Unit 3

Engineer Meligy

Biosphere

Lesson 1 Biosphere and its stability

Lesson 2 Biological processes in living organisms and their role in maintaining the stability of the biosphere

Lesson 3 Excretion and homoeostasis, and their roles in maintaining the stability of the biosphere

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Part 1
Lesson 1

Biosphere and its stability

- You have learned in the previous semester, that the natural environment on Earth consists of four spheres, which are Hydrosphere, Atmosphere, Biosphere and Lithosphere.
- In this unit, we will study **Biosphere** in details

Biosphere

Part of planet Earth in which life exists, It extends from the depths of the oceans to the tops of mountains, passing through land and air.

- The biosphere is considered a **huge**, **integrated system** that **includes:**

All living organisms (plants, animals, microorganisms)	Environments (in which they live)

Living organisms interact with their surrounding environment **through** a constant exchange of matter and energy.

1 The relationship of Biosphere with the other Earth's spheres

- The biosphere is closely connected to the other spheres that make up planet Earth.
- Biosphere does not function independently; rather, it **depends on** other Earth's spheres **for** the continuity and balance of life.

Remember

The Earth's sphere are closely innterconnected to each other.

- **Living organisms that constitute the biosphere constantly interact with the other spheres ?**

  - To obtain essential substances necessary for all their vital processes.

Interaction among Earth's Spheres

Hydrosphere

Supplies living organisms with the **water** necessary for all vital processes

Atmosphere

Provides **essential gases** such as oxygen required for respiration and carbon dioxide required for photosynthesis

Biosphere

Provides **mineral elements** through soil, upon which plants depend for their growth and stability

Lithosphere

EX **The life cycle of a plant represents a clear example of interaction among Earth's Spheres.**

Photosynthsis

Plant absorbs water (Hydrosphere) and mineral salts (Lithosphere) from the soil and carbon dioxide from the air (Atmosphere).

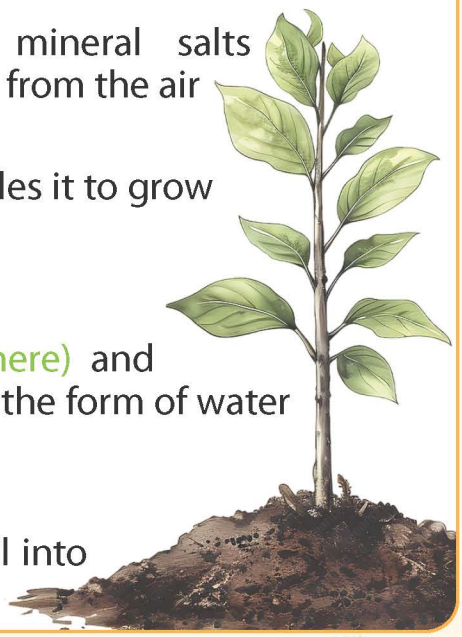
It uses solar energy to produce food that enables it to grow within the biosphere.

Transpiration

Plant releases oxygen into the air (Atmosphere) and returns part of the water to the atmosphere in the form of water vapor (Hydrosphere).

Decomposition

When the plant dies, it decomposes in the soil into simpler substances (Lithosphere).



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1. Which of the following statements correctly describes the biosphere?

a) The layer that contains all gases surrounding Earth

b) A part of the Earth that extends from the depths of the oceans to the highest mountain peaks

c) The layer that consists of sedimentary rocks

d) A part of the Earth where energy is exchanged without matter

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2. The biosphere interacts with the atmosphere when ……

a) Plants absorb water from the soil

b) Animals move from one place to another

c) Plants absorb carbon dioxide for photosynthesis

d) Rocks break down into smaller pieces

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3. Which of the following is considered a living component of the biosphere?

a) Air

b) Water

c) Soil

d) Plants

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4. Plants absorb water and mineral salts from the ……

a) Atmosphere only

b) Hydrosphere only

c) Atmosphere and lithosphere

d) Hydrosphere and lithosphere

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5. When plants are exposed to sunlight, which of the following gases increases its rate of release from the leaf?

a) Carbon dioxide (CO_2)

b) Oxygen (O_2)

c) Nitrogen (N_2)

d) Hydrogen (H_2)

Biotic and Abiotic factors

- The biosphere consists of living and non-living components that work together within a balanced system that makes life possible on the surface of Earth.

1 Biotic factors

- Include all living organisms that affect the environment and are affected by it, such as plants, animals, and microorganisms.
- Each organisms plays a different role within ecosystems, where

Plants	Animals	Decomposers
Produce food through photosynthesis process and represent the **primary source of energy** for all other organisms.	Depend for their nutrition on plants or on other animals (prey). So, they are classified as **consumers**.	Break down remains of dead organisms and return essential elements to the environment, allowing ecosystem to reuse them.

2 Abiotic factors

- Include the non-living components of the environment as **light**, **water**, **temperature**, **soil**, **minerals**, and **air**.
- These factors are responsible for determining the types of living organisms that can survive in a particular area, GR?

  As each organism requires specific environmental conditions in order to grow and remain alive.

Through the interaction of biotic and abiotic factors, a balanced ecosystem is formed, which maintains the continuity of life within the biosphere.

EX **In a lake ecosystem**, fish, algae, and bacteria interact with the physical and chemical components of water in a continuous cycle of matter and energy exchange.

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1. Which of the following living organisms forms its food from inorganic components?

a) Mouse b) Frog c) Snake d) Wheat plant

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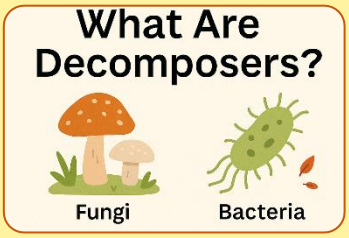
2. Which of the following represents a producer organism?

a) Yeast fungus
b) Decomposing bacteria
c) Green algae
d) Amoeba



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3. Which of the following living organisms differs from the rest in its mode of nutrition?

a) Human b) Green algae c) Lion d) Gazelle

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4. Why are decomposers important in an ecosystem?

a) They produce food for other organisms
b) They recycle nutrients back into the environment
c) They increase the amount of oxygen in air
d) They store energy from sunlight

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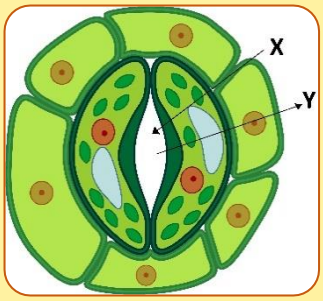
5. The following diagram shows one of the stomata responsible for gas exchange. Based on the table, what gases (X) and (Y) represent during photosynthesis?

	X	Y
a	O_2	CO_2
b	CO_2	O_2
c	H_2O	O_2
d	O_2	H_2O



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2 Levels of Organization in the Biosphere

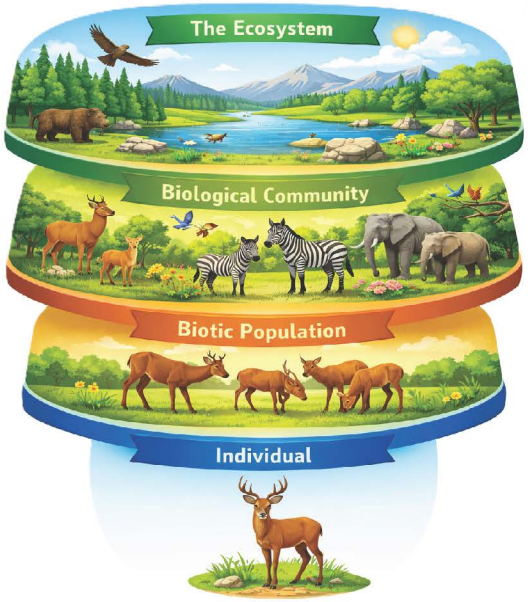
- Life on Earth is organized into progressively complex levels, beginning with the individual organism and ending with the biosphere.

1 Individual

Is a single living organism that belongs to a specific type of living organisms, **such as**

1▶ **One fish in a lake**

2▶ **One tree in a forest**



2 Biotic population

A group of individuals of the same species share the same place and time and interact with each others for feeding, reproduction, and protection , **such as**

1▶ **Herd of antelopes in the African savanna**

2▶ **School of fish in the Red Sea**

3 Biological community

They are various populations of different species that live in the same area that interact within a complex network of feeding relationships, such as

1▶ **Forest that includes trees, herbaceous plants, insects, birds, and mammals, all interacting with each other.**

4 Ecosystem

Geographic area where living organisms (biological community) and non-living things interact with each others.

When several ecosystems share similar climatic conditions and dominant living organisms, they form what is known as a biome.

Biomes

Large geographic areas (ecosystems) that share a specific climate conditions and have similar dominant organisms , such as

1▶ **Tropical rainforests** in the Amazon, Africa, and Asia share a warm, humid climate and a high level of biodiversity.

2▶ **Major deserts** share harsh climatic conditions and plants that are adapted to drought.

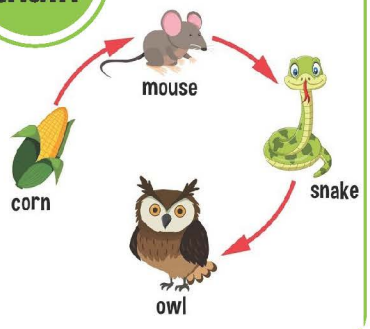
The **highest** and **most comprehensive level** is the **biosphere**, which is the vast system that includes all biomes on Earth, encompassing land, water, and air, including all forms of life and their interactions with the other Earth's spheres.

- From previous we conclude that, organization of life follows an integrated hierarchical sequence, in which higher levels are composed of groups of lower levels.
- All levels are interconnected by complex and reciprocal interactions that ensure the survival of living organisms and the balance of ecosystems on our planet.
- One of the main mechanisms linking these levels is **food webs**.

Food chains and food webs

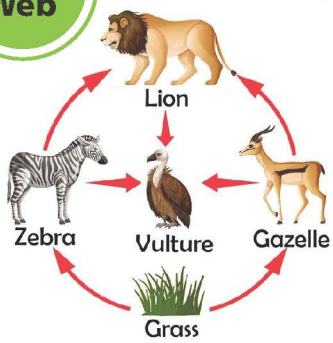
Food chain

It is a diagram that represents the transfer of nutrients and energy from a living organism to another in an ecosystem.



Food Web

It is a group of food chains that are interconnecting with each other in an ecosystem.



Importance of Food webs :

1. Illustrate how organisms obtain matter and energy.
2. Identify how each organism acquires its food
3. Clarifies role of each organisms within the community and its position in the food web,
4. Show how energy and nutrients are transferred across the different levels of biological organization.

Note

Ecologists use food chains and food webs as models to illustrate energy transfer within an ecosystem, where

1) Each step in the food chain or food web is called trophic level
2) In any ecosystem, Autotrophic organisms makes up the first trophic level.
3) Heterotrophic organisms make up the subsequent trophic levels.

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1. The smallest level of organization in the biosphere is the ……

a) Living organism
b) Biological community
c) Biological population
d) Ecosystem

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2. In the following diagram, the presence of the tree, fungi, and rabbit represents ……

a) Consumer organisms
b) Producer organisms
c) A biological population
d) A biological community

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3. Which of the following statements is correct?

a) A biological community is a group of individuals of the same species living in the same area
b) An ecosystem is the interaction of a biological community with the surrounding environment
c) A biotic population is a group of individuals of different species living together
d) The biosphere consists of different individuals living in a biological community

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4. A forest that includes trees, insects, birds, and fungi is considered a ……

a) Biome
b) Biological community
c) Biological population
d) Biosphere

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5. Several ecosystems that share similar climatic characteristics and dominant living organisms are called ……

a) Biological community
b) Biosphere
c) Biome
d) Biological population

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6. Which of the following represents one of the basic links between trophic levels in the biosphere?

a) Biological population
b) Food web
c) Biological community
d) Ecosystem