**B-3.6 (Chapter13.4 & 13.6) Illustrate the flow of energy through ecosystems (including food chains, food webs, energy pyramids, number pyramids, and biomass pyramids).**

**Key Concepts:** Food chain, food web, Trophic level: primary producers (autotrophs), primary consumers (heterotrophs), Types of consumers: herbivore, carnivore, omnivore, detritivore , Ecological pyramids: energy pyramid, number pyramid, biomass pyramid

***Food Chain***

A *\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_* is the simplest path that energy takes through an ecosystem. Energy enters an ecosystem from the \_\_\_\_\_\_\_\_\_\_. Each level in the transfer of energy through an ecosystem is called a *\_\_\_\_\_\_\_\_\_\_\_\_ level*. The organisms in each trophic level use some of the energy in the process of cellular respiration, lose energy due to heat loss, and store the rest. (10% is passed on, the other 90% is used for daily processes and given off as heat.)

• First trophic level - *primary producers* (green plants or other *autotrophs, Phytoplankton*).

• The second trophic level consists of *primary consumers (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)*.

○ Primary consumers that eat green plants are called *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*.

○ Examples: grasshoppers, rabbits and zooplankton.

• The third trophic level, or any higher trophic level, consists of *consumers*.

○ *carnivores*; *omnivores*

○ Examples of consumers include humans, wolves, frogs, and minnows.

• A heterotroph that decomposes organic material and returns the nutrients to soil, water, and air making the nutrients available to other organisms is called a *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*.

ARROWS POINT TO THE FLOW OF ENERGY!!!

***Food Web*** -represents many interconnected or NETWORK of food chains describing the various paths that energy takes through an ecosystem.

ARROWS POINT TO THE FLOW OF ENERGY!!!

***Ecological Pyramids***

1. *energy pyramid* represents the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ available for each trophic level in an ecosystem.

○ Each successive level in an ecosystem can support fewer numbers of organisms than the one below. With each level of the pyramid, only 10% of the energy available is used by organisms while there is an energy loss of about 90% to the environment.

2. *number pyramid* represents the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of individual organisms available for energy at each trophic level in an ecosystem. It can be used to examine how the population of a certain species affects another.

○ The total numbers of individual organisms tend to decline as one goes up trophic levels.

3. *biomass pyramid* represents the total \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of living organic matter (biomass) at each trophic level in an ecosystem.

○ Even though a biomass pyramid shows the total mass of organisms available at each level, it does not necessarily represent the amount of energy available at each level.

Pg 425 1. 2. 3. 4. 5. 6.

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**B-6.1 (Chapter 14.1) Explain how the interrelationships among organisms (including predation, competition, parasitism, mutualism, and commensalism) generate stability within ecosystems.**

**Key Concepts:** Ecosystem: stable ecosystem, Predation: predator, prey , Competition: niche , Symbiotic relationships: parasitism, mutualism, commensalism

*Abiotic and biotic factors*

• *\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_* are **non-living** and may be chemical or physical. Examples are water, nitrogen, oxygen, salinity, pH, soil nutrients and composition, temperature, amount of sunlight, and precipitation.

• *\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_* include all of the living components of an ecosystem. Examples are bacteria, fungi, plants, and animals.

An *\_\_\_\_\_\_\_\_\_\_\_\_\_* is defined as a community (all the organisms in a given area) and the \_\_\_\_\_\_\_\_\_\_\_\_ (nonliving) factors (such as water, soil, or climate) that affect them. A *stable ecosystem* is one where

• the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ numbers of each organism fluctuate at a predictable rate.

• the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of resources in the physical environment fluctuates at a predictable rate.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flows through the ecosystem at a fairly constant rate over time.

**Chapter 14.1 –**

1. How does a habitat differ from a niche? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

These fluctuations in populations and resources ultimately result in a stable ecosystem.

***Predation* Chapter 14.2**

*Predation* is an interaction between species in which one species (the *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*) eats the other (the *\_\_\_\_\_\_\_\_\_\_\_\_\_*). This interaction helps regulate the population within an ecosystem thereby causing it to become stable. Fluctuations in predator–prey populations are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. At some point the prey population grows so numerous that they are easy to find.

• A graph of predator–prey density over time shows how the cycle of fluctuations results in a stable ecosystem.

○ As the prey population increases, the predator population increases.

○ As the predator population increases, the prey population decreases****

***Competition***

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* is a relationship that occurs when **two** or **more** organisms need the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ resource at the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ time.

• Competition can be among the members of the same or different species and usually occurs with organisms that share the same niche.

○ An ecological *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* refers to the role of an organism in its environment including type of food it eats, how it obtains its food and how it interacts with other organisms.

○ Two species with identical ecological niches \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ coexist in the same habitat.

• Competition usually results in a decrease in the population of a species less adapted to compete for a particular resource.

***Symbiotic Relationships -***exists between organisms of two \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ species that live together in direct contact..

3 Types of symbiotic relationships

1. ***Parasitism*** one organism (the parasite) \_\_\_\_\_\_\_\_\_\_\_\_\_\_ at the expense of the other organism (the host). **( +, - )**

• Some live within the host (tape worms, heartworms, or bacteria), Some feed on external surface of a host( aphids, fleas, or mistletoe)

• Parasitism that results in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the host is devastating to both the parasite and the host populations. It is important that the host survive and thrive long enough for the parasite to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and spread.

1. ***Mutualism****-* both organisms benefit. **(+ , +)**

bacteria, which have the ability to digest wood, live within the digestive tracts of termites; plant roots provide food for fungi that break down nutrients the plant needs.

1. ***Commensalism*** *-* one organism benefits and the organism is not affected. **(+,0)**

barnacles that attach to whales are dispersed to different environments where they can obtain food and reproduce; burdock seeds that attach to organisms and are carried to locations where they can germinate.

14.2 – pg 434

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**B-6.2 (Chapter 14.4) Explain how populations are affected by limiting factors (including density-dependent, density-independent, abiotic, and biotic factors).**

**Key Concepts:**

Population: population density; Limiting factors: density-dependent, density-independent, abiotic, biotic

***Population***is a group of organisms belonging to the same \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that live in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ area. Populations can be described based on their size, density, or distribution.

*Population growth is based on available resources.*

**Pg 441** - When resources are abundant, a population has the opportunity to grow rapidly - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ growth.

**Pg 441** - Exponential growth cannot last forever. Eventually populations face limiting resources and undergo \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ growth.

A *carrying capacity* is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Population density***measures the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of individual organisms living in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ space. Regulation of a population is affected by limiting factors that include density-dependent, density-independent, abiotic and biotic factors.

2 Types of limiting factors….

1. *Density-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* - Limiting factors that operate more strongly on large populations. Density-dependent limiting factors include **competition, predation, parasitism, and disease**. These limiting factors are triggered by increases in population density (crowding).
	1. *The population is affect when too many species in the same area at the same time*.
	2. *Depends on high population*
		1. *Plague is not going to spread if people are not close to one another*
		2. *Lice spreads because people are close together.*
2. *Density-independent*  - those that occur regardless of how large the population is and reduce the size of all populations in the area in which they occur by the same proportion.
	1. Natural disasters don’t care if high population of small population (fires, floods, etc)
	2. human activities (such as pollution)

**14.4 Assessment**

 1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**B-6.3 ( Chapter 14.5) Illustrate the processes of succession in ecosystems.**

**Key Concepts:**

Ecological succession , Primary succession: pioneer species, climax community , Secondary succession

**Ecological**  *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* is the series of changes in an ecosystem when one community is \_\_\_\_\_\_\_\_\_\_\_\_\_\_ by another community as a result of changes in abiotic and biotic factors.

There are 2 types of Succession: (pg 446, 447)

1. *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ succession* occurs in an area that has not previously been inhabited: for example, bare rock surfaces from recent volcanic lava flows, rock faces that have been scraped clean by glaciers, or a city street.

***NO SOIL SO ECO HAS TO MAKE IT. USES LICHENS!!!***

○ Lichens (mutualistic relationships between fungi and algae) and some mosses, which break down rock into smaller pieces, are among the most important *\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_* (the first organisms) in the process of primary succession.

○ Once there is enough soil and nutrients, small plants, such as small flowers, ferns, and shrubs, grow. These plants break down the rock further, and provide more soil.

○ Then seeds of other plants and small trees are able to germinate and grow.

○ Over time more species grow and die. Their decomposed bodies add nutrients to the soil and larger plant species are able to populate the area.

**GOAL IS A STABLE**, Eventually a mature community (***climax community***) results where there is little change as long as no disturbances occur.

1. *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ succession* begins in an area where there was a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ community and well-formed soil: for example, abandoned farmland, vacant lots, clear-cut forest areas, or open areas produced by forest fires.

*THERE IS SOIL SO DON’T HAVE TO MAKE IT!! MUCH FASTER TO REOVER CLIMAX COMMUNITY!!*

• now succeeds just like after soil is made in primary succession.

GOAL IS A STABLE CLIMAX COMMUNITY!!!

**Succession** is a continual process.

○ When disturbances are frequent or intense, the area will be mostly characterized by the species that are present in the early stages of succession.

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**B-6.4 (Chapter 13. 5 ) Exemplify the role of organisms in the geochemical cycles (including the cycles of carbon, nitrogen, and water).**

**Key Concepts:** Geochemical cycles, Carbon cycle, Nitrogen cycle: elemental nitrogen, nitrogen fixation, denitrifying bacteria **;**Water cycle (hydrologic cycle)

*Geochemical cycles* (the movement of a particular form of matter through the living and nonliving parts of an ecosystem) since Earth is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ system and must continually cycle its essential matter. Matter changes form, but is neither \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nor \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; it is used over and over again in a continuous cycle. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are an important part of this cycling system.

***Carbon Cycle***

• major components of the biochemical compounds of living organisms (proteins, carbohydrates, lipids, nucleic acids).

• found in the atmosphere and also in many minerals and rocks, fossil fuels (natural gas, petroleum, and coal) and in the organic materials that compose soil and aquatic sediments.

• Organisms play a major role in recycling carbon from one form to another in the following processes:

○ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

○ Respiration:

○ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: When organisms die, decomposers break down carbon compounds which both enrich the soil or aquatic sediments and are eventually released into the atmosphere as carbon dioxide.

○ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: When wood or fossil fuels (which were formed from once living organisms) are burned, carbon dioxide is released into the atmosphere.

○ Weathering of rocks: Bones & shells fall to bottom of oceans or lakes & are incorporated into sedimentary rocks such as calcium carbonate. When decompose, C is released into ocean & into the atmosphere.

***Nitrogen Cycle***

• N is found in amino acids = Proteins

• N found in atmosphere as *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nitrogen* (N2), in living organisms (in the form of proteins and nucleic acids)

 Organisms play a major role in recycling nitrogen from one form to another in the following processes:

○ Nitrogen-fixation: Nitrogen-fixing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, found in the soil, root nodules of plants, or aquatic ecosystems, are capable of converting N2 found in the air or dissolved in water into the forms that are available for use by plants (*nitrogen fixation*).

○ Intake of nitrogen into the organisms: Plants take in the nitrogen through their root systems in the form of ammonia or nitrate and in this way, nitrogen can \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the food chain.

○ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: organism dying or from waste products, decomposers return nitrogen to the soil.

○ Denitrification: *Denitrifying bacteria* break down the nitrogen compounds in the soil and release elemental nitrogen, N2, into the atmosphere.

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Cycle (Hydrologic cycle)***

•Found in the atmosphere, on the surface of Earth and underground, and in living organisms.

• The water cycle, also called the *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cycle*, is driven by the Sun’s heat energy, which causes water to evaporate from water reservoirs (the ocean, lakes, ponds, rivers) on Earth and also from organisms.

• Organisms play a role:

○ Intake of water into the organisms: Organisms take in water and use it to perform life functions (such as photosynthesis or transport of nutrients).

○ Transpiration: the evaporative loss of water from plants

○ Respiration: metabolize food for energy and produce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as a by-product.

○ Elimination: need water to assist with the elimination of waste.

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**B-6.5 (Chapter 16) Explain how ecosystems maintain themselves through naturally occurring processes (including maintaining the quality of the atmosphere, generating soils, controlling the hydrologic cycle, disposing of wastes, and recycling nutrients).**

**Key Concepts:** Atmosphere: ozone layer, greenhouse effect, sink, Geosphere: soil erosion, deposition , Hydrologic cycle

Thereare naturally occurring Earth processes that help ecosystems maintain the materials necessary for the organisms in the ecosystem. The portion of Earth that is inhabited by life (the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) is interconnected with other Earth systems: the atmosphere, the hydrosphere, and the geosphere.

***Maintaining the Quality of the Atmosphere***

The composition of Earth’s *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* is mostly the result of the life processes of the organisms which inhabit Earth (past and present).

• Plants and other photosynthetic organisms need to produce enough oxygen.

• The oxygen that is produced through the process of photosynthesis is also responsible for the *\_\_\_\_\_\_\_\_\_\_\_\_\_ layer* in the atmosphere and prevents much of the Sun’s \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_from reaching Earth’s surface.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is maintained in the atmosphere through the nitrogen cycle.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is maintained in the atmosphere through the water cycle.

o As water vapor condenses in the atmosphere, impurities (such as dust and particulates) are removed from the atmosphere and fall to Earth with precipitation. In this manner, the air is cleaned after a rain or snow fall.

The *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ effect* is the normal warming effect when gases trap heat in the atmosphere.

• Greenhouse gases (such as carbon dioxide, oxygen, methane, and water vapor) trap heat energy and maintain Earth’s temperature range.

• The amt of carbon dioxide in the atmosphere cycles in response to the degree to which plants and other photosynthetic organisms cover Earth and absorb carbon dioxide.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Amount of CO2 in the atmosphere**  | **Greenhouse effect**  | **Average Global Temperature**  | **Plant cover on Earth**  | **Rate of photosynthesis** | **Amount of CO2 absorbed by plants**  | **Amount of CO2 in the atmosphere** |
| higher  | increases  | increases  | increases  | increases  | increases  | decreases  |
| lower  | decreases  | decreases  | decreases | decreases  | decreases  | increases  |

The amount of carbon dioxide in the atmosphere also cycles in response to the degree to which oceans cover Earth. The salt water of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ acts as a *sink* for carbon dioxide, absorbing what plants do not use and converting it to various salts such as calcium carbonate.

***Generating Soils (making soil)***

As part of the *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*, the soils on Earth are constantly being generated and eroded.

• Soils are composed of 4 distinct components – inorganic minerals, organic matter, water, and air.

• As the weathering of inorganic materials from wind, water, and ice and the decaying of organic materials continue, the process of soil generation continues.

• *Soil erosion* and *deposition* are natural processes

• The presence of soil in an ecosystem allows for succession to take place.

***Controlling the Hydrologic Cycle:***

The *hydrologic cycle* is maintained by the energy of the Sun and the effect of weather.

The hydrologic cycle purifies water in several ways:

• Evaporated water is pure water containing no impurities.

• As water seeps down through the soil and rock it is physically filtered of impurities.

• As water flow slows, heavier particles of sediment settle out, leaving purified water to travel toward the oceans.

***Disposing of Waste & Recycling Nutrients***

• Waste materials from organisms are decomposed by bacteria or other organisms in the soil or in aquatic ecosystems.

• Nutrients are cycled through an ecosystem from organisms to the environment and back through series of specific processes known as geochemical cycles.

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**B-6.6 (Chapter 16) Explain how human activities (including population growth, technology, and consumption of resources) affect the physical and chemical cycles and processes of Earth.**

**Key Concepts:**

Carrying capacity; Sustainability: population growth, technology, consumption of resources ; Technology: agricultural, industrial, alternative energy ; Resources: renewable, nonrenewable

People depend on the resources and geochemical cycles of Earth to provide clean water, breathable air, and soil that is capable of supporting crops. Human activities, including population growth, technology, and consumption of resources, can affect the cycles and processes of Earth.

• The *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ capacity* of an environment is defined as the maximum population size that can be supported by the available resources.

• Various factors (such as energy, water, oxygen, nutrients) determine the carrying capacity of Earth for the human population.

In order to meet the needs of humans to survive indefinitely (*sustainability*), there needs to be a balance between Earth’s resources and carrying capacity, the needs of humans, and the needs of other species on Earth.

Factors that affect the sustainability of humans include:

***Population Growth***

• World-wide has and will continue to grow exponentially

• The natural slowing of population growth as it nears Earth’s carrying capacity is due to an increase in the death rate and a decrease in the birth rate as a result of:

○ Food and water shortages

○ Pollution of the environment

○ Spread of diseases

• An increasing population can have an effect on the amount of available clean water.

○ If clean water is being depleted at a greater rate than it can be purified, it is NOT considered renewable in our lifetime.

• Waste

○ More waste is produced than can be managed effectively.

○ Some waste products require complicated and costly means for removal once they are introduced into the environment.

•Amount of available fertile soil for agriculture (food resources).

○ Soil is often lost when land is cleared, making the land unsuitable for agriculture.

○ Worldwide demand for land (for agriculture or habitation) has led to deforestation.

***• Human population growth has depleted the amount of fertile soil, clean water and available land in many areas of the world. When these resources become scarce, many natural processes (such as the water cycle, the carbon cycle, the nitrogen cycle, and the physical process of soil regeneration) are affected.***

***Technology***

Technology has benefited humankind, it has also contributed to the pollution of the air, water, and land. For sustainability, humans depend on technology to now provide cleaner energy sources, safer ways to deal with waste, and better methods for cleaning up pollution. Technological advances in agriculture, industry, and energy can have a positive or negative impact on Earth.

*Agricultural technology*

• Advances in agricultural methodology, tools, and biotechnology have improved the ability to grow crops to sustain a growing world population.

• Sustainable agricultural practices can help conserve fertile soil and reduce soil erosion.

• Farm machinery (such as tractors and combines) consumes nonrenewable resources and can contribute to erosion and air pollution.

• The addition of substances (such as fertilizers, pesticides, fungicides, livestock waste) to the environment can alter the composition of soil and can have a positive or negative effect on the water, carbon or nitrogen cycles.

*Industrial technology*

• Advances in industrial technology have changed the world and have lead to developments in communication, transportation, and industry.

• The development of certain chemicals, such as CFCs (chlorofluorohydrocarbons), contributes to the depletion of the ozone layer, which results in increased ultraviolet rays reaching Earth. CFCs are used in producing foam packing materials, for cleaning electrical components, and refrigeration chemicals (Freon).

• Technological advances have revolutionized the communication industry; however, the disposal of outdated or damaged equipment is becoming an increasing concern.

• The burning of fossil fuels for industry and transportation increases sustainability of the growing human population; however, it also:

o increases the greenhouse gases released in the atmosphere (mainly carbon dioxide), which increases global temperatures (global warming) that affect sea levels, climate and atmospheric composition

o produces acid rain (pollutants in the air combining with water to cause the normal water pH to be lowered)

♦ Acid rain decreases the pH of the soil and can leach nutrients from soils or destroy plant life.

♦ Acid rain changes the pH of aquatic ecosystems and therefore affects the types of organisms that can survive there.

*Alternative energy technology*

• Using natural renewable energy sources (such as wind, water, geothermal, or solar energy) decreases the burning of fossil fuels, which increases the quality of the atmosphere and the cycles involved.

• Using nuclear energy technology provides an alternative energy source that does not impact the atmosphere. However, the waste produced from nuclear energy use is becoming an increasing concern.

***Consumption of Resources***

• As the population increases and technology expands, the demand for Earth resources also increases. However, there is a limited supply of these resources available to sustain the human population.

• Some resources (such as food, clean water, and timber) are considered *renewable resources*, those that can be produced at roughly the same rate that they are consumed.

o Renewable resources have factors that limit their production, for example the amount of grain that can be produced is limited by the amount of land available for farming, fertility of the land, productivity of the grain, or availability of clean water.

• Other resources, such as fossil fuels, are *nonrenewable resources*, those that cannot be produced at the same rate that they are consumed. For example,

○ The demand for minerals, metals, and ores increases because these strategic materials are vital to industry but are decreasing in availability.

○ Minerals are regarded as nonrenewable because mineral deposits that can be extracted economically are formed so slowly by geological processes that their formation as a means of replacing what we are using is of no practical use to us.

• Sustainable use of resources can be accomplished by reducing consumption, reusing products rather than disposing of them, or recycling waste to protect the environment.