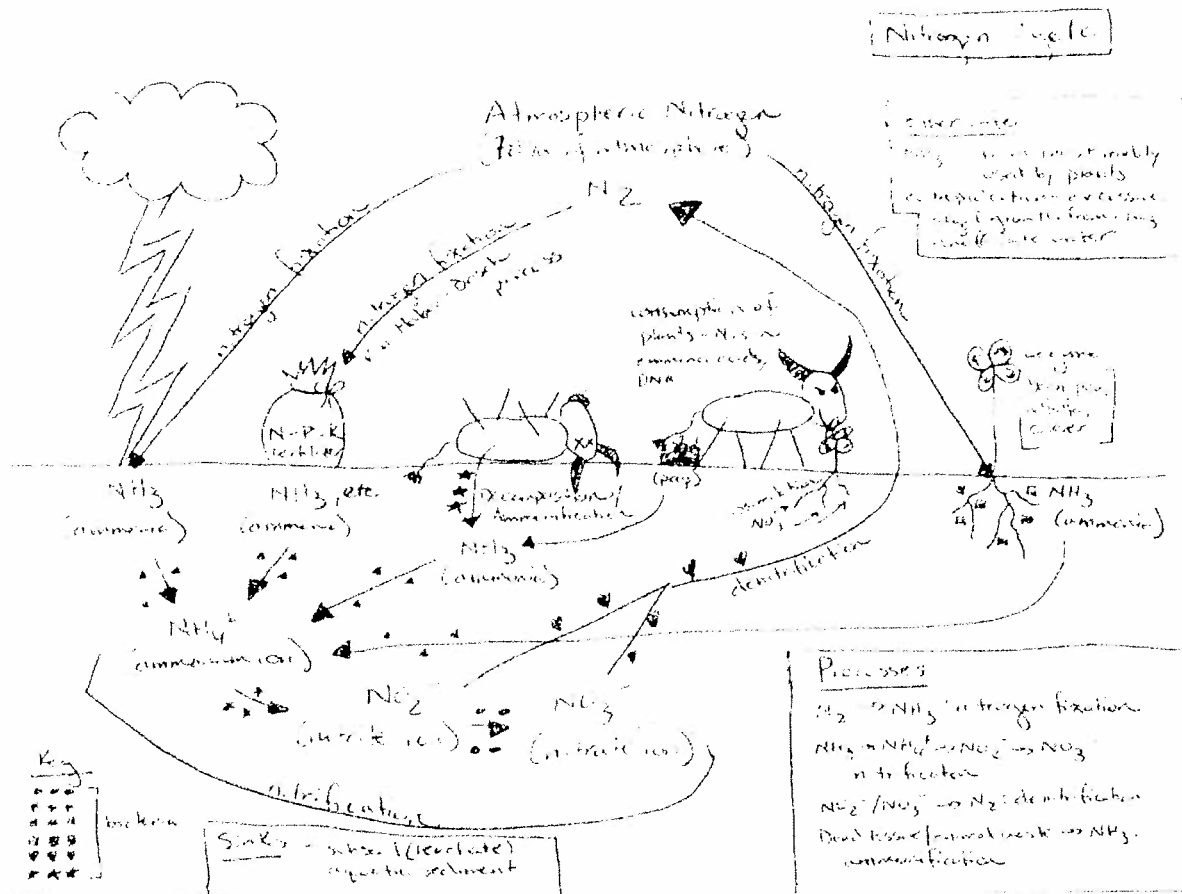
Feedback Loops

1. Many feedbacks are involved in global warming. For each of the following, determine whether it is a positive feedback loop or a negative feedback loop affecting the temperature of the planet and justify your answer.
 - a. Ice reflects sunlight energy, and ocean water absorbs sunlight energy. As the average temperature of the planet increases, more ice melts. This increases the amount of solar energy absorbed by the planet, which increases the average surface temperature further. *Positive*
 - b. Increasing surface temperatures increase the rate of evaporation. As evaporation rises, the skies get cloudier (on average). These clouds reflect solar energy back to space that would otherwise be absorbed, which cools the planet. *Negative*
 - c. Increasing surface temperatures cause semi-frozen soil called permafrost to thaw. The warmer it gets, the more it thaws. This permafrost often contains Methane molecules locked up within its ice in a form known as Methane Clathrates. As the permafrost thaws, these molecules of Methane escape to the atmosphere, where they act as a powerful greenhouse gas. *Positive*
 - d. Increasing surface temperatures increase the rate of evaporation. As the rate of evaporation increases, the rate of rainfall increases as well. When it rains, greenhouse gases such as CO₂ are removed from the atmosphere. *Negative*
 - e. The ocean absorbs CO₂ from the atmosphere via diffusion. As concentrations of CO₂ in the atmosphere rise, the rate at which CO₂ diffuses in to the ocean increases, removing CO₂ from the atmosphere at a faster rate. *Negative*

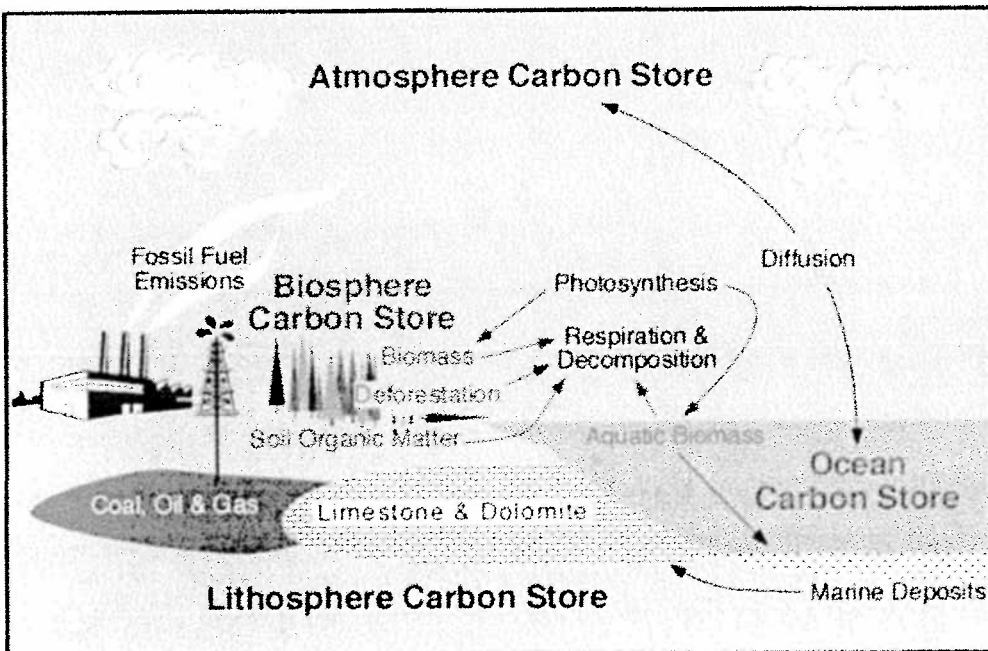
Phosphorus cycle



Nitrogen Cycle



Carbon cycle



Population practice problems:

1. In 2005, the United States had a population of approximately 295,000,000 people. If the birth rate was 13 births for every 1,000 people, approximately how many births occurred in the United States in 2005?

- a. 3,800
- b. 38,000
- c. 380,000
- d. 3,800,000
- e. 38,000,000

$$\frac{13}{1000} = \frac{x}{295,000,000}$$

2. A population of ground squirrels has an annual ^{per person} per capita birth rate of 0.06 and an annual per capita death rate of 0.02. Estimate the number of individuals added to (or lost from) a population of 1,000 individuals in one year.

- a. 120 individuals added
- b. 40 individuals added
- c. 20 individuals added
- d. 400 individuals added
- e. 20 individuals lost

$$.06 \times 1000 = 60$$

$$.02 \times 1000 = \frac{20}{40}$$

3. The Resource Manager of Tybee Island calls you in to do an assessment of the deer population there. It turns out that the vegetation has been severely damaged by deer in recent years and she cannot support the decision to allow deer hunting unless she has proof that the deer populations are increasing. You collect the following information during a one year period (2005): of the 1,000 deer on the island, 120 deer die, 200 deer are born, 20 immigrate via the causeway connecting the island to Savannah, and 10 emigrate via the causeway.

9% a. Calculate the population growth rate. Write it as a percent. Show your work.

$$\frac{(200 - 120) + (20 - 10)}{1000} = \frac{90}{1000} = 9\%$$

b. Calculate the doubling time for the deer population. Show your work.

$$\frac{70}{9} = 7.78 \text{ years}$$

c. Based upon the data you have collected for 2005, you instruct the resource manager that :

- A. She can open the island for a deer hunting season
- B. Deer populations are decreasing on their own, therefore she cannot allow a hunt
- C. Deer populations are not getting either larger or smaller, therefore she must assess the issue again next year
- D. The data you have collected cannot help you to inform the resource manager

4. Georgia farmers have complained that armadillos are becoming more common in the area. You want to find out if there is some truth to this statement. You set armadillo traps all over Bulloch County and find that the population of armadillos is approximately 2,000 for the county. Over the course of the next year, you determine that 300 armadillos are born, 290 die, 100 immigrate from the south and 90 emigrate northwards.

a. Is the farmers' statement true for Bulloch county? Explain.

$$\overset{-100}{\rightarrow} \frac{(300 - 290) + (100 - 90)}{10 + 10}$$

b. What is the doubling time for armadillos in Bulloch county? Show your work.

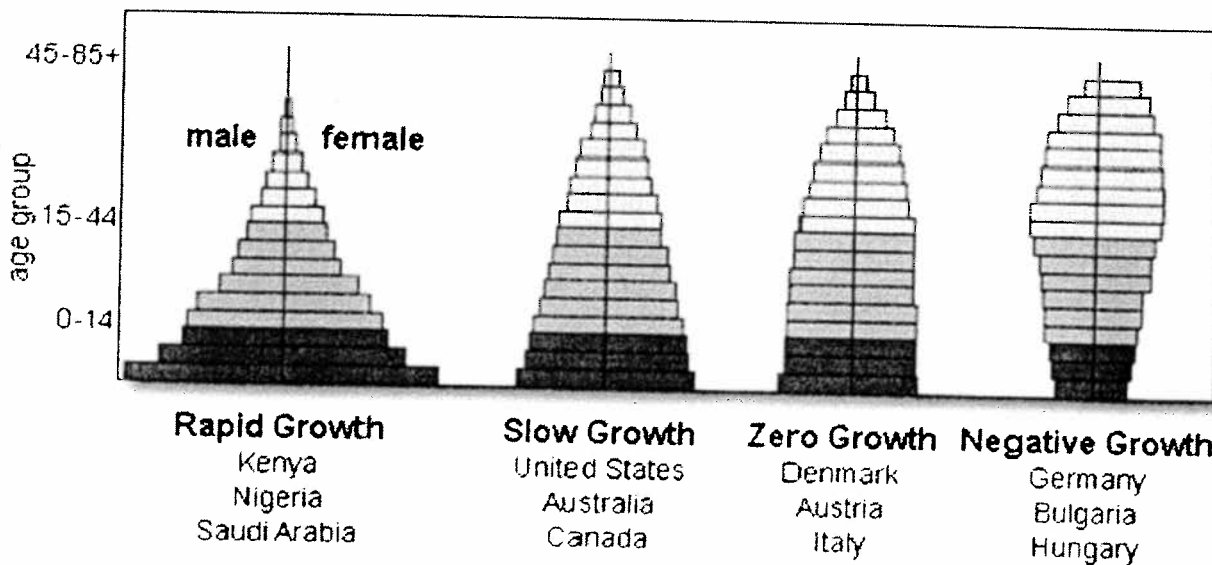
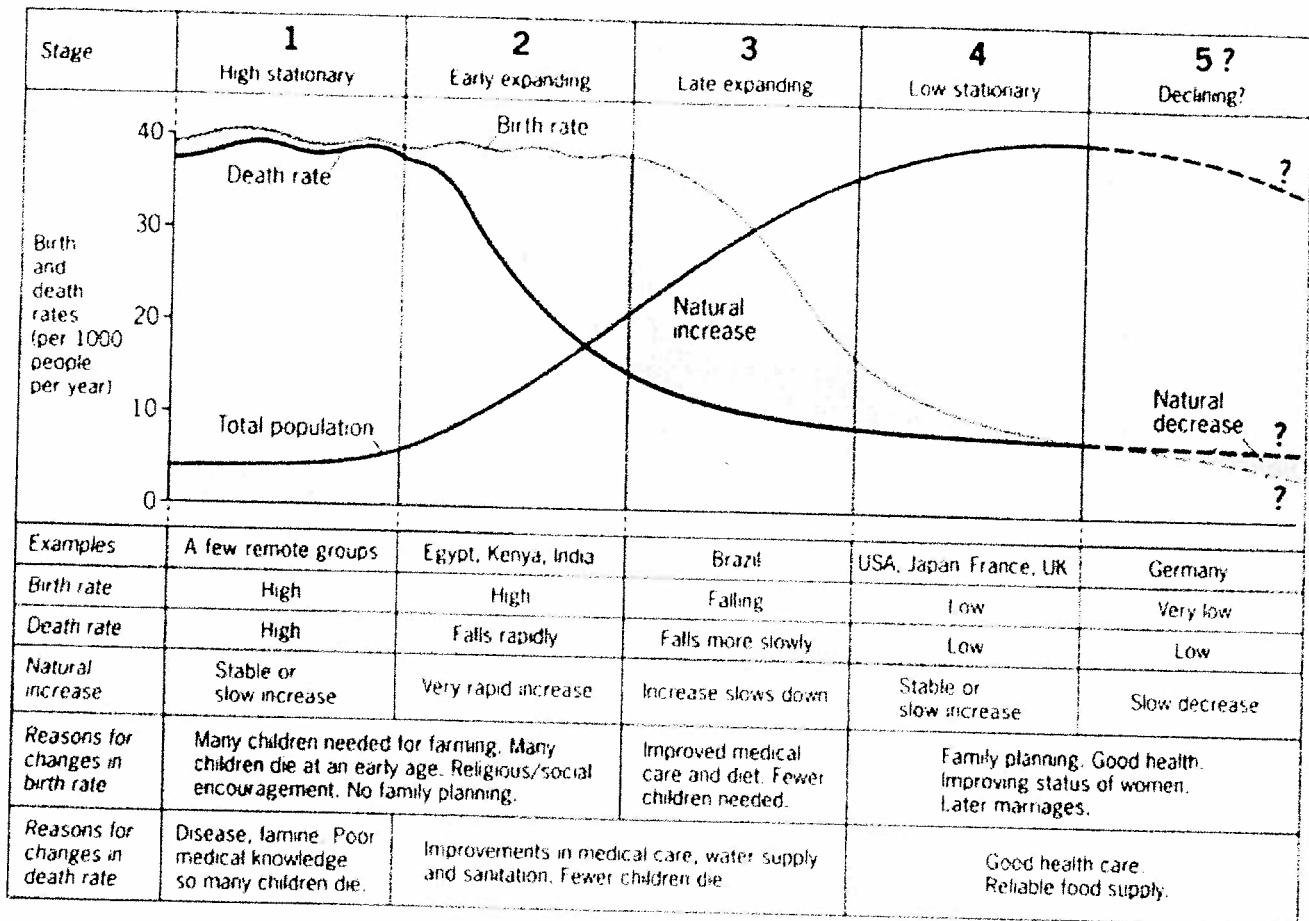
$$\frac{70}{1} = 70 \text{ years}$$

$$\frac{20}{2000} \text{ growth rate} = 1\%$$

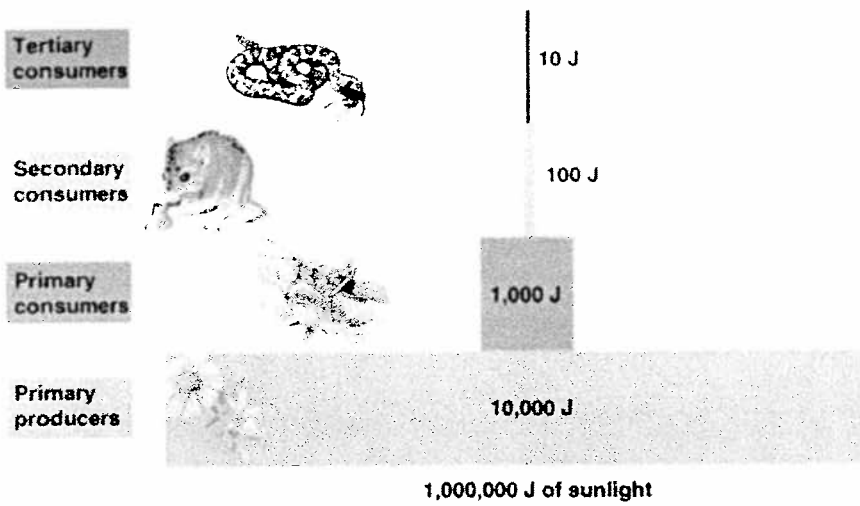
APES Final Review- Fall 2015

Biome Summary Chart

Biome	Location	Climate	Soil	Plants	Animals
Desert	midlatitudes	generally very hot days, cool nights; precipitation less than 10 inches a year	poor in animal and plant decay products but often rich in minerals	none to cacti, yuccas, bunch grasses, shrubs, and a few trees	rodents, snakes, lizards, tortoises, insects, and some birds. The Sahara in Africa is home to camels, gazelles, antelopes, small foxes, snakes, lizards, and gerbils
Tundra	high northern latitudes	very cold, harsh, and long winters; short and cool summers; 10-25 centimeters (4-10 inches) of precipitation a year	nutrient-poor, permafrost layer a few inches down	grasses, wildflowers, mosses, small shrubs	musk oxen, migrating caribou, arctic foxes, weasels, snowshoe hares, owls, hawks, various rodents, occasional polar bears
Grassland	midlatitudes, interiors of continents	cool in winter, hot in summer; 25-75 centimeters of precipitation a year	rich topsoil	mostly grasses and small shrubs, some trees near sources of water	american grasslands include prairie dogs, foxes, small mammals, snakes, insects, various birds. African grasslands include elephants, lions, zebras, giraffes.
Deciduous Forest	midlatitudes	relatively mild summers and cold winters, 76-127 centimeters (30-50 inches) of precipitation a year	rich topsoil over clay	hardwoods such as oaks, beeches, hickories, maples	wolves, deer, bears, and a wide variety of small mammals, birds, amphibians, reptiles, and insects.
Taiga	mid- to high latitudes	very cold winters, cool summers,; about 50 centimeters (20 inches) of precipitation a year	acidic, mineral-poor, decayed pine and spruce needles on surface	mostly spruce, fir, and other evergreens	rodents, snowshoe hares, lynx, sables, ermine, caribou, bears, wolves, birds in summer
Tropical Rainforest	near the equator	hot all year round, 200-400 centimeters (80-100 inches) of rain a year	nutrient-poor	greatest diversity of any biome; vines, orchids, ferns, and a wide variety of trees	more species of insects, reptiles, and amphibians than anyplace else; monkeys, other small and large mammals, including in some places elephants, all sorts of colorful birds

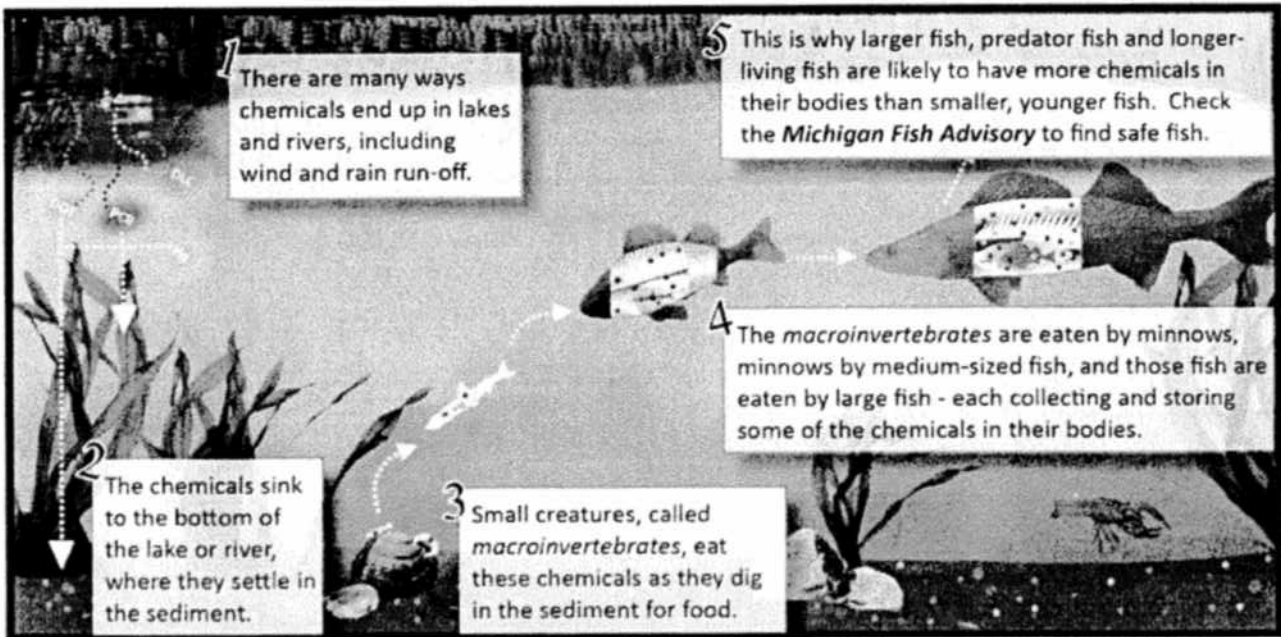


Trophic levels



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Bioaccumulation in Action



USDA
United States
Department of
Agriculture

unlock the secrets in the soil

"Do know those open the do of secrets hidden from most the soil scientists."
—Lama, the do know

Living in the soil are plant roots, bacteria, fungi, protozoa, algae, mites, nematodes, worms, ants, maggots, insects and grubs, and larger animals.

science of soil
soil is made of about **45%** minerals, **25%** water, **5%** humus, and **25%** air.

what's underneath
Healthy soil has amazing water-retention capacity. **1%** increase in organic matter results in as much as **25,000** gal of available soil water per acre.

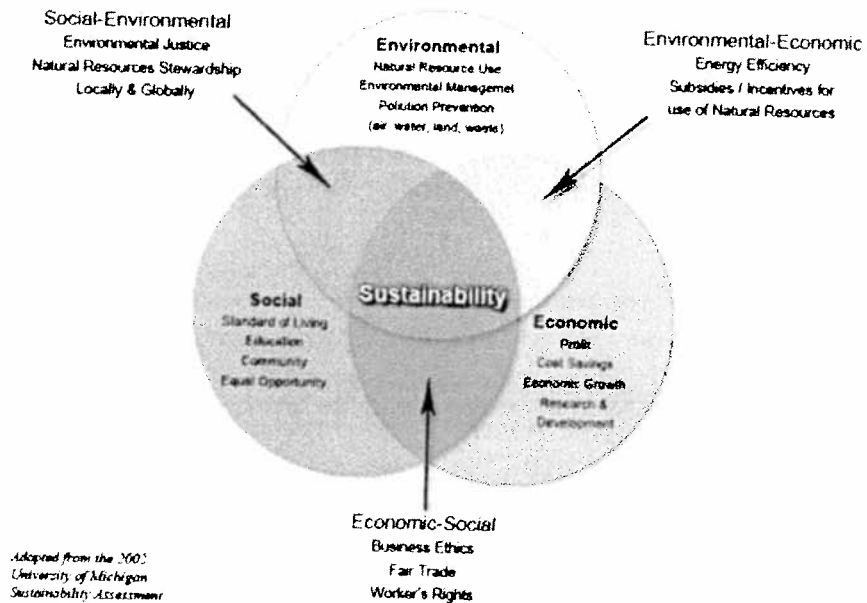
100 million-billion individual bacteria.

Earthworm populations consume 2 tons of dry matter per acre per year, turning soil into plant-usable nutrients.

what it does
Healthy soil is key to feeding **9 billion** by **2050**.

All of the soil microbes in 1cc/ft of soil weigh more than **2 COWS**.

The Three Spheres of Sustainability



APES Practice Test

Part I: Objective Section...60% of the test

- a) aesthetic b) moral c) ecological d) utilitarian e) cultural
1. Justification for preserving a tropical forest because organisms in the forest are a source of medicine. **D**
2. Justification for preserving grasslands because they convert carbon dioxide into oxygen. **C**
3. Justification for protecting an endangered species because it has a right to exist. **B**
4. Justification for preserving an endangered species because the tourism industry relies on the money travelers spend to see them. **D**
- a) micro- b) milli- c) kilo- d) mega- e) giga-
5. one millionth of a gram is a _____ gram. **A**
6. one thousand liters is a _____ liter. **C**
7. one million Watts is a _____ Watt. **D**

Read the following statement, then answer the series of questions that follow.

An experiment was conducted in which four identical automobiles were driven side-by-side on a test track using four different grades of gasoline. At the conclusion of the experiment, the gas mileage was calculated for each vehicle, and a visual inspection of each car's engine was performed by a mechanic to evaluate the amount of engine wear.

- a) the grade of gasoline.
b) the gas mileage of the automobiles.
c) the type of automobile.
d) the weather at the test track.
e) the test track.
8. The independent variable in the experiment was **A**
9. The qualitative data collected in the experiment was **D - visual inspection**
10. The quantitative data collected in the experiment was **B**
11. The dependent variable in the experiment was **B**
12. One of the most significant fluctuations in human population growth occurred in the 14th century as a result of
a) small pox b) West Nile virus **c) bubonic plague** d) influenza e) SARS
13. The underlying problem of all environmental problems is
a) the rapidly increasing human population
b) the refusal of developing nations to stop using CFC's
c) the greenhouse effect
d) contaminated soil and drinking water
e) that our generation does not have a global perspective on environmental problems and how to solve them
14. All nonrenewable resources have characteristics that allow them to be
a) reused.
b) converted for other uses.
c) converted to renewable resources.
d) recycled.
e) exhausted.
15. In a tragedy of the commons an example of the "commons" could include
a) factory workers.
b) pasture
c) immigrants.
d) residential property.
e) students.
16. A tragedy of the commons is most likely to occur if people behave
a) rationally b) illogically c) criminally d) immorally e) efficiently

17. The main argument for boycotting all products made with the tropical hardwood, mahogany, is that:
- a) logging mahogany is unsustainable, and it opens rainforest land to other types of encroachment
 - b) mahogany trees are an endangered species
 - c) mahogany is grown mainly in Belize, which is a brutal and repressive dictatorship
 - d) mahogany trees are the principal habitat for the endangered tree sloth
 - e) mahogany processing produces large amounts of methane, promoting global warming
18. In a total free-market system, commercial enterprises maximize profits by paying only _____ costs and ignoring _____.
- a) indirect; direct costs
 - b) intangible; externalities
 - c) direct; externalities
 - d) mandatory; supply and demand
 - e) direct; the discount factor
19. Many natural organisms and ecosystems perform service functions that are beneficial to humans. These include all of the following **except**:
- a) bees pollinating crops
 - b) bacteria fixing nitrogen in the ocean
 - c) salt marshes convert toxic compounds to nontoxic forms
 - d) biological degradation of toxic material applied to land
 - e) water in the atmosphere combines with sulfurous pollutants and rains to the ground
20. In order to explain a set of supported hypotheses, scientists may propose a(n)
- a) fact
 - b) operational definition
 - c) super hypothesis
 - d) conclusion
 - e) model
21. Non-point sources of pollution include all of the following except
- a) overspill from a stockyard.
 - b) runoff from croplands.
 - c) a smokestack from a power plant.
 - d) fertilizer overflow from lawns.
 - e) urban runoff from streets.
22. In science
- a) deductive reasoning is considered far more useful than inductive reasoning due to the infallibility of the conclusions that result from inductive reasoning.
 - b) error analysis causes great confusion.
 - c) most conclusions are 100% certain.
 - d) inductive reasoning is combined with deductive reasoning to analyze conclusions.
 - e) measurements are considered meaningless when they are accompanied by an estimate of uncertainty.
23. Which of the following statements is the best example of a hypothesis?
- a) If more carbon dioxide is added to the atmosphere, the temperature of the Earth will change.
 - b) If insects are present on crops, pesticides are needed.
 - c) If the amount of ozone in the atmosphere changes, life on Earth will suffer.
 - d) If the amount of mercury ingested by children increased, their cognitive ability decreases
 - e) If the size of a population increases, it has huge repercussions on the environment.
- need direction*
24. Precision and accuracy:
- a) refer to a series of logically connected statements
 - b) are comparable in their importance for scientific work
 - c) always involve inductive and deductive proof
 - d) always change in value
 - e) are not equivalent
25. Which of the following statements is true?
- a) Science is limited by technology.
 - b) Scientists quickly identify ideas at the frontiers of science that will become accepted theories.
 - c) The media carefully screens stories and only rarely reports claims that are not supported by the majority of the scientific community.
 - d) Science is unbiased.
 - e) All of the statements are true.

- a) Keystone species b) Exotic species c) Ubiquitous species d) Endemic species e) Indicator species
- 26) A fig tree whose fruit is necessary for the survival of numerous animal species. **A**
- 27) A native of Russian lakes, the zebra mussels that clog the waterways around Detroit. **B**
- 28) A Monterey pine, found only on a portion of the California coast. **D**
- 29) The purple loosestrife population in North America. **B**
- 30) *E. Coli*, bacteria found in human intestines. **C**
- a) Parasitism b) Predation c) Commensalism d) Competition e) Symbiosis
- 31) A wasp lays its eggs beneath the skin of a caterpillar, once hatched the larvae eat the body of the caterpillar from the inside. **A**
- 32) Microscopic mites live in human hair follicles; they cause no harm as they eat oils off the human's skin. **C**
- 33) A wolf feeding on a moose. - **B**
- 34) Biogeography refers to
- a) biological distribution of organisms in a food chain.
 - b) geographic distribution of biotic provinces.
 - c) geographic distribution of living organisms.**
 - d) biological distribution of introduced species.
 - e) changes in wildlife habitat over time.
- 35) What does the statement "two species that have exactly the same requirements cannot coexist in exactly the same habitat" refer to?
- a) species diversity
 - b) species dominance
 - c) competitive exclusion**
 - d) biological evolution
 - e) natural selection
- 36) The extinction of which of the following would have the most drastic consequences for the continuation of life on earth?
- a) human beings
 - b) herbivorous animals
 - c) bacteria and blue-green algae**
 - d) coniferous trees
 - e) viruses
- 37) Consider the following scenario: The temperature of your skin increases, which leads to an increase in perspiration. Perspiration evaporates from the surface of your skin. The temperature of your skin decreases. This is an example of
- a) a closed system.
 - b) an open system.
 - c) synergy.
 - d) a positive feedback loop.
 - e) a negative feedback loop.**
- 38) In a food chain that includes three trophic levels, photosynthesis occurs in the organisms in the ____ trophic level(s).
- a) 1st**
 - b) 1st & 2nd
 - c) 2nd
 - d) 3rd
 - e) 2nd & 3rd
- 39) The organisms permanently classified as primary consumers are
- a) decomposers.
 - b) omnivores.
 - c) carnivores.
 - d) herbivores.**
 - e) producers.
- 40) The processes that lead to biological evolution are:
- a) mutation, self-reproduction, competition and natural selection
 - b) natural selection, genetic drift, changing cell structures and self-reproduction over time
 - c) mutation, migration, competition, and changing cell structures over time
 - d) natural selection, migration, genetic drift, and mutation**
 - e) reproduction, migration, predation, and natural selection
- 41) The Norway rat and the black rat were both introduced to this country from Europe. The Norway rat is found only in cities and inhabits most cities in the U.S. The black rat can live in cities and rural areas but in New Jersey is only found in rural areas. Some cities in New Jersey, which previously had only black rats, now have only Norway rats. This is an example of:
- a) biological evolution
 - b) genetic drift
 - c) competitive exclusion**

APES Practice Final

Solarez 2015

- d) predation
e) mutation
- 42) Complex feeding patterns for consumers in an ecosystem are called
a) food webs. b) food chains. c) trophic levels. d) energy pyramids. e) biomass.
- 43) The hydrologic cycle is driven primarily by
a) mechanical and chemical energy.
b) photosynthesis and respiration
c) solar energy and the moon.
d) solar energy and gravity.
e) solar energy and mechanical energy.
- 44) Based on the theory of island biogeography, a correct prediction regarding large islands near the mainland is that they should have
a) a relatively high immigration rate and relatively high extinction rate.
b) a relatively high immigration rate and relatively low extinction rate.
c) zero immigration and a relatively low extinction rate.
d) a relatively low immigration rate and relatively high extinction rate.
e) zero immigration and a relatively high extinction rate.
- 45) Which of the following is the most important factor in determining the type of biome that will be found in an area?
a) species dominance
b) biological diversity
c) altitude
d) continental drift
e) climate
- 46) The number of identified and named species is nearest
a) 1.5×10^1 b) 1.5×10^3 c) 1.5×10^6 d) 1.5×10^9 e) 1.5×10^{12}
- 47) Two species with similar characteristics that are separated by large distances and are not closely related genetically most likely resulted from
a) biogeography
b) competitive exclusion
c) biotic province
d) island biogeography
e) convergent evolution
- 48) In an ecological community, species _____ is the total number of species, species _____ is the relative abundance of species, and species _____ is the most abundant species.
a) evenness; richness; dominance
b) richness; dominance; evenness
c) dominance; evenness; richness
d) richness; evenness; dominance
e) evenness; dominance; richness
- a) Linear growth b) Negative feedback c) Exponential growth d) Positive feedback e) Doubling time
- 49) Occurs when a quantity changes, indefinitely, by a fixed percentage in a fixed unit of time. **C**
- 50) Demonstrated by the sequence 2, 4, 8, 16, 32. **C**
- 51) Characterized by a sequence of events in which the output is a magnification of the input. **D**
- 52) Demonstrated by the sequence 12, 24, 36, 48, 60. **A**
- 53) Approximated by dividing the percent growth rate into 70. **E**
- a) Transpiration b) Fixation c) Respiration d) Mineralization e) Erosion
- A process that occurs during the carbon cycle. **C**
- A process that occurs during the rock cycle. **E**
- 56) A process that occurs during the water cycle. **A**

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57) A process that occurs during the nitrogen cycle. **B**

$$\frac{2004 - 1988}{16 \text{ years}} = \frac{16}{16} = 1$$

58) If the enrollment at West Ranch High School was 1600 students in 1988, and is 3200 in 2004, the growth rate of the student body at West Ranch High School is nearest

- a) 3.1% b) 3.6% **c) 4.3%** d) 5.3% e) 9.0%

59) A strain of bacteria grows at a rate of 10% each hour. If one hundred bacteria are present in a sealed bottle at 8:00 a.m., the number of bacteria present at 3:00 p.m. is nearest

- a) 200** b) 300 c) 400 d) 800 e) 1,600

60) Which of the following is one of the big six macronutrients?

- a) sodium b) iron c) chlorine **d) hydrogen** e) fluorine

61) Photosynthesis

- a) converts glucose into energy and water.
 b) requires the combustion of carbon.
 c) produces carbon dioxide and oxygen gas.
d) yields glucose and oxygen gas as products.
 e) requires carbon dioxide and nitrogen gas.

62) Nodules containing nitrogen-fixing bacteria are found on the roots of

- a) pine trees. b) roses. **c) peas.** d) grasses. e) oak trees.

63) Consider the following scenario: The population of a city increases, which leads to an increase in air and water pollution. The health of the people living in the city diminishes making it less desirable to live there. People move out of the city. This is an example of

- a) a positive feedback loop.
b) a negative feedback loop.
 c) synergy.
 d) a closed system.
 e) an open system.

64) The most common gas in the atmosphere is

- a) water vapor. b) carbon dioxide. c) oxygen. d) hydrogen. **e) nitrogen.**

65) The hydrologic cycle is driven primarily by

- a) solar energy and gravity.**
 b) solar energy and the moon.
 c) solar energy and mechanical energy.
 d) mechanical and chemical energy.
 e) photosynthesis and respiration

66) Which of the following is not a type of electromagnetic radiation?

- a) sound waves** b) light waves c) radio waves d) microwaves e) gamma waves

67) Nitrogen is a major component of all of the following except

- a) protein. b) DNA. c) ammonia. **d) sugar.** e) nitrate.

68) Which of the following is not a significant reservoir of phosphorus on Earth?

- a) the ocean b) animals **c) the atmosphere** d) rocks e) soil

69) The hydrologic cycle refers to the movement of

- a) hydrogen. b) oxygen. **c) water.** d) hydrocarbons. e) rain.

70) Consider the following scenario: The temperature of your skin increases, which leads to an increase in perspiration. Perspiration evaporates from the surface of your skin. The temperature of your skin decreases. This is an example of

- a) a positive feedback loop.
b) a negative feedback loop.
 c) synergy.
 d) a closed system.
 e) an open system.

70) Non-point sources of pollution include all of the following except

- a) overspill from a stockyard.
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